Annex III – Recommendations for High Survivability Exemptions

a) Request under Article 15.4(b) of Regulation (EU) 1380/2013 to exempt from the Landing Obligation Norway Lobster (*Nephrops norvegicus*) caught by Pots, Traps or Creels in ICES subareas VI and VII

Justifications positively assessed by STECF in 2015

b) **Request under Article 15.4(b) of Regulation (EU) 1380/2013 to exempt from the Landing Obligation Common Sole (*Solea solea*) under MCRS (less than 24cm in length) caught by 80-99mm otter trawl gears (OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX) in ICES division VIId within six nautical miles of coasts, albeit outside identified nurseries areas**

***N.B.*: the exemption applies to coastlines and fishing operations meeting the conditions laid down hereafter, especially in terms of bathymetry and tow duration.**

To note:

1. The evidence supporting this request is for a very specific fishery occupying the zone within the 0-6 nautical miles of the western coast of IVc and the northern coast of VIId. If this exemption was granted for 2017 Member States may work to identify similar fisheries where it may be appropriate for the exemption to apply in future years. Any extension to the exemption would have to be scientifically justified and would be submitted to STECF for review.
2. This exemption is being requested in both the North Sea (area IVc) and North West Waters (area VIId) through the Joint Recommendations being submitted by the Scheveningen and North West Waters regional groups respectively. This is due to the similarities in the South East England inshore fleet, its fishing activities and environmental conditions across the two sea areas. Some evidence below refers to both sea areas together, but it is the intention that the exemption request for each sea area be considered by each regional group separately.

Summary

Article 15.4(b) of Regulation (EU) 1380/2013 on the Common Fisheries Policy states that the landing obligation shall not apply to:

> "species for which scientific evidence demonstrates high survival rates, taking into account the characteristics of the gear, of the fishing practises and of the ecosystem;"

The North West Waters regional group notes that scientific evidence demonstrates a minimum survivability rate of 51% [1] for common sole (*solea solea*):

(i) of length less than the Minimum Conservation Reference Size (MCRS) of 24cm;
(ii) caught by vessels using 80-99mm otter trawl gears;
(iii) within 6 nautical miles of the English coast in ICES areas VIId and IVc;

and recommends that catches of common sole meeting this definition should be exempt from the landing obligation on grounds of high survival rates, as provided for by Article 15.4(b) Regulation (EU) 1380/2013. This will minimise unwanted mortality of the small number of under MCRS common sole that are unavoidably caught in a highly selective inshore fishery.

The study undertaken by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) that demonstrated this high discard survivability also recorded the vitality of common sole once brought on-board the vessel, and analysed the probability of their survival as a function of this. Two further studies have been commissioned to test whether the shallower depths and shorter tow times typical to the majority of fishing activity in this fishery result in catch with a higher vitality and thus an average survival rate closer to the 69% found for common sole in excellent health. These survival rates have not been adjusted to compensate for any additional mortality introduced by the stressors involved in captive observation, and so should be interpreted as *minimum* survivability estimates.

The South East England inshore common sole trawl fishery is defined by a common métier and target species. Fishing activity and marine conditions are similar throughout, and it would therefore be appropriate for an exemption to span the two ICES sea areas. The further research commissioned will look in particular at the shallower areas, including the Solent (area VIId) and the Thames Estuary (area IVc) with depths of around 15m.

There are 143 vessels across both the North Sea and the North West Waters that would be affected by this survivability exemption, responsible for a total landing of common sole of under 160 tonnes in 2015. Cefas observer programmes between 2013 and 2015 place approximate discard rates of undersized sole in this fishery at 1% of total catches and 4% of common sole catches; if granted, this survivability exemption is estimated to result in a maximum annual discard biomass of undersized sole of approximately 6.7 tonnes, of which a minimum of 3.3 tonnes should survive. For context, the 2016 common sole TAC is set at 13,262 tonnes in the North Sea, and 3,258 tonnes in VIId (North West Waters).

The low catch rate of undersized sole indicates that the gear used by vessels in the fishery is already highly selective against undersized sole, and improvements in avoidance are difficult to achieve safely and economically due to the small size and limited range of the majority of these vessels. The low biomass involved and the significant survival rate for undersized sole ensures that the risk of unintended negative consequences is minimal.

Key Information

Exemption target:	Common sole (*solea solea*): (i) of length less than MCRS of 24cm; (ii) caught by vessels using 80-99mm otter trawl gears; (iii) within 6 nautical miles of the English coast in ICES areas VIId and IVc.
Exemption grounds:	High survivability.
Survivability rates [1]:	51%: minimum percentage of the undersized sole in a typical catch that are expected to survive all stressors associated with the fishing activity. 69%: estimated minimum survival rate of sole in excellent condition once caught.
Stock health [2] [3] [4]:	Although separate management stocks, the IVc and VIId common sole stocks overlap geographically and are genetically homogenous. Stock health varies across the fishery: in IV, the spawning stock biomass has increased since 2007 and the fishing mortality steadily decreased since 1997, whereas in VIId the spawning-stock biomass has fluctuated without trend since 2002 and the fishing mortality increased in 2013 and 2014.
Vessels affected:	143 total: 72 in IVc only, 52 in VIId only, and 19 fishing in both.
Discard rate:	Discard rates of undersized sole in the South East England inshore otter trawl fishery are estimated to be on average 1% of total catches, or 4% of total common sole catches.
Biomass affected:	Annual landings of common sole caught in the area covered by this exemption are estimated to be under 160 tonnes. Based on the current discard rates, the annual biomass of undersized common sole covered by this exemption would be a maximum of around 6.7 tonnes.
Risk assessment:	The risk of an increase in common sole mortality due to this exemption is expected to be minimal. The low discard rate of undersized common sole indicates that the gear and fishing practices currently in use are already highly selective, and the low total biomass of undersized common sole caught indicates that any additional effort enabled by the exemption will be negligible.

The South East England inshore common sole trawl fishery

Solea solea—a.k.a. sole, common sole, Dover sole, or black sole—is a commercially valuable species of flatfish in the Soleidae family. Total landings of common sole by UK vessels into England amounted to 1,800t in 2014 with a commercial value of £12.2m (around €15.2m), making it by far the highest valued demersal fishery in England, with a value almost 50% higher than the second-highest valued, anglerfish [5]. Of this, less than 160 tonnes are caught across IVc and VIId in the South East England inshore common sole trawl fishery[1], with the majority found in the shallow waters of the eastern English Channel and Greater Thames Estuary, where depths are typically under 15 metres (see attached bathymetry maps). Peak season is between July and September.

Area	**Number of vessels**	**Biomass (tonnes)**	**Value (£)**
IVc	91	121.6	564,000
VIId	71	37.7	235,000
Total	143[2]	159.4	799,000

Table 1: 80-99mm mesh otter trawl common sole landings for non-sector vessels in IVc and VIId (2015 data)

The vessels which operate within this fishery are predominately part of the English non-sector/small-scale fleet: they are not part of a producer organisation and they fish against restricted monthly catch limits, managed by England's Fishing Administration, the Marine Management Organisation (MMO). Common sole provides a valuable income for the inshore trawl fishery (Table 1). Of the vessels which landed common sole in 2015, 79% are 10 metres or under in length.

Many of these vessels have fairly basic on-board equipment, and so from a safety and an economic perspective are restricted to operating within their local area, making avoidance techniques difficult to implement. The adoption of spatial measures to avoid undersized common sole is further complicated by the lack of any known spawning concentrations in UK waters in the eastern Channel [6] [7], or of any juvenile concentrations of an appropriate size for closure, as juvenile common sole are predominantly located along the French coast in the south and the east [8].

[1] The total biomass of common sole landed by non-sector UK vessels in IVc and VIId in 2015 was 159.4 tonnes. A length restriction by the Southern IFCA, as well as the shallow depth of the fishery (typically around 15m), prevent vessels larger than around 12m in length from trawling within 6 nautical miles of the coast. Very few vessels in this length range are represented by producer organisations, so in this case non-sector landings are a good proxy for total landings. On the other hand, some of these non-sector vessels do fish beyond 6 nautical miles, and so the figure of 159.4 tonnes is thought to be an overestimation for the total biomass of common sole caught within the South East England inshore common sole fishery.

[2] The total (143) is not the sum of the numbers of vessels fishing in IVc (91) and VIId (71), because 19 of those vessels fish in both.

The trawl designs and mesh size used by the South East England inshore common sole trawl fishery are well suited to shallow water and are highly selective for common sole, in keeping with the latest reform of the Common Fisheries Policy, which identified the reduction of discards and bycatch as a key objective [9]. The vessels use an 80–99mm mesh trawl with a very low headline height (usually less than 750mm) and the trawl doors and centre skids are small and lightweight, thereby minimising round-fish bycatch. 80mm mesh size trawls are effective at selecting out undersized common sole, however despite this some are sometimes still caught, especially when seaweed and other debris—often found in the shallow waters of the fishery—unpredictably alter the selectivity during the trawl. To mitigate this and allow cleaning of the net, tow times in the shallower waters are typically limited to 1–1.5 hours.

80mm mesh limits undersized common sole bycatch to on average 1% of the total catch, or 4% of the common sole catch[3], which puts the total annual biomass of undersized common sole caught by these vessels at around 6.7 tonnes[4] (of which 5.1 tonnes is caught in IVc and 1.6 tonnes in VIId). Attempts to reduce this by increasing the mesh size would lower catches of common sole above MCRS, rendering the trip uneconomical for these small inshore vessels for whom common sole is the smallest species they are targeting. For context, the 2016 common sole TAC is set at 13,262 tonnes in the North Sea, and 3,258 tonnes in VIId.

The Cefas common sole survivability study (summary)

Cefas was commissioned to assess whether common sole caught with 80-99mm otter trawl gears in the South East England inshore fishery has a high survival rate.

The approach they selected was to use vitality (health) assessments of common sole caught under normal fishing conditions and to combine information with captive observation of selected individual common sole with different vitality. With this data Cefas were able to estimate a weighted overall mortality for common sole due to fishing activity, as well as discard survivability rates for common sole as a function of their health when caught.

[3] The ICES InterCatch database actually lists discards for English vessels as 0.0% [11], however this includes many vessels not subject to this exemption and so effectively hides discards by this fleet segment as it catches only a small proportion of the total caught biomass of common sole. The figure used here is from a Cefas observer programme across 14 trips on board otter trawls in IVc between 2013 and 2015, which put average discard rates of undersized common sole at 1% of total catches and 4% of common sole catches.
An additional 14 trips were carried out on board otter trawls in VIId in this time period, giving an average discard rate of 0.3%; these trips however were not exclusively over the sole fishery grounds, and so we use the higher discard rate found in IVc as indicative of the fishery as a whole.

[4] Based on 2015 landings data (see footnote Erreur : source de la référence non trouvée) and the Cefas observer programme discard rate (see footnote Erreur : source de la référence non trouvée). 4% of the total common sole catch is undersized, so the 160 tonnes landed represents 96% of the total common sole catch. 160 tonnes divided by 96% gives 6.67 tonnes undersized common sole caught.

Vessel and gear

The vessel used for this trial was a steel hulled twin rig otter trawler of 9.82m overall length with a 179kW engine. The trawler uses 80mm cod-end mesh size, which is routine for an under 10m trawler in the area [10].

Fishing activity

The sea trials were carried out in ICES division IVc rectangle 33F1 (Figure 1) where typical depths are around 25m, the upper end of the depth range for the wider South East England inshore common sole fishery. The fishing activity (gear and tow times) was representative of normal practices for this fishery area just south of Lowestoft, and took place in the latter part of the common sole fishing season. Catches remained at normal to low levels throughout the study.

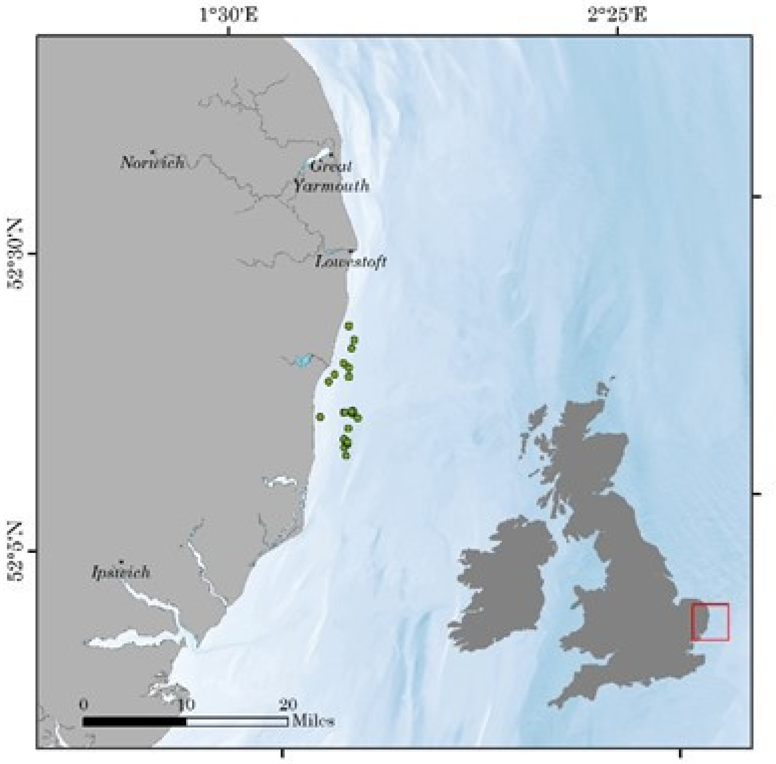

Figure 1: Locations of the fishing hauls in the study

Eight individual day-trips were undertaken between 4th October and 26th November 2015. The vessel was operated by the skipper and one crew member. The trawl gear was deployed, towed, and hauled according to normal commercial fishing practices for between 1.5 and 2 hours. The cod-ends were emptied into the aft pound and the nets were fully re-deployed ahead of catch sorting. This process took about 10-15 minutes, after which sorting of the catch began. The crew sorted the catch by hand, as they normally would, however instead of pushing the smaller unwanted common sole back into the sea, they were moved to purpose made on board hold tanks after being measured and assessed for their health condition.

Vitality assessment

Once the common sole were sorted, each individual was measured and scored using a pre-defined assessment protocol. The health or vitality of each fish was assessed using two methods: a semi-quantitative assessment of the vigour of the individual fish, and a semi-quantitative reflex and injury scoring method. A vigour assessment was conducted on all common sole based on four ordinal classes that are defined with a class at one extreme characterising very lively and responsive fish (1, excellent), and at the other extreme, a class characterising unresponsive fish (4, dead), with good and poor fish as intermediate categories (2 and 3 respectively).

