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Exploration des potentiels changements post-Brexit dans les opportunités de captures des pêcheries pélagiques européennes

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Voyager (Kilkeel, UK) entrant dans le port de Skagen, Danemark (07/06/2018), Photo : G. Carruel

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Glossary

AC: Advisory Council
Brexit: Process leading to the UK leaving the EU
CFP: Common Fisheries Policy
CPUE: Catch Per Unit of Effort
EEZ: Exclusive Economic Zone, jurisdiction assumed by a coastal State over the exploration and exploitation of marine resources in a band extending 200 nautical miles from the shore.
EU: The European Union (28 Member States)
EU27: The European Union without the United-Kingdom (27 Member States)
EU27 fleet: fishing vessels registered in one of the EU27 member state
EU27 waters: EEZs of the EU27 Member States
FAO: Food and Agriculture Organization
Fmsy: Fishing pressure level resulting in the maximum sustainable yield (for a set stock, and environmental conditions) and leading to a biomass level called Bmsy
HERAS: Herring Acoustic Survey
IBTS: International Bottom Trawling Survey
ICES: International Council for the Exploration of the Sea
JRC: Joint Research Centre
MS: The Member States of the EU
MSY: Maximum Sustainable Yield, corresponds to the greatest biomass quantity that can be harvested of a fish stock indefinitely (for set environmental conditions)
MSYBtrigger: Spawning stock biomass level triggering a special management action to reach Bmsy (spawning stock biomass level corresponding to long term fishing pressure maintained at Fmsy)
NEAFC: North-East Atlantic Fisheries Commission, the Regional Fisheries Management Organisation of the North-East Atlantic
NGO: Non-Governmental Organisation
Other waters: EEZs of non-EU countries and international waters
PelAC: Pelagic Advisory Council
STECF: Scientific, Technical and Economic Committee for Fisheries
TAC: Total Allowable Catch
UK: The United-Kingdom
UK fleet: fishing vessels registered in the United-Kingdom
UK waters: UK EEZ's
UN: The United Nations

Stocks managed by the Pelagic Advisory Council and referred to in the report:

- 6aNS7bc Herring: VIa North, VIa South & VIIb,c Herring (Clupea harengus)
- AS Herring: Atlanto-Scandian Herring (Clupea harengus)
- B Whit: Blue Whiting (Micromesistius poutassou)
- Boarf: Boarfish (Capros aper)
- CS Herring: Celtic Sea Herring (Clupea harengus)
- IS Herring: Irish Sea Herring (Clupea harengus)
- NEAtl Mackerel: Northeast Atlantic Mackerel (Scomber scombrus)
- NS AS Herring: North Sea Autumn Spawning Herring (Clupea harengus)
- NS Horse Mackerel: North Sea Horse Mackerel (Trachurus trachurus)
- S Horse Mackerel: Southern Horse Mackerel (Trachurus trachurus)
- W Horse Mackerel: Western Horse Mackerel (Trachurus trachurus)
- WB SS Herring: Western Baltic Spring Spawning Herring (Clupea harengus)

French summary

Lors du référendum du 23 Juin 2016 au Royaume-Uni (RU), une majorité des votants s'est prononcée en faveur d'une sortie de l'Union Européenne (UE). Cette sortie sera effective à partir de mars 2019, ce processus est connu sous le nom de « Brexit » (L'UE comptera alors 27 pays membres, désignés UE27 ci-dessous). Une période de transition, pendant laquelle la politique commune des pêches (PCP) continuera de s'appliquer, durera jusque fin 2020.

Un des groupes actifs lors de la campagne pour le Brexit était celui des pêcheurs du RU. Ils demandaient le retour à un contrôle par le RU des eaux anglaises, la sortie de la PCP et la fin de l'allocation de quotas selon le principe de stabilité relative.

Les conseils consultatifs ont été établis en 2004 comme des organisations permettant aux acteurs de la pêche de donner des conseils à la Commission Européenne. Le Pelagic Advisory Council (PelAC) s'intéresse aux questions de gestion long et court terme et donne des conseils pour 12 stocks dont 10 seront directement affectés par le Brexit. Les membres du PelAC sont donc préoccupés par le devenir de ces stocks. Les préoccupations de l'industrie liées aux incertitudes portées par ce processus sont également partagées par les autres acteurs comme les ONG environnementales. La perception de la dépendance de l'UE27 vis à vis du RU dans le domaine des pêches n'a pas été évaluée à l'échelle des stocks halieutiques et tournée vers les pêcheries pélagiques et c'est donc cet aspect qui a fait l'objet de ce travail.

En conséquence, cette étude s'intéresse au futur des pêcheries pélagiques européennes et tente d'expliquer comment elles pourraient être affectées par le processus de sortie du RU de l'UE. Une approche pratique avec une réflexion particulière autour des opportunités de pêche, des accès aux Zones Économiques Exclusives (ZEE) et de la répartition des quotas est choisie: Quel est le niveau actuel de dépendance de la flotille pélagique européenne vis à vis du RU ? Quels stocks halieutiques souffrent des plus grandes incertitudes à cet égard ? Lesquels semblent les plus vulnérables ? Quels sont les facteurs qui vont influencer les négociations en faveur d'un accès à la ZEE britannique/en faveur d'une nouvelle répartition des quotas ? Quelles alternatives existent pour les pêcheurs ?

L'étude menée se limite aux stocks de poissons pélagiques gérés par le PelAC et à une période comprise entre 2011 et 2016.

- Contexte de l'étude et méthode utilisée

La PCP, principal texte régissant les pêches au sein de l'UE, unifie le système de gestion des pêches. Elle stipule que l'accès aux pêcheries doit être accordé à tous les navires de pêche de l'UE. Elle définit également la procédure d'allocation des quotas. Cette dernière se fait depuis 1983 selon une clé de répartition appelé « stabilité relative » qui prend en compte plusieurs critères définis à l'époque. Différents mécanismes ont été développé pour adapter les opportunités de pêches aux situations concrètes rencontrées par les pêcheurs. Le premier, appelé « quota hopping », consiste à l'achat d'un bateau d'un autre pays membre afin de profiter de ses quotas. L'autre, appelé « quota swapping », consiste à échanger des quotas entre pêcheurs, organisation de producteurs, ou états membres.