Vitality assessment	Proportion of undersized common sole at each vitality in study	Survivability probability (%)
Excellent	0.57	69.4
Good	0.18	50.6
Poor	0.20	10.6
Dead	0.05	0.0

Table 2: Survivability and catch profile of study by vitality assessment

Common sole were also scored by the presence or absence of specific behavioural reflexes and injuries: body flex, operculum closure, tail grab and orientation right. A reflex action was scored as unimpaired (0) when it was strong or easily observed, or impaired (1) when it was not present or if there was doubt about its presence. An injury score based on the presence of different injury types was also recorded. Injuries were scored as absent (0) when not present or there was doubt about its presence, and present (1) when clearly observed.

Vitality composition

From all the common sole considered in this study (1329), 63 (5%) were dead when assessed at the point they would be discarded. The remaining fish were scored as either excellent (43%pt), good (27%pt) or poor (25%pt). When considering only the common sole under minimum landing size (i.e. under 24cm in length), the vitality score profile changes slightly, with 57% of the catch considered excellent, 18% as good, 20% as poor and 5% as dead (Table 2).

Survival of captive fish

A proportion of fish at each of these vitality scores was selected (by length) for on-board observation tanks. In total, 287 fish were captive for the survival experiment. Fish were held in captivity for 360 hours (2 weeks): survival for common sole was 69.4% for common sole in excellent health, 50.6% for common sole in good health, and 10.6% for common sole in poor health. When weighted to the proportion of the each vitality category of the total catch, the estimated overall survival probability during the observed period was 51% for the undersized common sole and 46% for the whole catch. These rates are not adjusted to compensate for the effects of induced experimental mortality, and so should be interpreted as the minimum estimates for the survival rate for discarded undersized common sole.

Factors influencing discard survival

The use of a binomial GLM model showed that common sole with impaired orientation and tail grab had a significant higher mortality than unimpaired common sole. The impairment of these two reflexes showed significant association with the proportion of dead to alive fish.

In this study, the injuries most commonly found in common sole were abrasion, scale loss and fin bleeding, with 74%, 57% and 53%, respectively, of the fish sampled suffering with these injuries. The injuries that had the most significant association on the proportion of dead fish were scale loss.

Further studies

Typical fishing activity in the South East England inshore common sole fishery is expected to cause less stress to the fish caught, due to shallower waters (10–15m, rather than 25m in the study), shorter tow times (typically 1–1.5 hours, rather than the 1.5–2 hours in the study), and an abundance of seaweed that gets caught in the net and cushions the common sole. The Cefas study showed a strong correlation between the condition of the fish once removed from the net and its survivability, and so if these less stressful conditions result in reduced damage to the catch, then the survivability should correspondingly increase.

To test this hypothesis, the UK has committed to further research in 2016 and 2017, which will involve extending the study period to the full duration of the fishing season and expanding the geographical area of the study to include the Solent (area VIId) and Thames Estuary (area IVc).

The Cefas study also identified particular types of damage that resulted in significant increases in mortality, and it is hoped that this further research may be able to identify particular methods for minimising these forms of damage to further increase the survivability of discarded common sole. This may also form the basis for further extension studies to evaluate whether the survivability exemption should be extended more widely e.g. to trawl fisheries on the southern coast of VIId and the eastern coast of IVc.

Conclusion

There is sufficient evidence for this proposal for a high survivability exemption for common sole that are:

(i) of length less than the Minimum Conservation Reference Size (MCRS) of 24cm;
(ii) caught by vessels using 80-99mm otter trawl gears;
(iii) within 6 nautical miles of the English coast in ICES areas VIId and IVc;

- scientific evidence shows the survival rate for discarded undersized common sole is at least 51%;
- additional studies have been commissioned to test whether the characteristics in the wider South East England inshore common sole fishery result in an higher survivability, and to identify potential measures to further increase this;
- the gear and techniques used in the fishery are already highly selective, and increased selectivity or avoidance is difficult to achieve safely and economically;
- the return of juvenile common sole will support improvement of future spawning numbers, which is particularly important given the unstable spawning biomass in VIId, as well as improving their yield when subsequently harvested; and
- the risk of unintended negative effects is inherently limited by the low biomass of undersized common sole caught.
- If this exemption was granted for 2017 Member States may work to identify similar fisheries where it may be appropriate for the exemption to apply in future years. Any extension to the exemption would have to be scientifically justified and would be submitted to STECF for review

Works Cited

[1] A. R. Santos, K. Duggan and T. Catchpole, “Estimating the discard survival rates of Common sole (Solea solea) in the English east coast inshore otter trawl fishery,” Cefas, 2016.

[2] ICES, “Sole in Subarea VIId,” in *Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) Report 2015*, 2015, pp. 393-437.

[3] ICES, “Section 3.44: Sole (Solea solea) in Division VIId (Eastern English Channel),” in *ICES Advice 2015, Book 6 - The Greater North Sea Ecoregion*, 2015.

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[10] Seafish, "Multi Rig Trawl - Sole triple rig," [Online]. Available: http://www.seafish.org/geardb/gear/multi-rig-trawl-sole-triple-rig/.

[11] IMARES Wageningen UR, "Discard Atlas of North Sea Fisheries," Wageningen, 2014.

Annex IIIb(i) (document attached)

Estimating the discard survival rates of Common sole (*Solea solea*) in the English east coast inshore otter trawl fishery

[CEFAS, February 2016]

Annex IV – Recommendations for *de minimis* Exemptions

(i) ***De minimis* exemption request for the vessels using trammel and gill nets to catch common sole in the Channel and the Celtic Sea (ICES divisions VIId, e, f and g)**

Justifications positively assessed by STECF in 2015

(ii) *De minimis* exemption request for vessels, obliged to land whiting, using bottom trawls and seines <100mm (OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, TB, SX, SV, OT, PT, TX) and pelagic trawls (OTM, PTM) to catch whiting in the Channel (ICES divisions VIId and e)

Justifications already assessed by STECF in 2015; new evidence (four documents) have been provided in accordance with article 3.2 of delegated Regulation (EU) 2015/2438 of 12 October 2015.

(iii) *De minimis* exemption request for vessels, obliged to land whiting, using bottom trawls and seines ≥100mm (OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, TB, SX, SV, OT, PT, TX) and pelagic trawls (OTM, PTM) to catch whiting in the Celtic Sea and the Channel (ICES divisions VIIb-j)

Justifications already assessed by STECF in 2015; new evidence (four documents) have been provided in accordance with article 3.2 of delegated Regulation (EU) 2015/2438 of 12 October 2015.

(iv) *De minimis* exemption request for vessels, obliged to land whiting, using bottom trawls and seines <100mm (OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, TB, SX, SV, OT, PT, TX) and pelagic trawls (OTM, PTM) to catch whiting in the Celtic Sea (ICES subarea VII excluding divisions VIIa, d and e)

Justifications already assessed by STECF in 2015; new evidence (four documents) have been provided in accordance with article 3.2 of delegated Regulation (EU) 2015/2438 of 12 October 2015.

(v) ***De minimis* exemption request for the vessels obliged to land Norway lobster in ICES subarea VII**

Justifications positively assessed by STECF in 2015

(vi) ***De minimis*** **exemption request for the vessels obliged to land Norway lobster in ICES subarea VI**

Justifications positively assessed by STECF in 2015

(vii) *De minimis* exemption request for vessels, obliged to land common sole, using TBB gear with mesh size of 80-119mm with increased selectivity, such as a large mesh extension, to catch common sole in the Channel (ICES divisions VIId and e) and the Celtic Sea (divisions VIIf, g and h)

Justifications positively assessed by STECF in 2015

(viii) ***De minimis*** **exemption request for the vessels, obliged to land megrims, using bottom trawls and seines <100mm (OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, TB, SX, SV, OT, PT, TX) to catch megrims in ICES subareas VI and VII and Union/international waters of ICES divisions Vb**

EXTENDED OUTLINE FOR DE MINIMIS EXEMPTION REQUEST FOR A MAXIMUM OF 7% FOR 2017 AND 2018 FOR MEGRIMS OF THE TOTAL ANNUAL CATCHES OF THIS SPECIES BY VESSELS USING BOTTOM TRAWLS AND SEINES <100MM (OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, TB, SX, SV, OT, PT, TX) IN ICES SUBAREAS VI AND VII; VESSELS OBLIGED TO LAND MEGRIMS IN THOSE AREAS.

Contents

KEY ISSUES

- Otter trawls targeting megrim and other species like monkfish operating in the Celtic Sea (Subarea VII) waters are reported to have largely variable megrim discards.
- In this megrim trawling fishery, main reasons for discarding are the undersize individuals (< 20 cm) and agreed control of landings of the OPs involved.
- In trawl, there is a percentage of megrim that is damaged and cannot be appropriate for human consumption that should be quantified.
- Total number of vessels deploying this metier is around 30 vessels in 2013 decreasing to 15 vessels in 2015.
- According to data from STECF and ICES, the average discards of megrim over 2013-2015 with OTB gear 70_99 mm gears amount to 30% of the catches.
- The application of the *de minimis* is likely to slightly alleviate the economic performance negative effects of the landing obligation; however, this reduction is, by nature, small.
- Despites this small reduction in cost, if a full implementation of LO would occur, all biomass of individuals under MCRS brought to port would have to be managed for no human direct consumption. This would have a treatment, transporting and processing cost. Therefore, it is not just how much it is lost during the trips but also how much is saved when avoiding to invest in dealing with biomasses that have to be destroyed or sold by just cents.
- All these at port cost are not taken into account in the calculation of the economic cost of the landing obligation provided in this study.
- There is a big difference between the current discards levels of the fleet (30%) and the size of the *de minimis* simulated (7%). In absolute terms the *de minimis* will increase the overall revenues in comparison with the landing

obligation scenario (without exemptions) in 0.3 million Euros while in terms of profits this increase is of around 0.15 million Euros.

- Technical and tactical solutions are expected to be obtained from the experimental trials to be deployed in 2017.
- Until those improvements of selectivity could be obtained, the *de minimis* appear to be a solution to soften the expected impact of the landing obligation on megrim trawl fisheries.
- By comparison and similarity with another comparable fleet, the implementation of the Landing Obligation in trawlers would, in general, increase the risks associated to fish handling up to unsafe levels for the crew.
- There is a limited capacity of implementation of technical solutions on board for handing large amount of biomasses in the short- and medium- term.

Introduction

In the joint recommendation agreed with the NWW regional group to establish a discard plan for demersal fisheries in the North Western Waters for 2017, more species were introduced in order to continue with the phasing-in until 2019. Megrim was introduced as new species for the fleet in January 2017 and Spain has gathered information to support a request of a de minimis exemption for all the fleet affected by this landing obligation.

In this document due to the fact that increases in selectivity to reduce catches of megrim below the 20 cm MCRS is shown to be very difficult to achieve in the medium- short term in the management units defined in this document. Moreover this study reveals that great efforts and important economic losses will have to be made by the fleet in 2017, in order to apply the landing obligation for megrim. There is an agreement between the NWW regional group participants that at the moment a *de minimis* of 7% is essential to alleviate from disproportionate costs. The fleet subject to the phasing in the landing obligation in 2017 is the one that fulfils the following thresholds in areas VI and VII:

Fishery	Gear Code	Fishing gear description	Mesh Size	Landing Obligation
Megrims (Lepidorhombus spp.)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls & Seines	<100 mm	Where the total landings per vessel of all species in 2014 and 2015 consist of more than 20% of megrims, the landing obligation shall apply to megrims.

In this report quantitative results on simulations about the bioeconomic impact of the full implementation of the landing obligation deployed from year 2017 onwards is presented. In order to accommodate economic impact studies to any management measures plus the effect of the certain required exemptions (e.g. *de minimis*), full coupled bio-economic models, as FLBEIA (Garcia et al. 2013) were used.

In the management of the landing obligation (LO), it is necessary that Member States do their utmost to reduce unwanted catches, and investigations to improve selectivity would take place in 2017. To this end, improvements of selective fishing techniques and survival experiments to avoid and reduce, as far as possible, unwanted mortality have high priority.

It is established in the CFP that *de minimis* exemptions of up to 5 %(*) of total annual catches of all species subject to the landing obligation shall apply in the following cases:

(i) where scientific evidence indicates that increases in selectivity are very difficult to achieve; or

(ii) to avoid disproportionate costs of handling unwanted catches, for those fishing gears where unwanted catches per fishing gear do not represent more than a certain percentage, to be established in a plan, of total annual catch of that gear.

(*)For a transitional period of four years, the percentage of the total annual catches referred to in this point shall increase by two percentage points in the first two years of application of the landing obligation; and by one percentage point in the subsequent two years;

1. Fishery selected in this study

The following fleet targeting megrim was selected to study the impact of the landing obligation and modeling the landing obligation economic results with or without the *de minimis exemption* applied. These results can be extrapolated for all the area VI and VII:

Table 1. Fisheries definition tables for the Celtic Sea (ICES Divisions VII b, c, e, f, g, h, j, k)

Fishery (species and area)	**Gear Code**	**Fishing gear description**	**Mesh Size**	**Landing Obligation**
Megrim VII	OTB	All Bottom Trawls	Mesh size larger or equal to 70.mm-99 mm wide	All catches of Megrim are proposed to the landing obligation in 2017.

2. Species for which the exemption is sought:

The targeted species of the trawling fisheries here presented in the Celtic Sea (ICES Divisions VII b, c, e, f, g, h, j, k) waters is: Megrim (*Lepidorhombus whiffiagonis*), the results of this studies will be used for Subarea VI as well.

Megrim is also under the landing obligation in Subarea VI and the fleet operating there shares the same characteristics with Subarea VII.

3. Definition of the management unit

Discard data collected by IEO Observers Programme in 2012 were raised to the fleet level using reported effort for that fleet (see STECF method in Catchpole and Ribeiro, 2014).

For discard calculation in 2013, 2014 and 2015, as used by ICES, see also method for calculation in in Catchpole and Ribeiro, 2014).

Discard estimations showed the following levels:

1. Bottom otter trawl (OTB_DEF_70_99) in VII, the megrim discard rates were 44%, 29% and 18% in 2013, 2014 and 2015, respectively. In 2012, megrim discards were estimated at around 35%.

According to landings of these management units, megrim is the main landed species for OTB_DEF_70_99, followed by anglerfish.

A detailed updated definition of the métiers is provided from 2013 to 2015 and included in the Annex I. Description of the Management Units includes:

1) Characteristics of the fishery and its activity
2) Catches and discards estimates
3) Length structure from 2013 to 2015
4) Reasons for discarding
5) Likely choke species
6) Other relevant information

4. Description of the problem and results based on referenced studies

4.1 Estimating bioeconomic impact of a full application of the Landing Obligation and a possible *de minimis* exemption applied to megrim on the Spanish trawl fleet operating in the ICES sub area VII

The application of the landing obligation on this fleet is likely to change the economic performance significantly. Revenues are reduced in a 5.8% and profits will be reduced in an 8.4%. It implies that the impact is high from the economic side. In absolute terms and in average the reduction in revenues by the application of the landing obligation will be of around 4 million Euros, and in terms of profits of around 2.5 million Euros.