Pour trois stocks en particulier, Harengs de Mer du Nord, Chinchards de Mer du Nord et Maquereaux Atlantique Nord-est, dentifiés comme les plus pertinents pour l'étude, un travail bibliographique a été mené. Les principales caractéristiques de la pêcherie, les routes de migrations, l'état du stock et les potentiels changements à venir ont été autant de critères examinés.

Les données de débarquements obtenues grâce au Joint Research Center ont été étudiées de manière quantitative et géographique. La répartition des quota et les swaps ayant lieux sont ensuite présentés.

Quatre scénarios différents ont ensuite été considérés : le premier (S1) correspond à un statu quo qui n'impliquerait pas de changement par rapport à la situation actuelle, les navires auraient

accès aux eaux britanniques et la répartition des quota ne serait pas modifiée. Le second (S2), postule une fermeture de la ZEE britannique aux navires de pêche. Les pêcheurs devraient dans ce cas-là reporter et adapter leur effort de pêche sur d'autres zones, (et/ou d'autres espèces). Un troisième scénario (S3) imagine un accès aux eaux du RU avec une volonté de renégociation de la répartition des quotas. Enfin, le dernier scénario (S4) résulterait en une fermeture de la ZEE et une absence d'accord pour la répartition des quotas. Ce cas peut potentiellement correspondre à celui d'un Brexit sans accord final.

Pour chacun des scénarios, une réflexion a été conduite afin d'identifier les différents facteurs qui influenceront les issues des scénarios.

Fort de la nature des Conseils Consultatifs comme un forum d'acteurs, un travail de recueil d'informations complémentaires et de perspectives individuelles a été mené. Pour cela, un questionnaire a été élaboré et distribué aux membres du PelAC.

- Diagnostic de la situation actuelle

Les stocks de Maquereaux Sud, Harengs de Mer Baltique, Harengs Atlanto-Scandien, Sanglier, Harengs de Mer d'Irlande représentent, pour différentes raisons, de faibles enjeux ou sont peu concernés par le Brexit.

Deux stocks affichent une dépendance du RU vis à vis de la ZEE de l'UE27 en termes de proportion des débarquements : le Chinchard Occidental et le Merlan Bleu. Respectivement 46% et 77% des débarquements britanniques proviennent des eaux de l'UE27. Cette dépendance doit être relativisée en soulignant que 17% (Chinchard) et 37% (Merlan Bleu) des débarquements européens proviennent des eaux du RU et qu'en valeur absolue, cela représente beaucoup plus de tonnes que les débarquements britanniques.

Le Hareng de Mer Celtique et celui de la zone 6a-7bc présentent une dépendance des pêcheurs européens vis à vis du RU. En effet, ils débarquent environ 7000 tonnes par an en provenance de la ZEE britannique. Le Hareng et Chinchard de Mer du Nord, Maquereau Nord-Est Atlantique sont pêchés de manière importante par la flottille UE27 dans les eaux britanniques (entre 57% des débarquements pour le Chinchard et 84% pour le Hareng). Ces trois derniers stocks sont parmi les plus vulnérables. En plus de leur importance économique, cela fait d'eux les enjeux majeurs et les stocks les plus à risque pour l'UE27 lors des négociations.

- Facteurs d'influence des scenarios

Différentes catégories de facteurs d'influence ont été identifiées :

En premier lieu, le niveau de dépendance actuel et les potentielles opportunités pour la flotte. Cette catégorie de facteurs peut être étudiée à travers les données obtenues dans la partie précédente. Pour ce qui est des opportunités pour la flotte, elles peuvent être examinées en s'intéressant aux anciennes zones de pêches, à celles qui existent en dehors des eaux du RU et de l'UE27, aux potentielles modification de répartition du stock et aux zones traversées lors de l'ensemble du cycle de vie.

L'abondance de la ressource et des utilisateurs est la deuxième catégorie identifiée. Elle inclue des facteurs tels que l'état du stock, la pression de pêche appliquée, la productivité du stock, le nombre de pays participant à la pêcherie, et l'existence d'accords internationaux.

Enfin, il existe des facteurs externe. Ils peuvent provenir de l'environnement maritime (stratégie de pêche, changements écosystémiques, mode de gestion différent et changement climatiques) ou aux négociations de manière plus large.

- Résultats des scénarios

Les potentielles issues des scénarios ont été explorées à la lueur du travail bibliographique et des retours des acteurs du PelAC. S1 ne requiert pas d'attention particulière puisqu'il n'implique pas de changement vis à vis des critères étudiés. L'aboutissement de S4 est assez clair également.

Ce scénario catastrophe ne peut que conduire à un rapide effondrement des stocks suite à une course au poisson entrainant de la surpêche. Les conséquences seraient désastreuses pour toutes les parties.

Dans le cas de S2, les pêcheurs devront reporter leur effort de pêche. Il ne sera surement pas possible de capturer la même quantité de poisson puisqu'ils se tourneront vers des zones de pêche de second choix. Cibler des juvéniles ou des poissons en période de fraye pourrait fournir des alternatives mais celles-ci pourraient se révéler non-durables. Finalement le changement climatique et la sensibilité environnementale des schémas de migration de ces stocks pourraient faire apparaître de nouvelles zones de pêche dans le futur.

Le scenario S3 implique une nouvelle série de négociations internationales avec de nombreux pays pour la plupart des stocks. La répartition actuelle des quotas pour les 3 stocks les plus vulnérables risque de changer au détriment de l'UE27. Les arguments de l'UE27 pour conserver une part importante de ses quotas sont ceux du cycle de vie de ces espèces qui traversent les frontières des ZEE plusieurs fois au cours de leurs migrations.

- Discussions

Seuls les débarquements des flottes britanniques et européennes sont pris en compte dans la partie diagnostic. Pour certains stocks, les pays tiers contribuent de manière significative aux débarquement totaux. De plus, les chiffres utilisés dans cette partie font référence aux débarquements et non aux captures. D'autres pêcheries capturent et rejettent potentiellement de grandes quantités de poissons pélagiques. Cela pourrait avoir une incidence importante lorsque l'obligation de débarquement s'appliquera à ses pêcheries. Enfin, les stock pélagiques ont un recrutement irrégulier qui conduit à des variations de biomasse importantes, les moyennes effectuées sur 6 ans pour le diagnostic ne reflètent donc pas forcément les futurs débarquements.

L'importance des facteurs extérieurs dans les scénarios ne doit pas être négligée. Les résultats des scénarios sont relativement incertains. Ces incertitudes sont d'ordre économique, comportemental (lié à la future stratégie de pêche adoptée), biologique (dont écologique), et lié aux négociations. Le report d'effort (cas de S2) pourrait être dirigé vers d'autres espèces, cela n'a pas été pris en compte dans l'étude car particulièrement difficile à mesurer.

Un des arguments clé dans l'obtention d'accords équilibrés semble être le concept d'attachement zonal. Néanmoins, la définition de cette notion est débattue et est une question éminemment politique. De plus, un accord ne reposant que sur cette notion et sans réévaluation sur un pas de temps donné court le risque de s'éloigner d'une réalité changeante. La mise en place d'un mécanisme de révision ne garantit pas non plus un accord stable puisque les changements au détriment d'une des partie pourraient la conduire à ne plus respecter l'accord.

La dépendance de la flottille de l'UE27 vis à vis de la ZEE du RU dans le secteur des pêcheries pélagiques ne fait pas de doute. Néanmoins, les situations sont variables et les scénarios de Brexit ne conduisent pas aux mêmes conclusions d'un stock à l'autre. Les pêcheries pélagiques les plus dépendantes sont celles des stocks de Harengs et Chinchards de Mer du Nord et Maquereaux de Nord-Est Atlantique. Que la question porte sur l'accès aux ZEE ou sur la renégociation des quotas, un grand nombre de facteurs influenceront les résultats. Les scénarios conduisent tous à des situations plus défavorables que la situation actuelle pour les pêcheurs européens.

Pour la plupart des stocks halieutiques étudiés, le cycle de vie ne respecte pas les frontières humaines que sont les ZEE. Quelques soient les résultats des négociations, l'importance de la coopération internationale doit être rappelée. Elle est capitale pour éviter les conséquences désastreuses d'une surpêche. Cet enjeux primordial est compris et mis en avant par les acteurs du PelAC dans leurs réponses au questionnaire. Permettre à ces acteurs de participer aux négociations paraît une manière constructive d'atteindre des accords à la hauteur des enjeux.

Foreword

The Advisory Council secretariat has a special duty of remaining neutral and acknowledging all the positions present among the council members. This is especially relevant when dealing with conflicting views between sectors but also applies when different perspectives arise from Member State to Member State.

This report was written at the Pelagic Advisory Council Secretariat and an impartial approach was therefore equally required. Time constraints led to the need to restrain the work on scenarios to a few fish stocks only and ultimately a choice had to be made. The fish stocks chosen are the ones for which the fishermen of the remaining EU Member States might be most affected. The respective fish stocks for the UK fishermen do not carry such huge uncertainties and do not affect as many people.

During the 6 months internship, numerous stakeholders from both the UK and other EU Member States provided remarks, suggestions and genuine help. This study will be available on the Pelagic Advisory Council website so that anyone interested in it can find it. This is fully in line with the transparency that is expected for such work.

1. Introduction

During the referendum vote of the 23rd of June 2016, 51.9% of the United-Kingdom (UK) voters pronounced themselves in favour of leaving the European Union (EU) (BBC, 2016). The UK government triggered Article 50 of the Treaty of the European Union (The Member States of the EU, 2007) on the 29th of March 2017 which means that the UK will not be part of the EU by March 2019, a process called "Brexit". A transitional period, during which the Common Fisheries Policy (CFP) will still fully apply to fisheries management, will probably last until December 2020 (BBC, 2018).
One of the active groups in campaigning for Brexit were the UK fishermen. They wanted to "restore full UK control" of their waters, pull out of the CFP and end the current fish quota allocation based on the relative stability rule (Fishing For Leave, 2018). These two variables: access and quota share are at the centre of the discussions. On the other EU member states side, Brexit has been a matter of concern for the fishermen.

The Advisory Councils were set up in 2004 as stakeholders' organisations to provide advice to the European Commission. Several of them, among which the Pelagic Advisory Council, will be affected by Brexit. This Advisory Council addresses both long term and short-term management issues and advises on 12 different stocks of which 10 will be directly impacted by Brexit because their management area is overlapping with UK waters and because a share of their catches is caught by UK vessels. Therefore, the PelAC and its stakeholders are concerned about the future management of these stocks. Brexit is described as a major challenge for several fishing fleets by the Joint Research Centre (JRC) 2017 Annual Economic Report on the EU Fishing Fleet (Scientific, Technical and Economic Committee for Fisheries, 2017a). The industry is concerned by the uncertainties carried out by the process and has organized itself by creating the European Fisheries Alliance to advocate for free access of market and waters after Brexit (EUFA, 2018). The fishermen have been actively alerting to the risk of the sector being underrepresented during the negotiations because of its relatively small economical weight (Perrotte, 2017). The importance of the fishing sector lies in the fact that it provides employment and economic activity in regions with few other alternatives (European Union Committee, House of the Lords, 2016). The other PelAC stakeholders, like environmental NGOs, are also concerned by these future changes (Clayton, 2017). Finally, the Northeast Atlantic is also the area with the highest fish landings in the Atlantic Ocean (Food and Agriculture Organization, 2017), which provides food for numerous markets. The perceived dependency of the EU27 on the UK on fisheries matters lacks a study at the stock level and focusing on the particular case of pelagic fisheries and this aspect is therefore the main topic of this study.

This study will consequently focus on the future of the European pelagic fisheries, trying to understand how they could be affected by the Brexit process. This could have been addressed in numerous different ways from a legal to an economic standpoint. This study will focus on a practical approach with a particular attention on fishing opportunities.
Numerous questions were articulated around the main issue of the consequences of the Brexit for European pelagic fisheries:
What is the current level of dependency of the EU27 fisheries on the UK? Which fish stocks carry the most uncertainties? Which ones are the most vulnerable? What are the inherent factors that might influence the negotiations for access to UK waters/ for new quota share? Could alternative fisheries be developed? What could be the outcomes of these negotiations according to the current information available? Where do the greatest uncertainties remain?