This impact is not likely to change the decreasing evolution of the overall number of vessels, which is likely to continue to decrease in the following years.

The application of the landing obligation has straightforward benefits from the SSB point of view. These benefits come from the reduction in the fishing mortality of megrim (due to a lower fishing effort) and from the change in the catch profile of megrim. However even if the biomass is higher, it is not enough to compensate the reduction in fishing effort required. That is, the result of a lower effort applied to a higher biomass is, in this case, negative.

The application of the *de minimis* is likely to slightly alleviate the economic performance negative effects of the landing obligation; however, this reduction is, by nature, small. The reason for this is that there is a big difference between the current discards levels of the fleet (35% -see Table 1 in Annex II) and the size of the *de minimis* simulated (7%, 7% and 6% for the years 2017, 2018 and 2019, respectively).

In absolute terms the *de minimis* will increase the overall revenues in comparison with the landing obligation scenario (without exemptions) in 0.3 million Euros while in terms of profits this increase is of around 0.15 million Euros.

4.2 Selectivity improvement

Improvements in gear selectivity are difficult to achieve for the megrim fishery using 70-99mm mesh size as results from several selectivity studies carried out by the IEO indicating that an increase of mesh sizes with the aim of increasing selectivity is hard to achieve without loss of a part of the catch of marketable sized and the subsequent decrease in profitability.

The scientific IEO Discard Program aims to advance in this objective through experiences to be carried till 2020.

5. Proposal of working plan 2016-2019 in relation to fleets and limiting topics

The Spanish *Ministerio de Agricultura, Alimentación y Medio Ambiente,* and its *Secretaría General de Pesca together with* AZTI and IEO as Scientific bodies have scheduled a work plan for the period 2015 to 2019 to answer industry needs in relation to implementation of the landing obligation.

This plan include the progressive inclusion of fisheries in the LO calendar.

Based on this calendar, topics to be worked out are highlighted and the strategy for each of the fisheries ∩ topics is defined.

Thus, for the first semester of 2017, selectivity experiences on board as well as survival experiments for some flat species (such as megrim) have been planned to be deployed on board otter trawls in ICES Subarea VII.

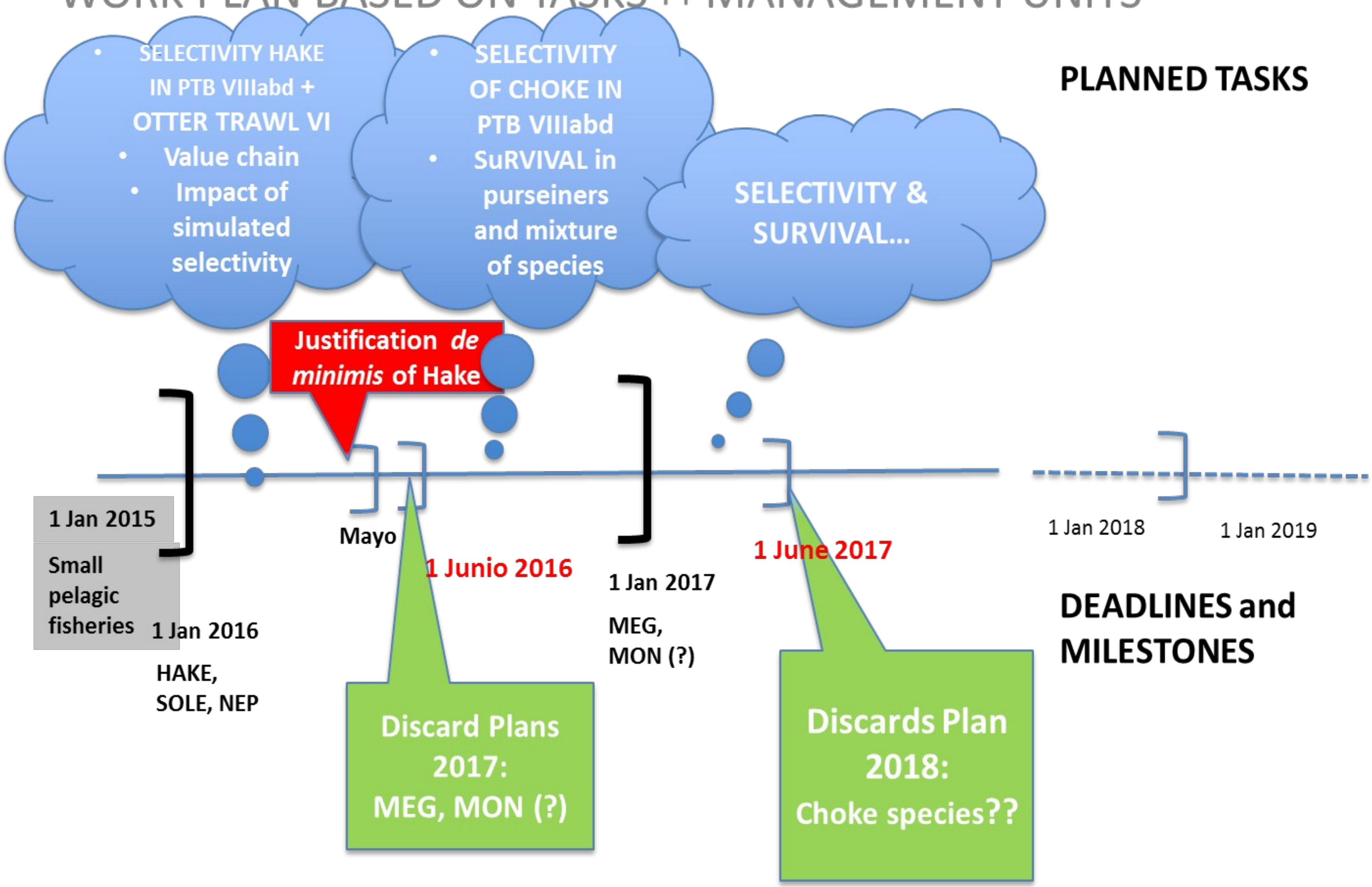
Despites the limited apparent success of selectivity improvement in multi-specific fisheries, some new devices and fishing tactics can be further explored.

The following plan reflects in a simplified way the work to be done. It is important to have in mind the relative long time required for stating an experimental survey as permits to do experiences at sea with "experimental" gears need to be required from neighboring countries.

	2015		**2016**		**2017**		**2018**	
TASKS	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec
Selectivity first trials Otter trawl VIIIabd	X							
Selectivity surveys Otter and **pair trawls** VIIIabd	X		**X (hake)**	**X (focused on choke sp.)** X		X	X	
Survival surveys Baka VIIIabd				X (sole, monk and rays)	X			X
Survival purseiners VIII c & abd				X (mix species management for increasing survival)	X			X
Selectivity surveys and survival surveys Baka VII					**X (Megrim and Monk)**		**X**	
Quality-Fish value chain: for each management unit			X		X		X	
Meeting with industry (results presentation)		X	X		X		X	

Strategic meetings		X	X	X	X	X	X	
Discard Plans (every June)	X		X		X			

WORK PLAN BASED ON TASKS ∩ MANAGEMENT UNITS



6 References

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ANNEX I

0. Definition of the management unit presents in area VI an VII with mesh size <=100mm (main source: NWW discard atlas).

Celtic Sea otter trawls

☐ **TR2 (mesh size 70-100mm)**

The trawlers with a codend mesh size range 70-100mm are the fishery with second highest effort in Celtic Sea, accounting for 18% of the total effort. It is less widespread than the TR1, and the main fishing areas are localized in ICES VIIe, close to the English and French shores and in VIIg, close to the Irish shore.

However, the TR2 effort is likely to be more widespread. The TR2 fishery in the Celtic Sea is mainly characterized by:

1) fishery for Norway lobster (Nephrops) operated mainly by Irish trawlers. There are significant Nephrops fisheries in the Smalls, Labidie and Porcupine bank.

2) mixed fishery targeting anglerfish, gadoid species and non-quota species (cuttlefish and squid), taking place in VIIe close to the English and French shore;

3) Spanish mixed fishery (otter trawl with cod end mesh size 70-99mm) targeting flat fish, principally megrims and anglerfishes, with hake as one of the main by-catches.

Effort is distributed on shallow waters of Grand Sole and Porcupine Bank fishing mainly in Division VIIj.

Attending to the discard rates for different species according to the NWW discard atlas, the megrim discard rate is variable.

Celtic Sea beam trawlers

Only one beam-trawl category operates in the Celtic Sea, the beam trawlers using codend mesh size between 80 and 120mm (BT2).

The BT1 (mesh size >120mm) have a negligible effort in this area. The BT2 effort accounts for 10% of the total effort in the Celtic Sea and is mainly carried out by English, Belgium and Irish vessels and is confined to ICES VIIe, g and h. This fishery is characterized by flatfish species including plaice and sole, as well as anglerfish and cuttlefish.

In the next tables global discards for the fleet per species are shown for Celtic Sea.

Table 3.1-4 Celtic Sea (ICES Divisions VII b, c, e, f, g, h, j, k) Spanish demersal fisheries: landings (t) and discards (t) per species and year; table sorted in a descended order on the average catch 2010-2012, top 10 species. Only for average total catch equal or greater than 20 t

Country	Species		2010			2011			2012			Average 2010-2012			
			Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	Total Catch	%DR
ESP	HKE	Hake	NA	NA	NA	NA	NA	NA	12,179	900	7	12,179	900	13,079	7
	LEZ	Megrims	NA	NA	NA	NA	NA	NA	4,250	2,334	35	4,250	2,334	6,584	35
	ANF	Anglerfish	NA	NA	NA	NA	NA	NA	3,077	678	18	3,077	678	3,755	18
	WIT	Witch	NA	NA	NA	NA	NA	NA	2,430	324	12	2,430	324	2,754	12
	HAD	Haddock	NA	NA	NA	NA	NA	NA	161	1,895	92	161	1,895	2,056	92
	ALB	Albacore	NA	NA	NA	NA	NA	NA	1,455	0	0	1,455	0	1,455	0
	BRF	Blackbelly rosefish	NA	NA	NA	NA	NA	NA	910	29	3	910	29	939	0
	LIN	Ling	NA	NA	NA	NA	NA	NA	612	212	26	612	212	824	0
	NEP	Norway lobster	NA	NA	NA	NA	NA	NA	333	237	42	333	237	570	42
	FOX	Forkbeards	NA	NA	NA	NA	NA	NA	86	0	0	86	0	86	0

Table 3.1-3. Celtic Sea (ICES Divisions VII b, c, e, f, g, h, j, k) demersal fisheries: landings (t) and discards (t) per species, country and year; table sorted in a descended order on the average catch 2010-2012, top 5 countries per species. Only for average total catch equal or greater than 20 t

Species		Country	2010			2011			2012			Average 2010-2012			
			Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	Total Catch	%DR
HAD	Haddock	FRA	5,243	1,654*	24*	7,398	4,858*	40*	9,471	21,951*	70*	7,370	9,488*	16,858*	44*
		IRL	2,590	3,108	55	3,273	2,487	43	4,101	4,085	50	3,321	3,227	6,548	49
		ENG	668	218	25	1,200	662	36	1,158	648	36	1,008	509	1,518	32
		BEL	167	141	46	211	527	71	231	1,297	85	203	655	858	67
NEP	Norway Lobster	IRL	5,082	NA	NA	4,136	NA	NA	6,024	NA	NA	5,081	NA	5,081	NA
		FRA	846	NA	NA	515	NA	NA	375	NA	NA	579	NA	579	NA
		SCO	174	NA	NA	177	NA	NA	195	NA	NA	182	NA	182	NA
		NIR	328	NA	NA	8	NA	NA	33	NA	NA	123	NA	123	NA
HKE	Hake	FRA	4,716	102	2	7,109	114	2	9,578	625	6	7,135	281	7,415	3
		IRL	1,519	55	3	1,605	13	1	1,601	50	3	1,575	39	1,614	2
		ENG	589	18	3	875	41	4	737	60	8	734	40	774	5
		SCO	567	4	1	246	8	3	1,201	38	3	672	16	688	2
ANF	Anglerfish	FRA	2,161	26	1	7,427	720	9	9,703	1,241	11	6,430	662	7,093	7
		ENG	3,898	440	10	4,337	546	11	3,895	998	20	4,043	661	4,704	14
		IRL	3,461	269	7	3,045	266	8	3,099	516	14	3,202	351	3,552	10
		SCO	1,411	32	2	1,526	100	6	1,447	108	7	1,461	80	1,541	5
WHG	Whiting	IRL	4,309	2,025	32	4,699	915	16	5,811	2,062	26	4,939	1,667	6,607	25
		FRA	2,704	902	25	3,290	1,107	25	2,864	1,114	28	2,953	1,041	3,994	26
		ENG	550	318	37	490	142	23	483	233	33	507	231	739	31
		BEL	100	86	46	99	79	44	168	213	56	123	126	249	49
		NLD	76	83	52	152	35	19	133	81	38	120	66	187	36
COD	Cod	FRA	1,401	423	23	2,943	1,329	31	4,155	3,057	42	2,833	1,603	4,436	32
		IRL	901	542	38	851	753	47	1,399	379	21	1,051	558	1,609	35
		ENG	200	97	33	260	582	69	441	184	29	300	288	588	44
		BEL	52	34	40	123	177	59	289	95	25	154	102	256	41
		SCO	10	5	31	37	23	38	47	29	38	32	19	50	36
LEZ	Megrims	IRL	2,346	417	15	2,212	301	12	3,048	603	17	2,535	441	2,976	15
		FRA	1,997	193	9	1,613	372	19	1,948	685	26	1,853	417	2,269	18
		ENG	1,740	134	7	1,777	287	14	1,653	494	23	1,723	305	2,029	15
		SCO	743	100	12	645	129	17	683	220	24	690	149	840	18
MAC	Mackerel	ENG	746	56	7	29	3	9	5,404	5	0	2,060	21	2,081	5
		FRA	209	87	29	592	105	15	93	3,285	97	298	1,159	1,457	47
		SCO	823	0	0	1	0	5	0	0	24	275	0	275	10
		IRL	200	NA	NA	174	NA	NA	104	0	0	159	0	159	0
PLE	Plaice	ENG	841	100	11	916	146	14	935	394	30	897	213	1,111	18
		BEL	238	92	28	352	103	23	338	344	50	309	180	489	34
		FRA	271	167	38	291	107	27	265	154	37	275	143	418	34
		IRL	153	268	64	153	104	41	190	302	61	165	225	390	55
POL	Pollack	ENG	854	8	1	1,135	43	4	1,024	11	1	1,004	21	1,025	2
		FRA	884	22	2	1,030	36	3	733	1	0	882	20	902	2
		IRL	813	7	1	880	15	2	950	4	0	881	9	890	1
		BEL	22	0	0	26	0	1	33	0	0	27	0	27	1

Note: Data with * were identified to be unreliable and should not be used.