These questions clarify and structure the answer elaborated in this report. An analysis of the fish stocks and the fisheries' current situation is presented at the start. Attention was set on current landing origins and quota distribution. The fleet's dependency for each fish stock was made clear. The factors of influence involved in the negotiations were then identified. For the vulnerable stocks, the potential consequences of Brexit according to hypothetical scenarios were explored.

The focus will be limited to the pelagic fish stocks managed by the AC which represent 5 different species (herring, mackerel, blue whiting, horse mackerel, boarfish), targeted by 10 EU member states (MS) and member of the PelAC (Denmark, France, Germany, Ireland, The Netherlands, The United-Kingdom, Poland, Spain, Sweden), Portugal, and other fishing countries. Other countries happen to catch a small proportion of these stocks as by-catch (Belgium, Lithuania, Estonia).

2.Context of the study

2.1. The Common Fisheries Policy: equal access and quota distribution

The Common Fisheries Policy is the main legal document governing fisheries in the EU. It specifies that : "(18) Union fishing vessels should have equal access to Union waters and resources subject to the rules of the CFP" (European Parliament and Council Of The European Union, 2013). The idea of "non-discrimination" between Member States (MS) was enshrined in the Treaty of Rome in 1957 but it was applied to fisheries and translated into the "equal access" requirements in 1970 (Council Of The European Communities, 1970; Symes, 1997). Access to and use of the fishing grounds situated in the waters under all MS jurisdictions were granted to the MS fishing fleets[1]. The equal access provisions were later limited with the entry of new MS (including the UK) and the development of the CFP (Walter, 2010).

The first CFP was established in 1983 by Regulation (EEC) No 170/83. Among other things such as the unified management system up to 200-nautical miles off the coasts, the CFP laid down the allocation key of the quota principles that still apply today (Marti, 2018). It was later adjusted in 1986 (after the entry of Spain and Portugal). It is based on three elements (Andersen, Nielsen and Lindebo, 2009). First, it is derived from the historic catches from 1973 to 1978. Second, it includes a preferential treatment for regions particularly dependent on fisheries (called "The Hague preferences"), which favoured Ireland and the North of the United-Kingdom. Lastly, there is a compensation for jurisdictional losses following the implementation of the 200-nmiles EEZ by non-EU countries in 1977.
Because fishermen need to adjust fishing possibilities to the actual situation, mechanisms arise to circumvent the initial allocation. The first one is quota hopping: when a boat is owned by (and sometimes crewed with) other nationals than the MS of the vessel and its fishing rights. It is possible because of the freedom of establishment and it is illegal for a MS to restrict ownership of vessels to its nationals (European Union Committee, House of the Lords, 2016). In the UK, an "economic link" condition nonetheless requires the owner to contribute in a way to the UK economy since 1999 (Department for Environment, Food & Rural Affairs, 2009). The other way is by using quota swapping. It is used as a short and long-term instrument to adjust the quota distribution. Swaps occur at different levels, between fishermen, producers' organisations and Member States. Some quota is swapped for money but most of it is swapped for fish, other quota is swapped for fishing efforts or as gifts (Andersen, Nielsen and Lindebo, 2009). In 2013, 17% of the EU TACs were swapped (Hoefnagel, de Vos and Buisman, 2015). All swaps are registered within the Fishery Data Exchange System (FiDES) except in certain countries for swaps within companies or between fishermen.

In 2002 and 2013, the relative stability was continued even if it was accused of not being in harmony with the principle of free movement of capital and labour within the EU. The CFP reform of 2013 introduced a landing obligation whose implementation requires flexibility in the quota transfers, this could prove to be undermined by relative stability (Sobrino and Sobrido, 2017).

[1] For the purpose of this study, and in the entire report, "UK fleet" means fishing vessels registered in the UK and "EU27 fleet" means fishing vessels registered in one of the EU27 MS.

2.2. Pelagic fisheries particularities

Pelagic fisheries have inherited a dedicated Advisory Council. This is because of the migratory nature of these stocks. But the pelagic fishes have other particularities that impact the people fishing them. These stocks are usually forming shoals of single fish species. This means that the fisheries usually experience a low by-catch rate. It also implies that, as most time is spent searching for schools, there is no clear relationship between time at sea and catch volumes (Coers, 2009).
The European industry in the pelagic sector is very much consolidated and the fleet is structured by big international companies. These are often integrating vertically the processing and distribution too. The fishing boats are large and can fish far away in the high seas. The important investments needed for such vessels requires the companies to have long term plans (Coers, 2009). The significant size of the companies allows them to answer these needs through collaborative scientific work (participation in research surveys but also hiring of scientists and setting up of their own research projects) (Beukhof and Pastoors, 2018; Pelagic Freezer-trawler Association, 2018).

2.3. Bibliographical work on the fish stocks

A bibliographical work was conducted on the main fish stocks only (as defined in section 4.3.). These are North Sea Autumn Spawning Herring, North Sea Horse Mackerel and Northeast Atlantic Mackerel. For each of the three fish stocks, international fishing and cooperation, stocks status, fisheries characteristics, former fishing grounds, and finally distribution and migration patterns along the life cycle and related changes were looked at.

2.3.1. North Sea Autumn Spawning Herring (Clupea harengus)

Besides the EU27 and the UK, Norway and the Faroe Islands also fish this stock. These other countries together caught 27% of the total catches in 2016 (ICES Advisory Committee, 2017d). A management strategy between the EU and Norway has been in place since 1998, it was updated several times since then. The last update was enforced in January 2015 (Westberg and Verborgh, 2017) but the agreed ensuing ICES advice wasn't followed by the EU and Norway when fixing the TAC for 2017 (ICES Advisory Committee, 2017d).
The ICES stock advice is of category one. The stock seems to be in a good state according to the ICES evaluation of the reference points: the fishing pressure is deemed to be below Fmsy and the stock size is thought to be above MSY Btrigger. The last years trend in the TAC advice is going upward from 200000t in 2011 to 518000t in 2016. The stock is considered by ICES to be in a low productivity phase with low recruitment in the last decade (below average year classes found since 2002) (ICES Advisory Committee, 2017b). This is linked to the influence of the environment on the herring productivity (ICES Advisory Committee, 2017b).
The fleet fishing North Sea Autumn Spawning Herring is composed of trawlers (mid-water, otter, and pair) and purse seiners (ICES Advisory Committee, 2017d) (ICES, 2018a). This fish stock is a by-catch of the sprat, Norway pout, and blue whiting fisheries (ICES Advisory Committee, 2017b; ICES, 2018a).

During its life cycle, North Sea herring follows migration patterns taking it across the North Sea. The North Sea Autumn Spawning Herring larvae are mainly found in the Channel (overlapping the UK and French EEZs) and along the eastern coast of Britain in autumn and winter (Figure 1). This is also were spawning occurs (ICES Advisory Committee, 2017b).

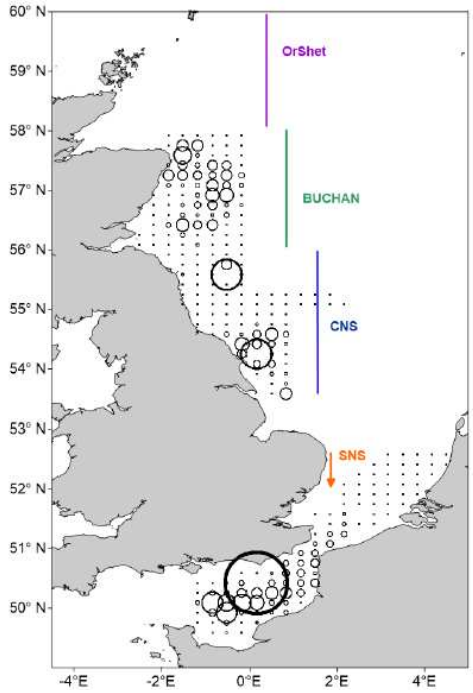


Figure 1: North Sea Herring abundance of larvae < 10mm (n/m^2) in the Buchan, Central and Southern North Sea as obtained from the International Herring Larvae Surveys in autumn and winter 2016/2017 (maximum circle size = 20000n/m2). The survey around the Orkneys was cancelled due to technical problem of the research vessel. The abundance in the Southern North Sea is given as the mean of the three surveys done in December 2016 and January 2017 (ICES Advisory Committee, 2017b)

Juveniles are found in different locations. 0 and 1 ringer year classes seem to be distributed mainly along the North Sea shore of the Netherlands, Germany and Denmark and more rarely along the eastern coast of Great Britain according to the catches of the IBTS from January and February 2015-2017 (ICES Advisory Committee, 2017b) (Annex 1). Finally, adults are mostly present in the North-West of the North Sea (as shown by the HERAS acoustic survey of 2016), where most of the catches occur (ICES Advisory Committee, 2017b) (Figure 2).

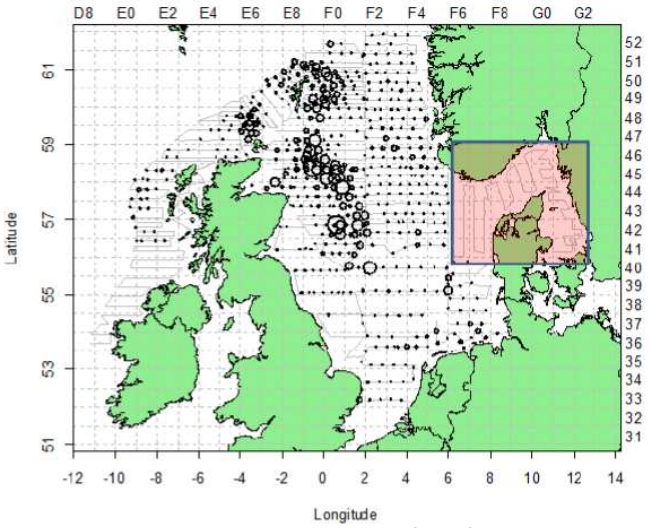


Figure 2: Distribution of NASC (nautical area scattering coefficient (m^2 nmi^{-2})- a biomass index value-) attributed to herring in HERAS 2016. Cruise tracks are outlined in light grey with circles representing size and location of herring aggregations. NASC values are resampled at 15nm intervals along the cruise track. Distribution displayed here is for all herring encountered in the HERAS survey regardless of stock identity. Herring abundances in the strata covered by Denmark are not displayed here (ICES Advisory Committee, 2017b)

In the 1980's, as the fishery re-opened, fishing occurred more in the eastern North Sea (this was probably due to a delayed migration because of favourable food conditions in the area) (Corten, 2001). Finally, the proportion of catches from this area started decreasing after 1986. Changes kept occurring after this date as herring is one of the 16 species that showed changes in its distribution pattern since 1985 in the Northeast Atlantic (ICES Advisory Committee, 2017a). This is partly because the species chooses its spawning and feeding grounds based on planktonic food resources (which is in turn influenced by hydrographical and environmental features such as temperature) (ICES, 2018a).

2.3.2. North Sea Horse Mackerel (Trachurus trachurus)

There is no other country than the UK and the EU27 fishing North Sea Horse Mackerel.
The ICES stock advice is of category 3. The fishing pressure is believed to be above Fmsy and the MSY Btrigger reference point is not defined. The recent TACs show a downward trend from 40000t (2011) to 15200t (2016). According to survey indices and fisheries data, there are signals of better recruitment since 2013 (ICES Advisory Committee, 2017e). But ICES warns that the catch of immature individuals (most of the catch) might harm the recovery process of the stock. No long-term management plan is in place for this stock. Stakeholders of the PelAC are working on genetic identification of the stock and on historical catch rates (Pelagic Advisory Council, 2018).
The EU fleet fishing for this stock is mostly composed of the Dutch freezer-trawlers, fishing for human consumption (ICES Advisory Committee, 2017g). There is no fishing occurring outside of the EU27 and UK EEZs. Problems might arise with the landing obligation implementation on the 1st of January 2019 for demersal fisheries as a significative part of the catches comes from the bycatch of the bottom trawlers of the Channel (The French bottom trawler may be fishing and discarding around 1000t of Horse Mackerel per year) (Jourdain, 2018).