Irish Sea otter trawls

☐ **TR2 (mesh size 70-100 mm)**

Nephrops are the primary focus of the TR2 category. This species lives on areas of soft clay muds which are distributed in two distinct patches, an area in the western Irish Sea and a smaller region in the eastern Irish Sea. The use of the gear is thus concentrated in the defined Nephrops regions.

Highest TR2 effort is on the larger Nephrops grounds in the western Irish Sea. In contrast to the significant reduction in TR1 effort, TR2 effort has remained relatively stable.

Recently, some TR2 effort has shifted to fisheries targeting queen scallops. The main countries involved in this fishery are Northern Ireland and Ireland in both areas with contribution from English and Isle of Man vessels predominantly in the eastern regions.

Irish Sea beam trawls

Beam trawls operating within the Irish Sea belong to the BT2 (80-119mm) category.

Beam trawls operating within the Irish Sea targets sole, plaice, and rays.

Beam trawl effort has significantly reduced in the Irish Sea, primarily due to the decreasing catch opportunities for sole. This gear has shown a continued contraction in fishing areas and effort reduction within the Irish Sea since 2003 (Figure 2.1-10). At present there are primarily two distinct focal areas continually exploited during 2010 – 2012, one in the central western Irish Sea and other in the central eastern Irish Sea. The main countries involved in this fishery are Belgian and Irish vessels.

West Scotland Otter trawls

☐ **TR2 (mesh size 80-100mm)**

The other major demersal trawl fishery (TR2) operates with mesh in the size range 80-100mm.

The main areas of operation of this gear are the more inshore areas of the North and South Minch and the Firth of Clyde. The main target of the TR2 fishery in the West of Scotland is the Norway lobster (Nephrops norvegicus) which inhabits soft mud habitats that predominate in the inshore areas described above . Effort in the Firth of Clyde is particularly intense. Some activity for Nephrops also takes place in the slightly more offshore area of Stanton Bank.

A small by-catch of mainly gadoid fish species also occurs in this fishery. Scotland is the country expending most effort, with some activity from English and Irish vessels. Irish TR2 boats also sporadically operate a small mixed fishery for gadoids and groundfish in the southern parts of VIa.

Table 3.3-4. West Scotland (ICES Division VIa) demersal fisheries: landings (t) and discards (t) per country, species and year; table sorted in a descended order on the average catch 2010-2012, top 10 species per country, only for average total catch equal or greater than 20 t.

Country	Species		2010			2011			2012			Average 2010-2012			
			Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	Total Catch	%DR
SCO	NEP	Norway Lobster	8,234	NA	NA	8,639	NA	NA	9,973	NA	NA	8,949	NA	8,949	NA
	POK	Saithe	2,785	487	15	4,117	1,115	21	4,394	2,439	36	3,765	1,347	5,112	24
	HAD	Haddock	2,408	2,773	54	1,359	1,261	48	4,083	390	9	2,617	1,475	4,092	37
	HKE	Hake	2,342	NA	NA	3,342	NA	NA	2,600	NA	NA	2,761	NA	2,761	NA
	MAC	Mackerel	181	NA	NA	5,228	NA	NA	3	NA	NA	1,804	NA	1,804	NA
	LIN	Ling	1,376	NA	NA	1,684	0	0	1,628	NA	NA	1,563	0	1,563	0
	ANF	Anglerfish	1,040	11	1	1,011	3	0	1,178	14	1	1,076	9	1,086	1
	COD	cod	114	495	81	107	1,411	93	135	951	88	119	952	1,071	87
	WHG	Whiting	245	1,008	80	79	276	78	202	977	83	175	754	929	80
	LEZ	Megrims	820	22	3	713	15	2	586	50	8	707	29	736	4
FRA	HKE	Hake	3,081	0	0	2,949	160	5	3,022	NA	NA	3,017	80	3,097	3
	POK	Saithe	1,626	0	0	1,807	19	1	2,313	NA	NA	1,915	10	1,925	1
	BSF	Black scabbardfish	1,839	1	0	1,579	9	1	1,693	NA	NA	1,704	5	1,708	1
	BLI	Blue ling	1,642	NA	NA	1,374	13	1	1,374	NA	NA	1,463	13	1,476	1
	RNG	Roundnose grenadier	1,591	1	0	877	89	9	1,037	NA	NA	1,168	45	1,213	5
	ANF	Anglerfish	293	3	1	942	3	0	942	2	0	726	2	728	0
	LIN	Ling	728	0	0	594	7	1	529	NA	NA	617	4	621	1
	USK	Tusk	194	2	1	174	NA	NA	167	NA	NA	178	2	180	1
	LEZ	Megrims	207	2	1	90	2	2	94	NA	NA	130	2	132	2
	COD	Cod	50	133	73	41	1	3	4	4	50	32	46	78	42
NIR	NEP	Norway Lobster	1,877	NA	NA	2,374	NA	NA	2,269	NA	NA	2,173	NA	2,173	NA
	COD	Cod	3	269	99	1	NA	NA	1	NA	NA	1	269	271	99
IRL	HAD	Haddock	399	16	4	281	75	21	845	99	11	508	64	572	12
	ANF	Anglerfish	517	5	1	476	10	2	322	13	4	438	9	448	2
	POK	Saithe	451	15	3	329	0	0	341	NA	NA	373	7	381	2
	JAX	Trachurus sp	2	NA	NA	1,008	NA	NA	68	NA	NA	360	NA	360	NA
	HKE	Hake	497	NA	NA	255	NA	NA	230	NA	NA	327	NA	327	NA
	MAC	Mackerel	371	NA	NA	375	NA	NA	87	NA	NA	278	NA	278	NA
	LEZ	Megrims	318	11	3	223	5	2	214	8	3	252	8	259	3
	HER	Herring	283	NA	NA	212	NA	NA	9	NA	NA	168	NA	168	NA
	WHG	Whiting	101	33	25	146	27	16	96	67	41	114	43	157	27
	LIN	Ling	163	NA	NA	91	NA	NA	47	NA	NA	101	NA	101	NA
DNK	JAX	Trachurus sp	NA	NA	NA	NA	NA	NA	438	NA	NA	438	NA	438	NA
ENG	MAC	Mackerel	NA	NA	NA	NA	NA	NA	171	NA	NA	171	NA	171	NA
	NEP	Norway Lobster	45	NA	NA	87	NA	NA	137	NA	NA	90	NA	90	NA
	POK	Saithe	42	NA	NA	74	NA	NA	8	NA	NA	41	NA	41	NA
DEU	POK	Saithe	275	0	0	NA	NA	NA	9	NA	NA	142	0	142	0
	ANF	Anglerfish	86	NA	NA	59	NA	NA	62	NA	NA	69	NA	69	NA

Table 3.3-5 West Scotland (ICES Division VIa) Spanish demersal fisheries: landings (t) and discards (t) per species and year; table sorted in a descended order on the average catch 2010-2012, top 10 species per country, only for average total catch equal or greater than 20t

Country	Species		2010			2011			2012			Average 2010-2012			
			Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	%DR	Landings	Discards	Total Catch	%DR
ESP	HKE	Hake	NA	NA	NA	NA	NA	NA	4,140	46	1	4,140	46	4,186	1
	LIN	Ling	NA	NA	NA	NA	NA	NA	869	11	1	869	11	879	1
	SFS	Silver scabbardfish	NA	NA	NA	NA	NA	NA	655	0	0	655	0	655	0
	ALC	Bardii's smoothead	NA	NA	NA	NA	NA	NA	335	0	0	335	0	335	0
	RNG	Roundnose grenadier	NA	NA	NA	NA	NA	NA	258	0	0	258	0	258	0
	LEZ	Megrim	NA	NA	NA	NA	NA	NA	213	35	14	213	35	248	14
	RHG	Roughhead grenaider	NA	NA	NA	NA	NA	NA	191	0	0	191	0	191	0
	ANF	Anglerfish	NA	NA	NA	NA	NA	NA	142	3	2	142	3	145	2
	BRF	Blackbelly rosefish	NA	NA	NA	NA	NA	NA	78	0	1	78	0	79	1
	BSF	Black scabbardfish	NA	NA	NA	NA	NA	NA	68	0	0	68	0	68	0

1. Otter bottom trawl (OTB_DEF_70_99) targeting megrim in the Subarea VII, focusing in the Spanish fleet.

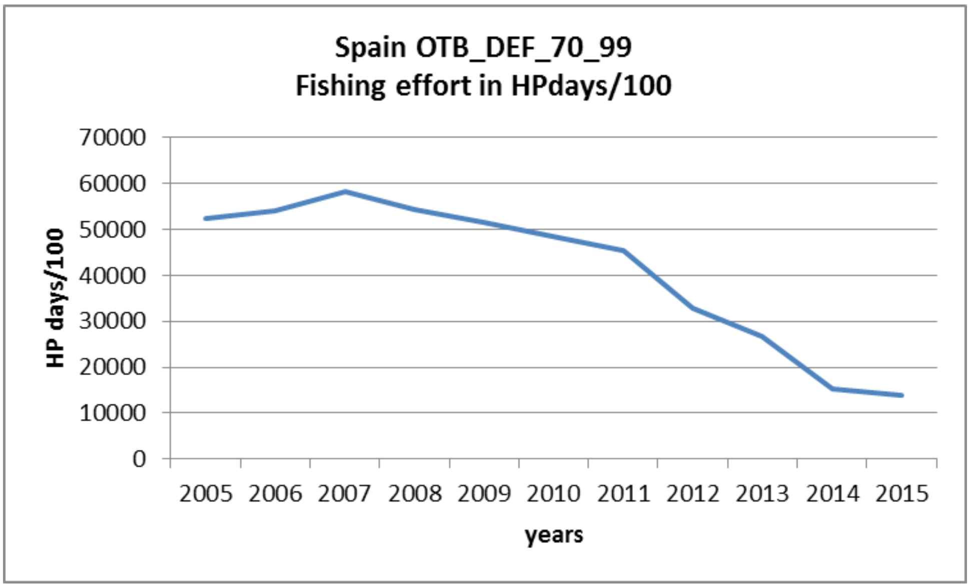
1) Characteristics of the fishery and its activity

The main Spanish fishery targeting megrim in ICES subarea VII are the Vigo otter trawlers. The Spanish mixed fishery OTB_DEF_70-99 at ICES VII (otter trawl with cod end mesh size 70-99mm) target flat fish, principally megrims and anglerfishes, with hake as one of the main by-catches. All the fishing units are based in Vigo port (Galicia, Spain). This is, a variable number of vessels from 30 in 2013 to 15 in 2015.

The minimum landing size of megrim was reduced from 25 to 20 cm length in 2000. However, the Spanish fisherman associations established a minimum size of 25 cm for megrim with the aim of protecting the small fishes and getting better prices in sales.

Catches are refrigerated on board and sold fresh in auction. Average duration of the trips is about 10 to 15 days, with 2-3 days of cruise.

Effort is distributed on shallow waters of Grand Sole and Porcupine Bank fishing mainly in Division VIIj. In the last 10 years a significant decrease in fishing effort is observed reaching to the minimum of the time series in 2015.



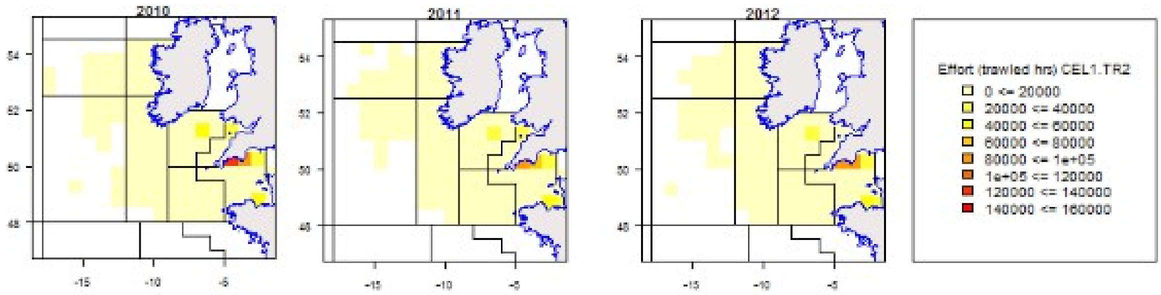


Figure1. From NWW Discards Atlas (2014), Distribution of Celtic Sea international fishing effort of OTB_70_99 Fishery, in fishing hours, between 2010 and 2012. Source: STECF.

2) Catch and discards estimates.

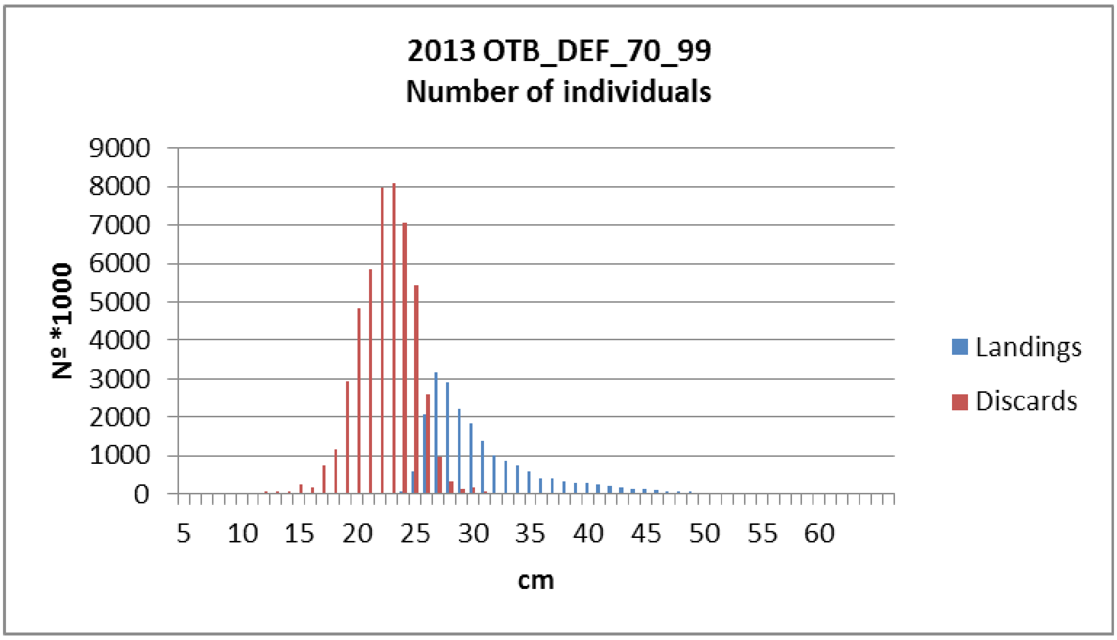
Megrim is the main landed species (aprox. 36%), but other species are also landed such as by anglerfish (22%). Total discards are composed of megrim, hake and pelagic species (boarfish, mackerel, horse mackerel, greater silver smelt and whiting). Other species not regulated by TAC complete the rest of the bycatch (landed and discarded).

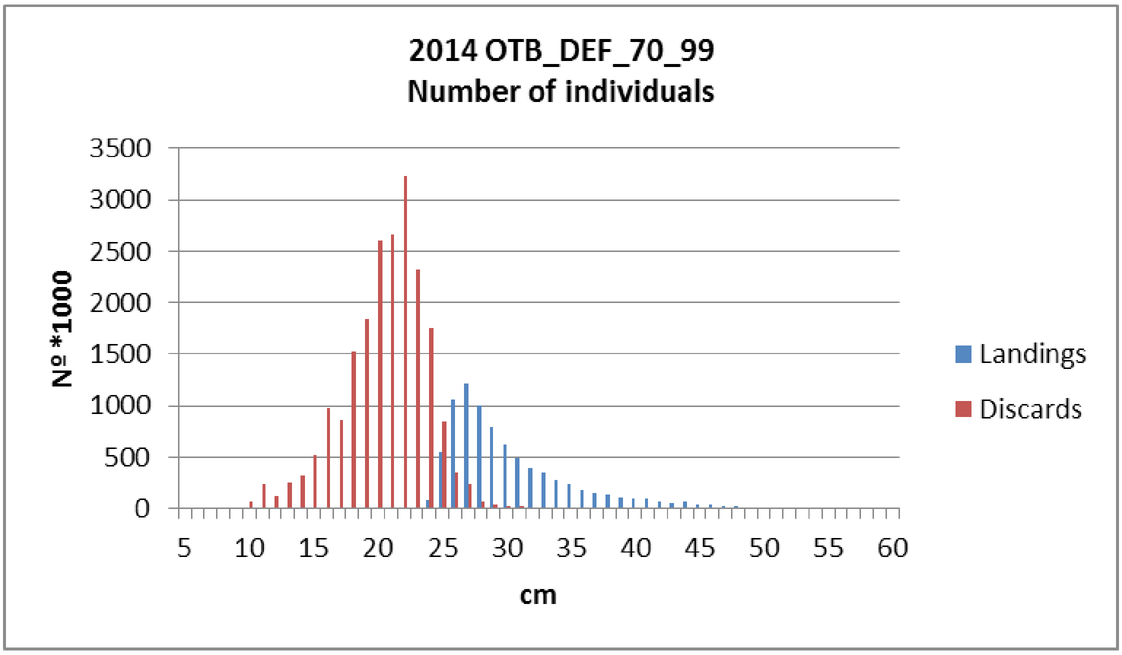
Discard ratio of megrim is estimated to be around 35% in 2012. Analyzing the values for the last 3 years, shows that discards in tons and percentage have decrease significantly from 44% to 18% of catches in 2015.(ICES, 2015)

Table 2. Estimated total catch (tons) and total discarded percentage by year for OTB_DEF_70_99 operating in the Celtic Sea from 2013 to 2015. Just Megrim catches are included.

Year	Landing	Discards	Catches	% Discards from total catch
2013	4114	3223	7337	44%
2014	2757	1131	3888	29%
2015	2358	507	2865	18%

3) Length structure 2013-2015





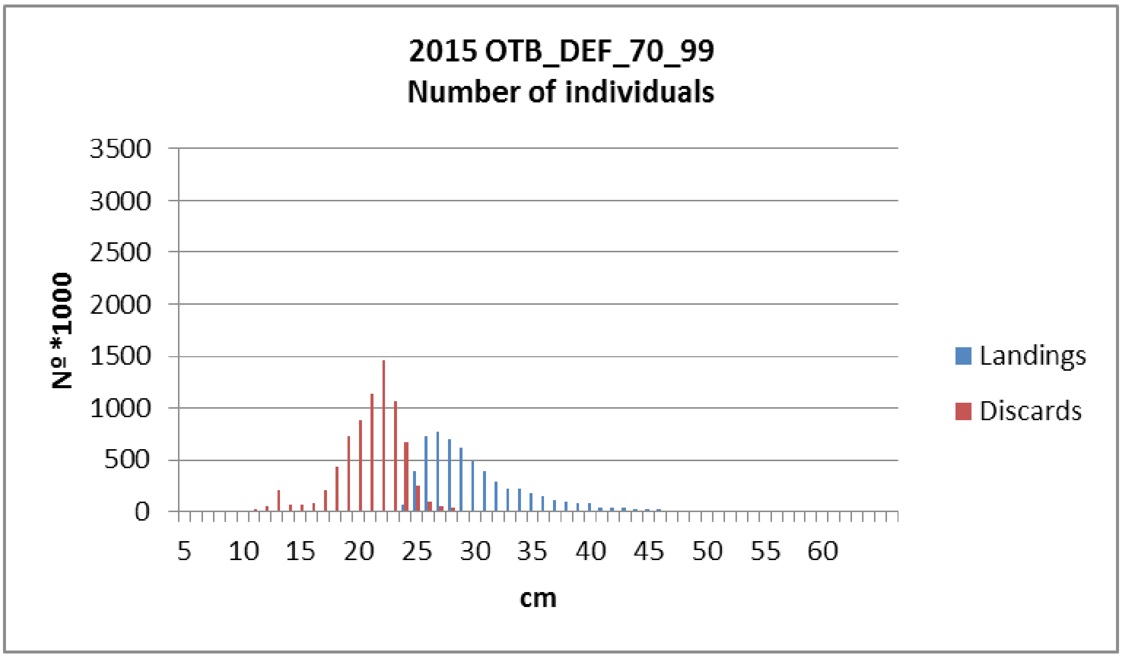


Figure 2. Retained and discarded megrim length distribution.

Minimum Conservation Size is established at 20 cm in EU regulation.

4) Reasons for discarding

Taking into account the length distribution as it can be seen in the graphic, part of the individuals are discarded due to the size, the rest are mainly discarded because the fish is damaged. In the range of length between 20 and 25 cm, the Spanish fleet discards because of a regulation in force established by P.Os.

At the moment the Producers Organizations has 25cm established as commercial size so there is a proportion of discards that would be landed in the future as marketable fish for human consumption, between 25 and 20cm, which is the minimum conservation reference size in the EU regulation. The rest would need to be managed as undersize fish. Under 20mm MCRS is the main reason for discarding.

In Table 3, Spanish national regulation introduced in the North Western Waters Region is presented.

Table 3 form an extraction of Table 5.4-1 (Catchpole and Ribeiro, 2014) List of mitigation measures that are currently legislated (L) or researched (R) by member state.

Spain	L	Fisherman organizations convened from 2004 to control landings of megrim under 25 cm size through internal association quota by fishing boat (current mandatory MLS: 20 cm). This fishing sector measure aims small megrim avoidance fishing and marketing, otherwise high grading onboard.

5) Likely choke species, and impact of the landing obligation

The main choke species is the megrim individuals under the MRCS (< 20 cm), in the case that there would be a full implementation of the landing obligation for this species in the period 2017-2019. After this last year, with the implementation of the new regulation considering no exemptions in force, the main choke species for this métier are likely to be, boardfish, mackerel, horse mackerel, blue whiting, and argentine.

6) Other relevant information

The handling and storage of the currently discarded megrim according to regulatory specifications, can lead to: slow down the operations on board, increase of workload and reduction of trip duration increasing the steaming time and reducing profitability. The effect of an increase of biomass handling on board has been quantified for Baka VIIIabd (Aboitiz et al. (in prep.)). This is a similar type of vessel (otter trawler between 24 an 40 m) which shares the multispecific composition of the catch profile with the fleet of this study.

Results showed that the enforcement of the Landing Obligation would increase the risks associated to fish handling up to unsafe levels for the crew.

Possible solutions, such as employing more people on board would increase costs and would reduce crew salaries. Automatization or any other technological solutions for improvement the sorting, handling and storing additional amount of catches on board, are not feasible to implement in the short- and medium- term in the present fishing vessels due to the physical configuration of the vessel.

ANNEX II Economic consequences of the de minimis exemption on megrim on the Spanish trawl fleet operating in the ICES sub area VII

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Abstract

In this work the likely impacts of the *de minimis* exemption to the landing obligation for the catches of megrim made by the Spanish trawl fleet operating in the ICES sub area VII are calculated.

For doing so a bio-economic simulation model has been conditioned in where the main settings of the ICES working groups providing with biological advice for the stocks concerned have been used.

Results show how the landing obligation would produce a high economic impact for the fleet while a *de minimis* would only slightly reduce this impact

Resumen

En este trabajo se calculan las posibles consecuencias de aplicar una exención del tipo *de minimis* sobre la obligación de desembarco, para la especie gallo capturada por la flota de arrastre española que opera en la zona CIEM VII.

Para ello se ha condicionado un modelo de simulación bioeconómico en el que los datos iniciales coinciden con aquellos que se usan en los grupos de trabajo del CIEM que sirven para proporcionar el consejo biológico.

Los resultados muestran como la aplicación en la obligación de desembarco tendría una impacto importante en el rendimiento económico de la flota, mientras que la aplicación de los *de minimis*, generaría una muy pequeña reducción es este impacto.

Keywords: Landing obligation; Trawl fleet; *de minimis*.

Palabras clave: Obligación de desembarco; Flota de arrastre; *de minimis*.

Introduction

Landing obligation (LO) is part of the Common Fisheries Policy (CFP) (EU, 2013). The aim of this discard ban is to reduce the waste of the sea-protein that discards create or at least the waste created in terms of human consumption (direct or not). Landing obligation has also the intention of boosting changes to end up with more selective fisheries.

The Article 15 of this regulation foresee *de minimis* exemptions up to 7%-5% (depending on the year) of the total annual catches of the species subjected to landing obligation. Such exemption can be applied if scientific evidence indicates that increases in selectivity are very difficult to achieve or to avoid disproportionate costs of handling unwanted catches. It can be applied for those fishing gears where unwanted catches per fishing gear do not represent more than a certain percentage, to be established in a plan, of total annual catch of that gear.

This study is focused on a Spanish trawl fleet that operates in the ICES sub area VII and in particular on one of its metier targeting megrim. There are not specific works in terms of the possible selectivity improvements that can be undertaken in order to reduce the discards of this fleet. However, in adjacent areas such as the Bay of Biscay, there are scientific works for similar trawl fleets that expose the difficulties of doing so (Alzorriz et al., 2016). Given that, the *de minimis* exemption for megrim is based on the fact that improvements in selectivity in this fishery (trawlers in sub area VII) and for this species (megrim) are very difficult to achieve for this fleet (Spanish trawlers). Nevertheless it is important to consider the likely ecological and economic implications of this exemption, before putting them it into force.

In that sense the objective of this work is to present the economic and biological results that would be obtained from the application of a *de minimis* exemption for megrim on the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub-areas VII.

For doing, so a full feedback bioeconomic model (FLBEIA) has been conditioned using the available data in order to anticipate the consequences of the application of a *de minimis* for megrim by the mean of simulations. That is, the objective is not to provide the exact amount that is to be lost-gained through the application of the *de minimis*, but to compare the performance of the fishery under different scenarios

Material and methods

1) Area and fleet studied

The fleet studied is the Spanish trawl fleet operating in the whole ICES sub area VII (Figure 1).

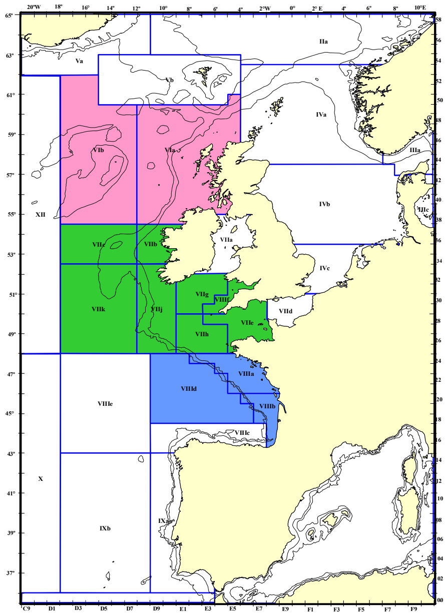

Figure 1. The fishing area studied (in green)

This fleet uses otter trawl as the main gear. Its operation can be more easily explained using the main métiers defined for it, according to the Data Collection Framework . In that sense a métier can be defined as the group of operations target to the same species, or group of species, in the same area and/or time of the year following the same exploitation pattern. The two métiers in which the activity of this fleet can be divided are:

OTB_DEF_110_119. The predominant gear for this métier is an otter trawl with a codend mesh size between 110 and 120 mm. This is a métier facing a mixed fishery taking predominantly gadoid species such as haddock and saithe and groundfish species such as anglerfish and megrim. Historically, cod was more important but the depleted nature of the stock has reduced fishing opportunities. In recent years, hake has become increasingly important. In the deeper water on the shelf slope, species such as blue ling are also caught.

OTB_DEF_70_100. The predominant gear for this métier is an otter trawl with a codend mesh size between 70 and 100 mm. This is a métier facing a mixed fishery targeting flatfish, principally megrims and anglerfish, with hake as one of the main by catches.

This last métier, OTB_DEF_70_100, is the one studied from now on.

Figure 2 can be used as a reference of the mixed composition of the landings of this métier. As it can be seen more than 80 species are landed and are part of the revenue composition of the fleet (Figure 3).