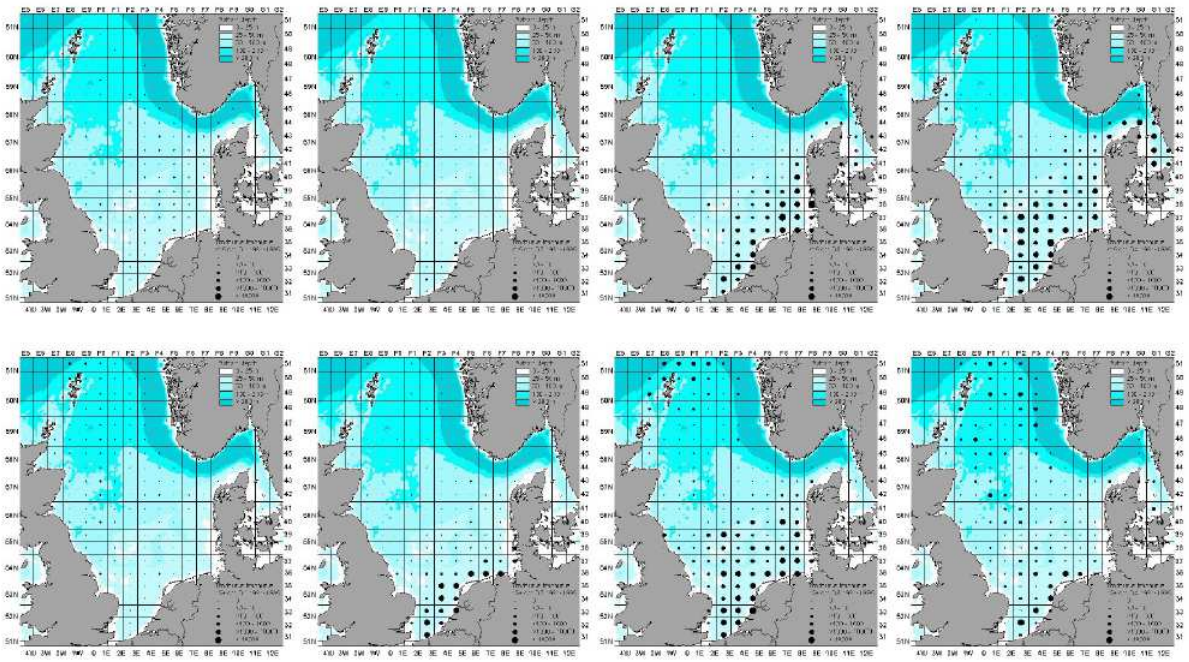


Figure 3: Average quarterly catch rate (number per hour fishing) for juvenile (<15cm, above) and adult (>=15cm, below) horse mackerel in the IBTS survey , 1991-1995 (ICES, 2018b)

There has been no egg survey since 1991 (ICES Advisory Committee, 2017g), but spawning has been reported to occur off the North Sea coasts of Belgium, the Netherlands, Germany and Denmark (ICES, 2018b). Adult fish migrates in winter to the Channel, forming shoals and then back in a more dispersed way in summer to the North Sea up to Denmark and the Norwegian EEZ (ICES, 2018b) (Figure 3). Juveniles of North Sea Horse Mackerel may stay longer in the Channel than adults in spring (ICES, 2018b).

Historically, in the 1980's and 1990's fishing occurred in the South East of the North Sea (IVb, IVc and IIIa) when horse mackerel was used for fish oil and fish meal production by the Danish, but this fishery disappeared in the 1990's with the restructuration of the Danish fleet (Brunel et al., 2016). Like for herring, horse mackerel is one of the 16 species that showed changes in its distribution pattern since 1985 in the Northeast Atlantic (ICES Advisory Committee, 2017a).

2.3.3. Northeast Atlantic Mackerel (Scomber scombrus)

Numerous different countries outside of the EU27 and the UK are fishing Northeast Atlantic Mackerel: Norway, Russia, Iceland, Greenland, and the Faroe Islands (ICES Advisory Committee, 2017f). In 2016, these other countries together caught 58% of the stock's total catches.
Historically, the EU, Norway and the Faroe Islands had a coastal state agreement since 1999. The Icelandic fishery then developed, and the Faroe Islands stepped out of the agreement in 2010. In 2010, EU and Norway agreed on a 10-year bilateral mackerel agreement on relative shares, access and management. Later, in 2014, the EU, Norway and the Faroe Islands signed a 3 parties' agreement that was valid for the subsequent 5 years. This agreed management strategy left 15.6% of the quota to the other fishing nations (Iceland, Russia, and Greenland). The agreement's provisions weren't followed as the sum of the TAC of each of these countries exceeded the ICES advices in 2015, 2016, and 2017 (ICES Advisory Committee, 2017g).
Northeast Atlantic Mackerel ICES advice is of category 1. The fishing mortality is thought to be above Fmsy but the Biomass is above MSYBtrigger. The agreed TAC trend between 2011 and 2016 is going up from 959000t to 1057000t. ICES does not give any particular evaluation of the stock's productivity but the working group WIDE stresses that recent productivity of the stock appears to be different than in the 1990's (ICES Advisory Committee, 2017g). The recruitment seems to be higher since the 2000's (ICES Advisory Committee, 2017f).
ICES estimates that 77.8% of the catches are made by pelagic trawl, 20.3% by purse seine and less than 2% by other gears (ICES Advisory Committee, 2017f). More precisely, the EU fleet is composed of Dutch, German, French and English large freezer trawlers operating a single mid-water pelagic trawl or a pair trawl. There is a Danish fleet equipped with purse seine and Scotland and Ireland use refrigerated seawater tanks storage single (for Scotland) or pair (for Ireland) pelagic trawlers (ICES Advisory Committee, 2017g). This stock is widely distributed and there is a large number of fishing areas outside of the EU27 or UK waters: in the Norwegian, Icelandic, Faroese, Greenlandic EEZs and in international waters.

In the North Sea, in 2005, eggs were distributed in a broad band running obliquely from the north English coast to the Norwegian deeps. Stage one eggs are found in North West Ireland and Scotland (Figure 4) (ICES, 2018c). Eggs are also found between the British isles and the Icelandic coast (Figure 5) (ICES, 2017; ICES Advisory Committee, 2017g).

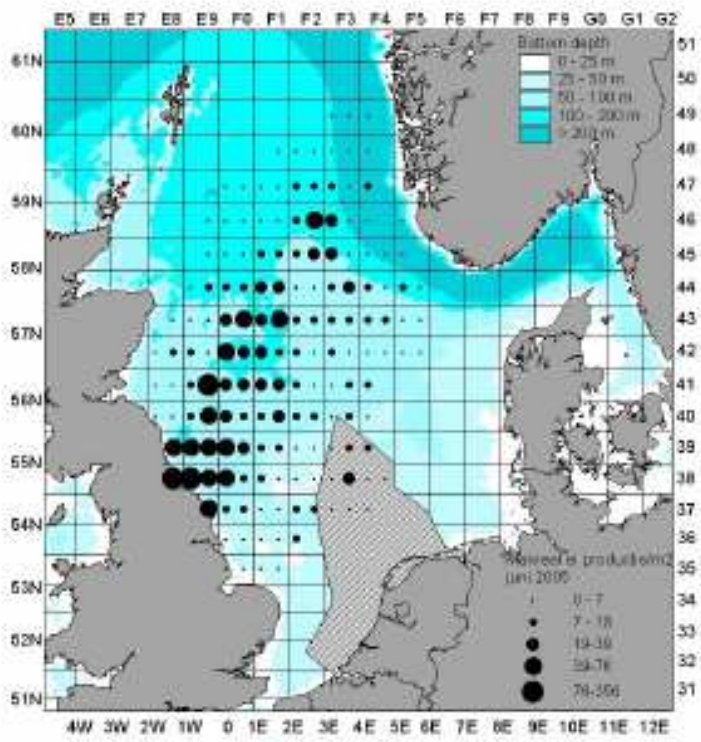


Figure 4: Distribution of stage I mackerel eggs (as number per m^2) during spring 2005 (ICES, 2018c)

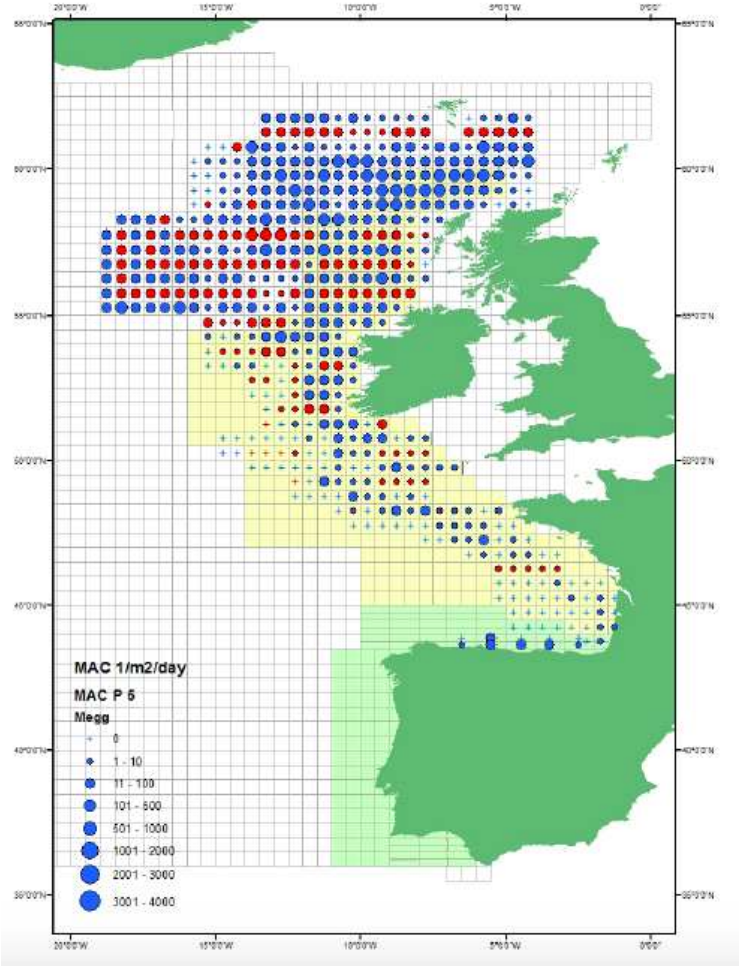


Figure 5: Mackerel egg production in period 5 (1-30 May). Filled blue circle represent observed values, filled red circles represent interpolated values, blue crosses represent observed zeros (ICES, 2017)

There has been a northward shift in the egg production for the western component of the stock between 1977 and 2010 (ICES, 2017). Nurseries of the North-Sea component of the stock are located in the Southern North Sea, off the coast of Denmark, and along the western and southern coasts of Norway. Since 2004, juveniles have also been found on the Icelandic shelf (Jansen et al., 2015; ICES, 2017). The adult stock is widely distributed and is composed of 3 different components: Southern spawning, Western spawning and North Sea spawning components. This last one represents around 4% of the total stock and it is under protection measures (applying in IIIa, IVabc.) (ICES Advisory Committee, 2017f). This stock has an important migration pattern, some mackerel overwinter near the Norwegian and Faroese continental shelf, they then migrate to the central North Sea. In spring, the western component of the stock is found spawning in Northern Scotland and West Ireland, it continues its migration northward to the Norwegian, Icelandic and International waters in summer for feeding (Annex 2).

The central North Sea used to be a fishing ground that is now protected. Northeast Atlantic Mackerel is one of the 2 species that showed the greatest changes in distribution since 1985, with an important North-westward expansion of the stock (ICES Advisory Committee, 2017a). It is also worth noting that an important summer fishery has developed in recent years for this stock in area IIa and IVa in international waters, Norwegian, and Icelandic EEZs (ICES Advisory Committee, 2017g). It could be possible to see the development of other fishing grounds as it was suggested that climate driven changes affect migration patterns of mackerels (Jansen et al., 2012). The distribution, spawning area and migration pattern of this stock are not the only changes that are observed. There seems to be a change in the growth, and maturation of the fish. Between 2002 and 2013, the growth (length at age and weight at age) of mackerel has reduced, this is linked to the changes in the stock size (Olafsdottir et al., 2016). The maturation stage is also changing with an earlier maturation trend from the 1980's to the 2000's (Brunel, 2018), a later maturation trend from the 2000' to 2011 and a trend toward an earlier maturation from then on (ICES Advisory Committee, 2017g).