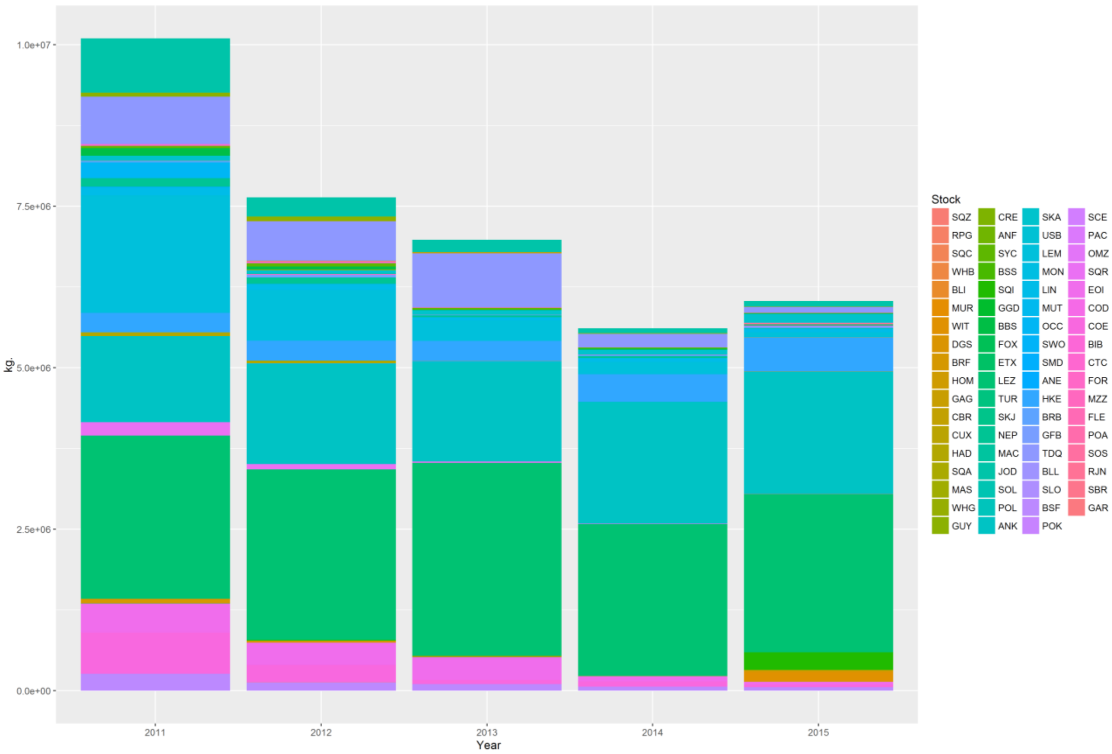

Figure 2. Landings composition (in kg.) by species for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub-areas VII. Source: IEO.

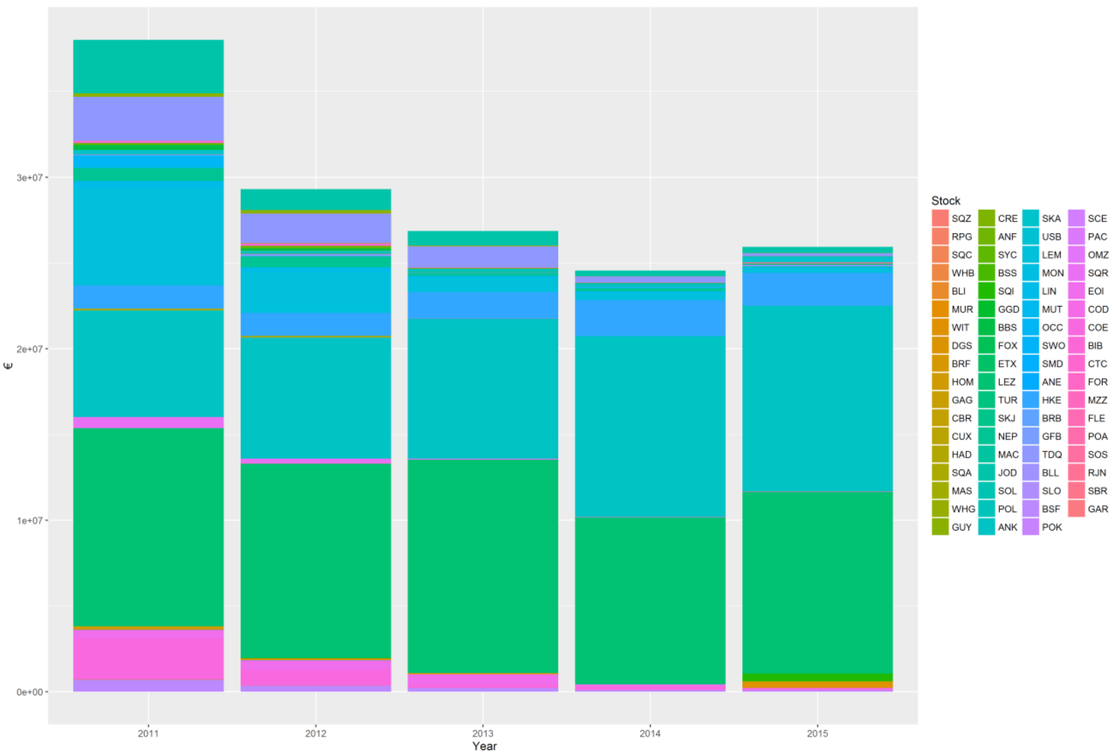

Figure 3. Landings value (in €) by species for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub-areas VII.

Even if there are more than 80 species taking part of the landing composition, six of them account for approximately the 80% of the value (Figure 4) and quantity (Figure 5).

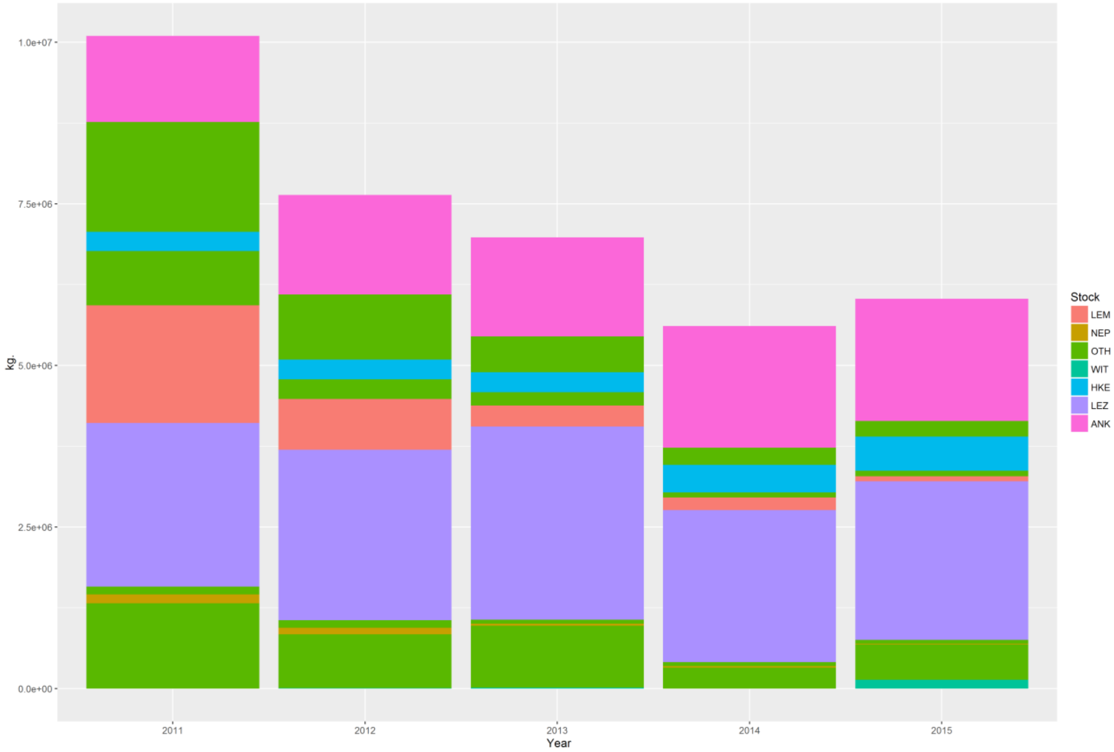

Figure 4. Landings composition (in kg) of the 6 main species for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub-area VII.

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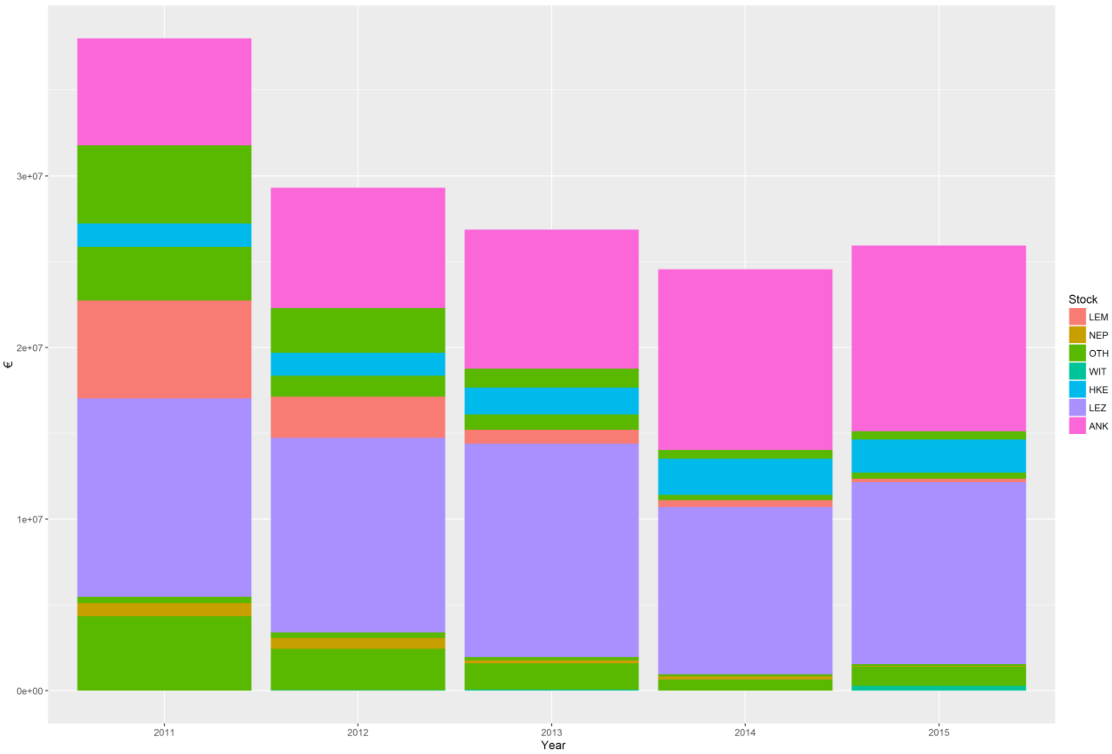

Figure 5. Landings value (in €) of the 6 main species for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub-areas VII.

These two main species are: Megrim (36% of the catches and 38% of the value), Anglerfish (22% of the catches and 30% of the value).

In terms of the discards rate of this fleet and according to the main species discarded and their discard rate is presented in Table 1

Table 1. Discard rate (average 2010-2012) for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub-areas VII. Source: Anon. (2014).

Stock	Discard rate
HKE	7 %
LEZ	35 %
ANF	18 %
WIT	12 %
HAD	92 %
NEP	42 %

2) Description of the simulation model used

Simulations have been performed using FLBEIA . This is a simulation bioeconomic model coupled in all its dimensions (economic, biologic and social). It has been developed in R using FLR libraries .

3) Fleets conditioning

The analysis is centered on the Spanish fleet operating in sub area VII, however this is not the only fleet considered in the simulation. Fleets included are those used in , that is, those included in the ICES working group assessing the northern stock of hake and megrim. It includes trawlers, gillnetters and longliners operating in the ICES sub-areas VIII and VII, from UK, Ireland, France and Spain. There is a group of "others" that accounts for the fishing mortality of hake and megrim that is not covered by the fleets explained above. It implies that all the fishing mortality of hake and megrim stocks has been included, although divided by fleets.

Not all these fleets are equally conditioned. The fleets for which costs and prices are included explicitly is the Spanish fleet operating in ICES Divisions VIII a,b,d (see Figure 1) and the Spanish fleet operating in the ICES sub area VII. These two fleets are composed of different vessels.

Costs of fishing of the Spanish trawl fleets has been obtained from the Annual Economic Report (AER) of the EU fishing fleet . The specific fleet segment considered has been the demersal trawlers between 24 and 40 meters of length. The particular values obtained for this fleet are presented in Table 2.

Table 2. Costs data of the fleet considered in the simulation

Variable	**Spanish Trawl Fleet (VII)**	**Units**
Fuel Cost	1595	€/days
Crew Cost	31%	% from the fishing income
Other Variable Cost	630	1000€/days

Fixed Cost	161608	€/vessel/year
Capital Cost	318859	€/vessel/year
Depreciation	79026	€/vessel/year

Source: AER 2015

Three types of cost dynamics have been considered in the study. Variable costs and fuel costs change with the fishing effort, crew costs change with the revenue obtained from the landings and, finally, capital, depreciation and fixed costs change with the number of vessels. The average unit value of these costs (e.g., fuel cost per fishing day or fixed costs per vessel) is kept constant along all the years of the simulation.

4) Population dynamics

The conditioning of the population dynamics is the same as in in . Twelve stocks have been introduced in the biological operating model: Megrim (*Lepidorhombus. whiffiagonis)*, Hake (*Merluccius merluccius*), Black anglerfish (*Lophius budegassa),* White anglerfish (*Lophius piscatorius)*, Western Horse mackerel (*Trachurus trachurus)*, Mackerel (*Scomber scombru,)*, Blue whiting (*Micromesistius poutassou*), Rays (*Leucoraja naevus*), Inshore squids (*Loliginidae*), Seabass (*Dicentrarchus labrax*), Cuttlefishes and bobtail squids (*Sepiidae, Sepiolidae*) and Red mullet (*Mullus surmuletus*)*.*

Hake has been simulated using an age structured dynamic and the data necessary to condition the model has been taken from ICES assessment working group reports . The stock recruitment relationship (S-R) used is a Bayesian segmented regression which is consistent with the methodology used by ICES on estimating the reference points of this stock . The population has been projected combining this S-R relationship with the exponential survival equation provided in . The reference target point used is the MSY fishing mortality (F_{MSY}). The value for hake is 0.27 and has been calculated by ICES . The TAC advice is generated using the Harvest Control Rule (HCR) provided by ICES in the framework of the Maximum Sustainable Yield (MSY) . This HCR implies that F_{MSY} for hake is advised unless the biomass falls below a trigger biomass (46200 tonnes). If this happens a linear reduction of this biomass is advised in order to recover the biomass. There is also a third reference point, the limit biomass (33000 tonnes). If the biomass falls below this last limit, the F advised should be zero (TAC=0).

Megrim has been simulated using an age structured dynamic. The conditioning has been based on the stock assessment model used by ICES to give advice. Currently, this is used by ICES only as trends . The S-R relationship used is a deterministic segmented regression. The population has been projected combined this S-R relationship with the exponential survival equation provided in . Megrim has not a defined F_{MSY}, however, TAC advice is provided using the ICES annex IV decision rule . The TAC advice is obtained using a biomass index of the previous 5 years. If the index of the last two years is a 20% higher than the index of the first three years (of this 5 years period) the TAC advised is increased in a 15%. If the index of the first three years is a 20% higher than the index of the last two years the TAC advised is reduced in a 15%. In any other case in between these two cases, TAC is not changed.

Western horse mackerel, blue whiting and mackerel are widely distributed stocks exploited by several fleets apart from those considered here. Although the catch of these stocks is relatively important for the Spanish trawl fleet, the amount of catch harvested by it is small in comparison with the international catch of these stocks. Hence, the catch of this fleet is supposed to have little impact on the dynamics of them. For the historical period, the conditioning has been done using data from working group reports . However, as it is practically impossible to include in the model all the fleets that catch these stocks, in the projection part of the simulation it has been assumed that the biomasses of these stocks stay constant and equal to the average of the last three years biomasses (2011-2013).

For, rays, inshore squids, seabass, cuttlefishes, bobtail squids and red mullet there is no assessment. However, it has been important to consider that their catches are related to the effort deployed by the fleets. Given that, an arbitrary biomass has been set with the only condition that this has to be consistent with the catches at all the levels of fishing effort observed in the past.

In the historical period discards data for hake and megrim the discard data used in the ICES assessment group has been included in the model, and the fleet share used by it, included

5) Uncertainty

Stochasticity in the model is introduced using Monte Carlo simulation and has been incorporated only in the biological side (in the S-R relationship). For hake and megrim a lognormal multiplicative error around the S-R curve (with a variation coefficient equal to the one observed in the historical period) has been used. 250 iterations have been run. For the case of hake there is another source of uncertainty derived from the Bayesian stock recruitment model fit. At each iteration of the simulation, parameters are drawn from the joint posterior distribution of the Bayesian model fit. For the sake of simplicity results are provided in medians.

6) Fishing Effort

The interaction between fish population and catch is done in biomass and the relationship between catch and effort is based on a Cobb Douglas production model at age level with constant return to scale (i.e. elasticity of effort and biomass equal to 1). Historical catchability is calculated using historical biomass and effort data in the Cobb-Douglas function, i.e. catchability is equal to catch divided by the product of biomass and effort. In the projection, catchability is assumed to be constant and equal to the 2011–2013 average. This procedure has been used for all the metiers and all the explicit stocks, individually.

The historical part of the evolution of the fishing effort is presented in Figure 6 (left). It shows the number of fishing days has been decreasing along the last 5 years.

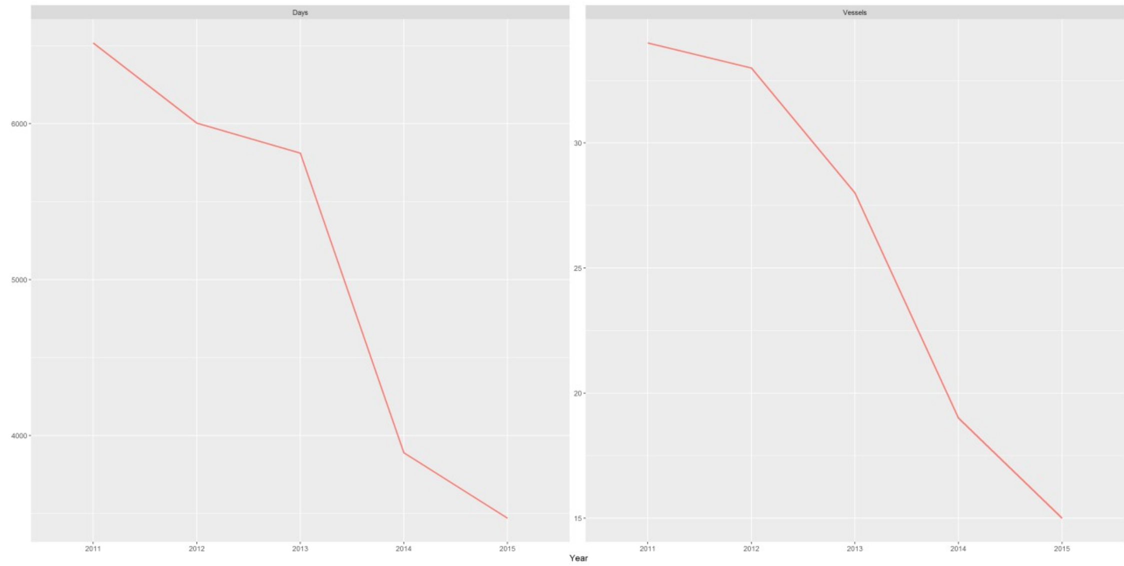

Figure 6. Evolution of the fishing effort (left) and number of vessels (right) for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub area VII in the period 2011-2015. Source: IEO

For the projection of this effort in the simulations performed the approach taken is based on the Fcube method . The effort corresponding to the TAC-share of each stock caught by the fleet is calculated. It has been assumed that the effort share along metiers is fixed and that the selection of the effort level is done in each step.

2.7. Capital: Number of vessels

In the historical part the evolution of the fishing fleet is presented in Figure 6 (right). The recent evolution (2011-2015) shows how the number of vessels has been decreasing along these 5 years.

For the projection of the number of vessels, the investment or disinvestment in new vessels (capital changes) has also been simulated following the model described in . This model relates the investment and disinvestment in new vessels with the ratio between revenue and break even revenue. The break-even revenue stands for the amount of revenue needed to cover both, fixed (in Table 2) it includes repairs, maintenance, insurance premium and administration costs) and variable costs. Variable costs are those changing with the value of landings, such as the crew remuneration, and those changing with the fishing effort, such as fuel cost and other variable costs (Table 2).

The annual investment for each fleet is determined by the possible maximum investment multiplied by the profit share (*ps* in Eq. 1). Profit share stands for the percentage of the profits that are re-invested in the fishery; however, investment in new vessels will only occur if the operational days of existing vessels are equal to maximum days (Table 1). If they aren't, the algorithm increases the effort of the current fleet. If they are equal to the maximum days, the investment decision follows the rule below:

$$
If \begin{cases} \psi < 0 \ and \ ps\psi < 0.2 \ Investment = ps \times \psi \\ \psi < 0 \ and \ ps\psi > 0.2 \ Investment = -0.2 * Fleet_{t-1} \\ \psi > 0 \ and \ ps\psi < 0.1 \ Investment = ps \times \psi \\ \psi > 0 \ and \ ps\psi > 0.1 \ Investment = 0.1 * Fleet_{t-1} \end{cases} \quad (1)
$$

I n Equation 1 ψ is equal to the ratio between (REV-BER) and REV. REV stands for the revenues obtained by the fleet and BER stands for the break-even revenue (the level where the fleet expects to generate neither profits nor losses from the total number of landings). There is not an estimation of profit-share (*ps*) available to the authors for this fleet. In that sense it has been decided to use this obtained in . This implies that is has been assumed that 30% of the profits are re-invested in the fishery. However, this value can be quite variable and in reality depends on external (e.g. overall economy situation) and/or particular (e.g. expected future revenues, expected retirement date) factors.

0.1 stands for the limit on the increase of the fleet relative to the previous year and 0.2 stands for the limit on the decrease of the fleet relative to the previous year. Again, in these two cases, there are no estimations and they have been obtained from the same source as the *ps*.

7) Prices of fish

Prices of fish (Table 3) have been assumed to be constant. For the stocks for which their dynamics have been explicitly model, prices at age group are used. For the other (OTH) group, an average price has been calculated.

Table 3. Species considered and first sale prices. Source: AZTI.

Code	Age	Average Price
ANK	all	5.53€
HKE	<3	2.27€
HKE	3	2.16€
HKE	4	2.07€
HKE	>4	2.89€
MEG	<7	4.02€
MEG	7	4.11€
MEG	>7	5.14€
MON	all	4.38€
OTH	all	3.24€

8) Scenarios analyzed

The scenarios do reflect only the management alternatives in the Spanish trawl fishing fleet operating in sub-area VII. However, there are other factors that affect the conditioning of the model. The most important thing is that the results include the inclusion of the landing obligation on hake (with a *de minimis* for years 2016-2019) for the fleets targeting them (mainly trawlers operating in Divisions VIII abde). This is important given that hake which is not subject to the landing obligation for the metier studied due to their condition of non-directed species, is a single management stock that is distributed, among others, in areas VIII and VII.

Three scenarios have been compared in relative terms to a baseline scenario. The main characteristics of each one are:

Statu quo: This scenario will be based on the no application of landing obligation to this fleet and reflects an extrapolation of the fishing pattern of the historical period conditioned in the simulation model

Landing obligation scenario: This scenario responds to the application of the landing obligation of megrim in area VII, from 2017 onwards. The implementation of this scenario is based on considering that the effort of this metier cannot be increased once the quota share of the first species is reached. In this scenario an uplift of the TAC of megrim has been simulated in the advisory process. That is, when landing obligation is in place, the TAC advice is given in terms of catches instead of landings.

De minimis for megrim: This scenario is based on the Landing obligation scenario in where on top of it a *de minimis* exemption is granted for megrim. This *de minimis* is of 7% in 2017 and 2018 and of 6% in year 2019.

Results

Results in terms of the evolution of several transversal and economic indicators are presented in Figure 7. The specific indicators used are:

- Fishing effort: Days at sea.
- Revenue: Value of all the landings in €.
- Gross Value Added (GVA): The sum of the remuneration to the crew and the remuneration to the capital (profit) in €.
- Profits: It stands for the remuneration to the capital and is calculated subtracting all the costs from the landings value (revenue).

For the case of fishing effort (Figure 7 top-left) there is a decrease in the effort that can be applied when the landing obligation is introduced compared with the statu quo (no landing obligation) scenario. This decrease is lower, when a *de minimis* is granted where this extra effort is used to catch the extra catch allowed for the megrim through. The average (2017-2019) reduction of effort when landing obligation is introduced is of 4.1%, and when *de minimis* is applied of 3.7%.

In terms of revenue and gross value added and profits (Figure 7), the difference between the statu quo scenario and the other two are also negative. For the case of revenues the application of the landing obligation will reduce them in a 5.8%, while the *de minimis* will only change this reduction to 5.4%. However, this higher revenues provided by the *de minimis* are created at the expense of a slightly higher effort (there is more to catch for the same quantity landed) which implies that the GVA, which has been reduced by the application of the landing obligation in a 7.3%, with the introduction of *de minimis* would be reduced (compared with the statu quo) in a 6.9%. The same effect is being created in terms of profits. The application of the landing obligation will reduce them in an 8.4% without *de minimis* and in a 7.9% with *de minimis*.

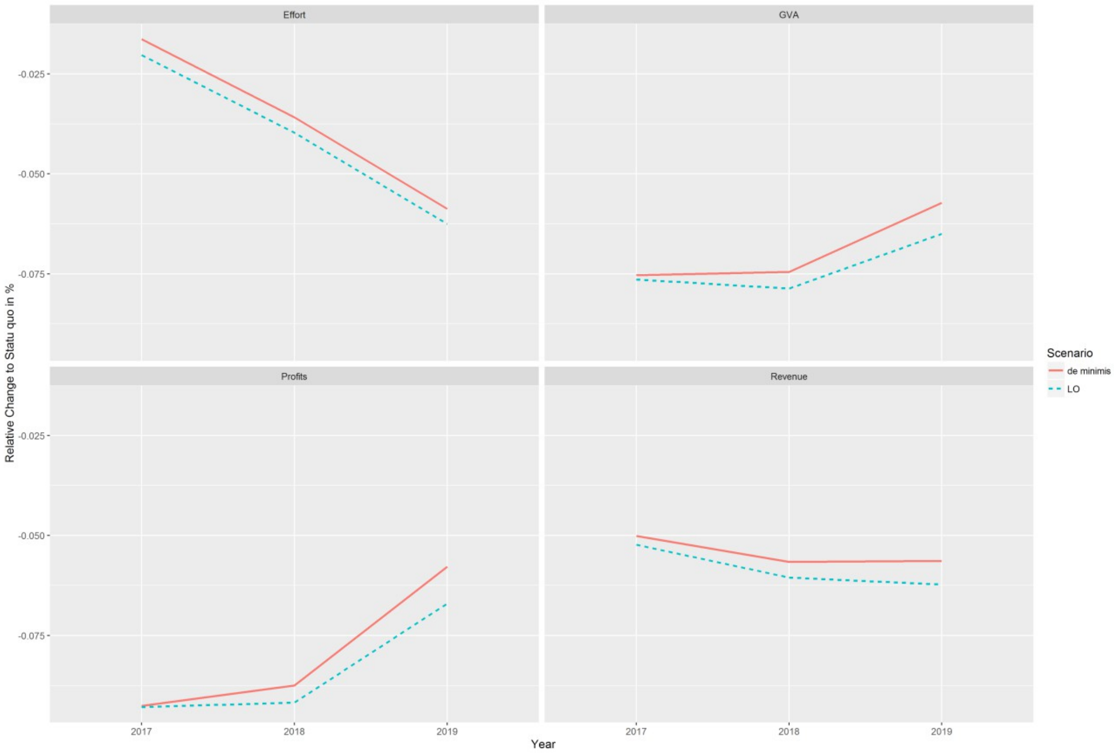

Figure 7. Evolution of transversal and economic indicators for the different scenarios in relative terms to the statu quo.

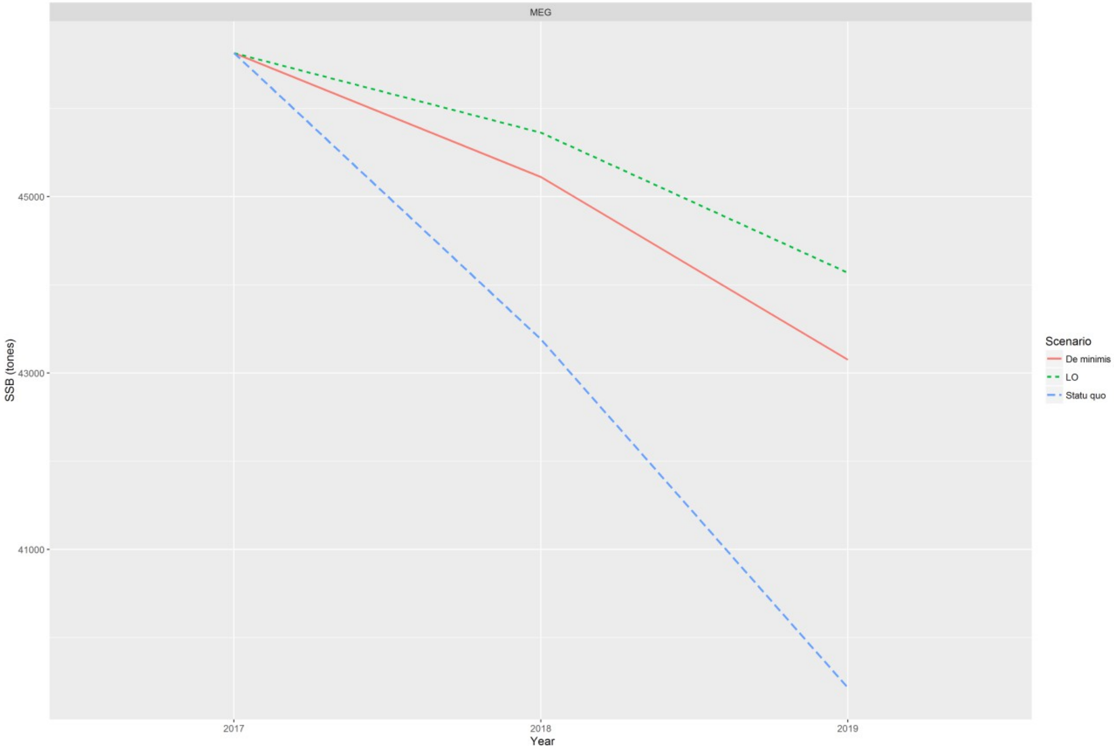

Figure 8. Evolution of Spawning Stock Biomass (SSB) for megrim under different scenarios

Figure 8 shows the evolution of the Spawning Stock Biomass (SSB) for the stock of megrim decreases slightly. However in terms of the differences between the different scenarios the reduction is of around a 5% comparing the landing obligation with the statu quo. The change if a *de minimis* for megrim is applied is of around 1%. Overall it can be affirmed that *de minimis* does not change the overall evolution of the SSB.

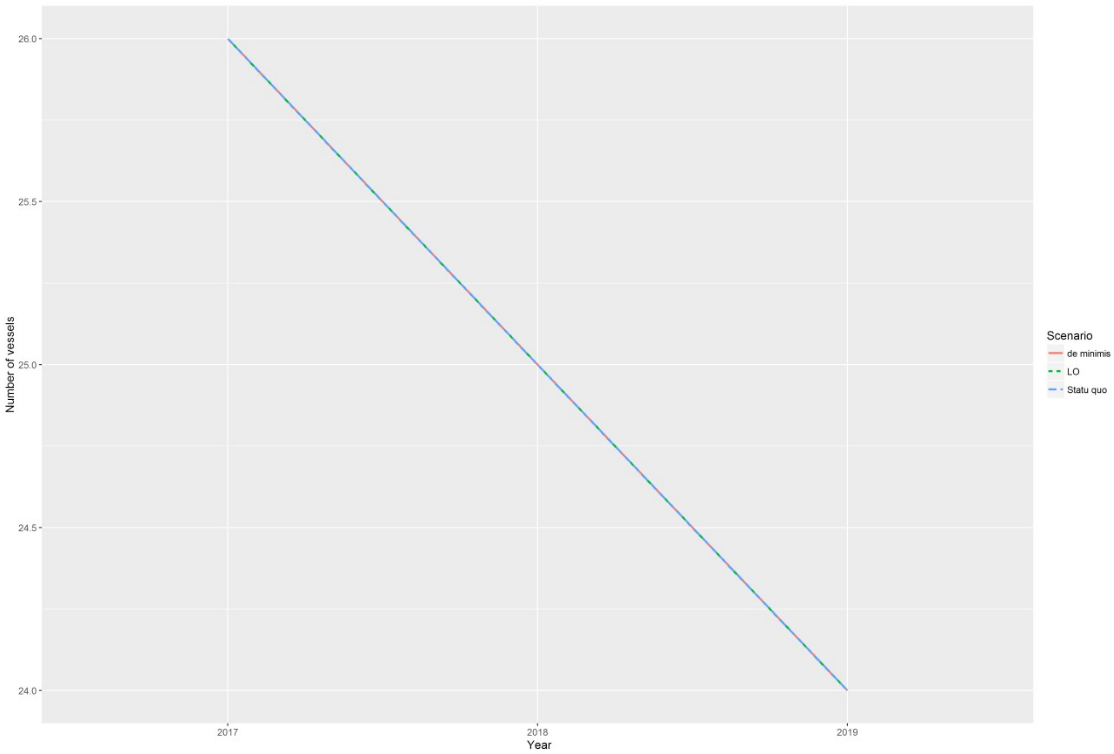

Figure 9. Evolution of the number of vessels for the OTB_DEF_70_100 métier of the Spanish trawl fleet operating in ICES sub area VII under different scenarios

Finally, in terms of the evolution of vessels and the subsequent evolution of crewmembers, the application of equation 1 (capital changes) in projection part is presented in Figure 9. The first result is that there are no differences between the scenarios simulated. The main reason for this result is that the profitability of each of the scenarios is close enough to not change the results derived from the investment-disinvestment decisions.

The second result from Figure 9 is obtained the trend obtained with what has been observed in the historical evolution of the fleet (Figure 6). The result is that there are no changes in the trend and that the evolution in terms of total number of vessels is likely to follow the decreasing trend observed in the recent past.

Conclusions

The application of the landing obligation on this fleet is likely to change the economic performance of it significantly. Revenues are reduced in a 5.8% and profits will be reduced in an 8.4%. It implies that the impact is high from the economic side. In absolute terms and in average the reduction in revenues by the application of the landing obligation will be of around 4 million Euros, and in terms of profits of around 2.5 million Euros.

This impact is not likely to change the decreasing evolution of the overall number of vessels, which is likely to continue to decrease in the following years.

The application of the landing obligation has straightforward benefits from the SSB point of view. These benefits come from the reduction in the fishing mortality of megrim (due to a lower fishing effort) and from the change in the catch profile of megrim. However even if the biomass is higher, it is not enough to compensate the reduction in fishing effort required. That is, the result of a lower effort applied to a higher biomass is, in this case, negative.

The application of the *de minimis* is likely to slightly alleviate the economic performance negative effects of the landing obligation; however, this reduction is, by nature, small. The reason for this is that there is a big difference between the current discards levels of the fleet (35% -see Table 1) and the size of the *de minimis* simulated (7%, 7% and 6% for the years 2017, 2018 and 2019, respectively). In absolute terms the *de minimis* will increase the overall revenues in comparison with the landing obligation scenario (without exemptions) in 0.3 million Euros while in terms of profits this increase is of around 0.15 million Euros.

List of species

ANE	EOI	MON	SLI
Engraulis encrasicolus	Eledone cirrhosa	Lophius piscatorius	Molva macrophthalma
ANF	**ETX**	**MUR**	**SLO**
Lophiidae	Etmopterus spinax	Mullus surmuletus	Palinurus elephas
ANK	**FLE**	**MUT**	**SMA**
Lophius budegassa	Platichthys flesus	Mullus barbatus	Isurus oxyrinchus
BAS	**FOR**	**MZZ**	**SMD**
Serranus spp	Phycis phycis	Osteichthyes	Mustelus mustelus
BBS	**FOX**	**NEP**	**SOL**
Scorpaena porcus	Phycis spp	Nephrops norvegicus	Solea solea
BIB	**GAG**	**OCC**	**SOS**
Trisopterus luscus	Galeorhinus galeus	Octopus vulgaris	Solea lascaris
BLI	**GAR**	**OMZ**	**SQA**
Molva dypterygia	Belone belone	Ommastrephidae	Illex argentinus
BLL	**GFB**	**PAC**	**SQC**
Scophthalmus rhombus	Phycis blennoides	Pagellus erythrinus	Loligo spp
BRB	**GGD**	**POA**	**SQI**
Spondyliosoma cantharus	Gaidropsarus mediterraneus	Brama brama	Illex illecebrosus
BRF	**GUY**	**POK**	**SQR**
Helicolenus dactylopterus	Trigla spp	Pollachius virens	Loligo vulgaris
BSF	**HAD**	**POL**	**SQZ**
Aphanopus carbo	Melanogrammus aeglefinus	Pollachius pollachius	Loliginidae
BSS	**HAL**	**RED**	**SWO**

Dicentrarchus labrax	Hippoglossus hippoglossus	Sebastes spp	Xiphias gladius
BXD	**HKE**	**RJC**	**SYC**
Beryx decadactylus	Merluccius merluccius	Raja clavata	Scyliorhinus canicula
BYS	**HOM**	**RJN**	**TDQ**
Beryx splendens	Trachurus trachurus	Raja naevus	Todaropsis eblanae
CBR	**JAX**	**RPG**	**TUR**
Serranus cabrilla	Trachurus spp	Pagrus pagrus	Psetta maxima
COD	**JOD**	**SBA**	**USB**
Gadus morhua	Zeus faber	Pagellus acarne	Labrus bergylta
COE	**LEM**	**SBG**	**WHB**
Conger conger	Microstomus kitt	Sparus aurata	Micromesistius poutassou
CRE	**LEZ**	**SBR**	**WHG**
Cancer pagurus	Lepidorhombus spp	Pagellus bogaraveo	Merlangius merlangus
CTC	**LHT**	**SCE**	**WIT**
Sepia officinalis	Trichiurus lepturus	Pecten maximus	Glyptocephalus cynoglossus
CUX	**LIN**	**SIL**	
Holothuroidea	Molva molva	Atherinidae	
DEL	**MAC**	**SKA**	
Dentex macrophthalmus	Scomber scombrus	Raja spp	
DGS	**MAS**	**SKJ**	
Squalus acanthias	Scomber japonicus	Katsuwonus pelamis	

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ANNEX III Scientific information to support "*De minimis*" exemption for Spanish fishing vessels of métier OTB_DEF<70-99 targeting megrim in ICES VII

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Megrim (*Lepidorhombus whiffiagonis*) in Div. VIIb-k and VIIIa,b,d is caught in a mixed demersal fishery catching anglerfish, hake and Nephrops, both as a targeted species and as valuable by-catch.

The megrim stock assessment is made by an analysis of trends. In the last decade, the spawning-stock biomass (SSB) shows an increase and fishing mortality has decreased. Recruitment (R) has been relatively stable over the time-series. The 2014 and 2015 TAC were set at 19101t, including a 5% contribution of Four-spot megrim (*L. boscii*) in the landings for which stock there is no assessment.

The Spanish Porcupine ground fish survey (SpPGFS-WIBTS-Q4) occurs at the end of the 3rd quarter (September) and start of the 4th quarter. It is a bottom trawl survey that aims to collect data on the distribution, relative abundance and biology of commercial fish in ICES Division VIIb-k, which corresponds to the Porcupine Bank and the adjacent area in western Irish waters between 180-800m. The survey area covers 45 880 Km2 and approximately 80 hauls per year are carried out. Abundance index of megrim species are used in ICES WGBIE.

Landings in recent years were relatively stable around 15000t. The minimum landing size of megrim was reduced from 25 to 20 cm length in 2000. Discarding of smaller megrim is substantial and also includes individuals above the minimum landing size of 20 cm. The discards were variable, between 2000 and 4000t. There is not fisheries assessment by ICES for this stock. Catch, landing and discard data and survey indices do not appear to indicate the presence of important change in trends of recruitment or the overall biomass.

Description of the fishery targeting megrim in ICES VII

Megrim in the Celtic Sea, west of Ireland, and in the Bay of Biscay are caught in a mixed fishery predominantly by French followed by Spanish, UK and Irish demersal vessels. In 2014, the four countries together have reported around 96% of the total landings (ICES, 2015).

The Spanish mixed fishery OTB_DEF_70-99 at ICES VII (otter trawl with cod end mesh size 70-99mm) target flat fish, principally megrims and anglerfishes, with hake as one of the main by-catches. Effort is distributed on shallow waters of Grand Sole and Porcupine Bank fishing mainly in Division VIIj. Discard ratio of megrim is estimated in 26-33% of total catch (Table 1). The main cause of discarding is minimum legal size, although some high grading is known to occur.

Also a small percentage of discards are made by the Spanish mixed fishery OTB_DEF_100-119_0_0 in ICES VIIj-k, targeting anglerfishes (*Lophius spp*) and hake (*Merluccius merluccius*).

Table 1. Megrim (Lepidorhombus whiffiagonis) discard estimates (T) in 2014 by division ICES VII in Spanish bottom trawl metiers targeting demersal species.

Especie	Area ICES	*Métier*	D	L	C	%C-D
MEG	VIIb	*All métiers*	**101.61**	**202.4**	**304.01**	33.42
MEG	VIIb	OTB_DEF_70-99_0_0	101.61	202.4	304.01	33.42
MEG	VIIc	*All métiers*	**161.71**	**304.5**	**466.21**	34.69
MEG	VIIc	OTB_DEF_100-119_0_0	0.89	5.94	6.83	13.03
MEG	VIIc	OTB_DEF_70-99_0_0	160.82	298.56	459.38	35.01
MEG	VIIg	*All métiers*	**17.67**	**43.69**	**61.36**	28.80
MEG	VIIg	OTB_DEF_70-99_0_0	17.67	43.69	61.36	28.80
MEG	VIIh	*All métiers*	**108.16**	**307.81**	**415.97**	26.00
MEG	VIIh	OTB_DEF_70-99_0_0	108.16	307.81	415.97	26.00
MEG	VIIj	*All métiers*	**945.17**	**1909.46**	**2854.63**	33.11
MEG	VIIj	MIS_MIS_0_0_0_HC		0.29	0.29	0.00
MEG	VIIj	OTB_DEF_100-119_0_0	2.58	5.15	7.73	33.38
MEG	VIIj	OTB_DEF_70-99_0_0	942.59	1904.02	2846.61	33.11
MEG	VIIk	*All métiers*	**2.32**	**4.51**	**6.83**	33.97
MEG	VIIk	OTB_DEF_100-119_0_0	2.32	4.51	6.83	33.97
MEG	**All areas**	**Total**	**1336.64**	**2772.37**	**4109.01**	**32.53**

Selectivity projects

Several projects have been carried out by IEO over the last years in NWW waters to study the selectivity of different gears and configurations (see reference list). Pilot studies on square mesh were conducted in the 90's. A project in 2010 designed the selectivity measures to be tested in Porcupine and Gran Sole (ICES VII) and selectivity trials have been conducted in 2014 focusing on mesh netting geometry and mesh size to minimise round fish by catch.

De minimis exemption in the frame of the landing obligation for megrim species (*Lepidorhombus whiffiagonis* and *L. boscii*), fished by bottom trawling (OTB), at divisions CIEM VII, can be justified due to the fact that further improvements in gear selectivity are difficult to achieve for the megrim fishery using 70-99mm mesh size. The results from several selectivity studies carried out by the IEO indicate that an increase of mesh sizes with the aim of increasing selectivity is hard to achieve without loss of a part of the catch of marketable sized and the subsequent decrease in profitability. The scientific IEO Discard Program aims to advance in this objective through experiences to be carried till 2020.

Conclusion

An increase in selectivity is hard to achieve without loss of a part of the catch which is of marketable size and this has as a consequence a decrease in fishermen´s revenues.

The obligatory landing of all megrim discards of small size implies an additional cost in crew time and an increase of space onboard both which are a problem from the logistic and economic point of view.

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