3. Material and method

3.1. Material and method for the diagnostic

In order to understand what is at stake in the Brexit negotiations regarding the pelagic stocks, it is important to have an overview of the current situation, starting with a focus on the pelagic fish stock landings. For this purpose, the proportion of landings by the EU27 fleet in UK waters and vice versa were looked at for each of the 12 stocks at stake. Absolute values were also taken into account, but this part mainly focusses on proportions as they might reflect more accurately the dependency. Geographical representations of these landings origins were then illustrated to have easy-to-understand results on the areas of importance regarding these fisheries. The quota reparation key is presented for each fish stocks and the swaps taking place were studied too. They show areas where the relative stability does not seem to correspond anymore to the actual fishing taking place. Focusing on these exchanges and the landing figures gives a first idea of the dependency existing and will help drafting scenario outcomes.
The timeframe used covered the years 2011 to 2016, which is similar to the one chosen by some other comparable studies (Andersen et al., 2017; European Parliament Committee on Fisheries, 2017). The 2017 data was not used as it is still recent and may be subject to future corrections as is often the case (Scientific, Technical and Economic Committee for Fisheries, 2017a).

The landing data for the years 2011 to 2016 was retrieved from the Joint Research Centre (JRC, 2018) were it is available in open access. Following email exchanges with Dr. Steven Holmes from the JRC, particular attention was given not to count the landings several times through the addition of the different annexes. Additional data was downloaded from the ICES website such as the ICES statistical rectangles geographical data (Jensen, 2009) and the tables needed to match the rectangles within each FAO area, Sub-Area and division (ICES, 2005). EEZs geographical data came from the Flanders Marine Institute (Flanders Marine Institute, 2016). In order to enhance the final maps, a relief map layer was obtained from the US National Park Service (Patterson, 2013). The mean landings per fish stock per statistical rectangle and per fleet (EU27 or UK) were calculated on the 6 years period. Three herring fish stocks had overlapping areas. Following advice from the industry (Balsfoort, 2018), their distribution was simplified according to the following table (Table 1), to make it possible to distinguish them. Similarly, for simplification purpose, the North Sea and Western Horse Mackerel stocks were divided based on the location indicated on the ICES advice sheets, even though the ICES working group WIDE divides the catches taking into account both the location and the time of the year (ICES Advisory Committee, 2017g) (Table 2).

Table 1: Herring stocks original and simplified location

Stock	Atlanto-Scandian Herring	North Sea Autumn Spawning Herring	Western Baltic Spring Spawning Herring
Subarea, division and sub-division	I, II, IVa, V, XIVa	IIIa, IV, VIId	Eastern part of IV, subdivision 20-24
Simplified location used	I, II, V, XIVa	IV, VIId	IIIa,b,c

Table 2: Horse Mackerel stocks division

Stock	North Sea Horse Mackerel	Western Horse Mackerel
WG WIDE division of stocks	1 and 2 quarter: Divisions IIa and IVa 1-4 quarter: Divisions IVb, IVc and VIId.	3 and 4 quarter: Divisions IIIa and IVa. 1-4 quarter: IIa, Vb, VIa, VIIa–c, e–k and VIIIa-e.
Simplified location used	IIIa, IVb, IVc, VIId	VIII, IIa, IVa, Vb, VIa, VIIa,-c, VIIe-k

The landings made from the straddling ICES rectangles between the EU27, UK and other waters were divided proportionally to the geographical area occupied by the EEZs. This allowed to calculate the proportion of catches per area. Maps representing both the EU27 and UK catches for each stock using a bivariate legend were used to show the importance and localization of some area for the fleets. The free open source software under GNU General Public License, QGIS version 2.18.15 (QGIS Development Team, 2002) was used for this purpose.
Annual distribution of landing origins per stock and per year were also looked at in order to identify any important variation between each of the 6 years of the study. Maps were built with the free open source software under GNU General Public License, R version 3.4.4 (R Core Team, 2016).
Finally, the quota for 2016 where obtained from the Council Regulation (EU) 2016/72 (Council Of The European Union, 2016). The 2016 swap data came from the PelAC public document "Choke Mitigation tool" (NWWAC Advice Drafting Group on the Landing Obligation, 2018) that obtained this data from a request to the European Commission Fishery Data Exchange System (FIDES) database. These where compared with the landing data from the JRC.

3.2. The scenarios studied

The exact Brexit scheme regarding fisheries is not known yet. Some scenarios were elaborated in relation to the various agreements that could emerge from the negotiations. These scenarios set probable conditions linked to the access to the UK waters, and the quota share renegotiation. Other criteria could have been taken into account to draft the scenarios such as applied management rules or openness of the market but they seem to have less impact on the outcome in terms of catching opportunities.

The first scenario (S1) is one where the UK allows full access to its waters. The quota share would stay the same as today. This would mean that no major change would occur. There still could be changes in the management rules and regulations if the UK doesn't completely follow the CFP.
The second possible scenario (S2) is one where the UK will deny access to the EU27 fishing vessels in its EEZ. The fishermen would therefore defer (and adapt) their fishing effort to other areas (and/or on other species) according to the opportunities they will find.
Another scenario envisaged here (S3) is one with an authorized free access of the UK waters but quotas renegotiations. This will consider that the UK and EU27 negotiations would likely result in a series of bilateral agreements similar to the ones existing between the EU and Norway (but with full access to EEZs). They would lead to shared management (based on ICES scientific advice), reciprocal access to waters and agreements on quota shares.
Finally, the last scenario (S4) would be one of no access and no agreement on the quota shares. This may unfold in case of a "no deal" outcome.

3.3. Material and method for the identification of factors and of the outcomes of scenarios

The scope of the study was narrowed down at this point to 3 fish stocks and 2 scenarios identified in the diagnostic. These stocks corresponded to EU27 fisheries showing a great dependency on the UK waters and representing very important landing volumes.

3.3.1. Identification of factors

The identification of factors is the identification of the information needed to formulate the hypothetical outcomes of the scenarios
A reflection was conducted to try to understand, for each scenario, what kind of factor would play an important role in the outcomes of it. For the scenario S2, the conditions of a deferred effort were identified. For the scenario S3, the features that would impact the quota renegotiations were reflected on. The previous international agreements were studied to see what factors were playing an important role in it. Scientific papers dealing with international handling of common pool resources were also at the basis of this reflection. In addition, the PelAC stakeholders were asked if they could think of other such factors in a survey conducted for the qualitative approach to the scenarios outcome (see section 3.3.2.2.).

3.3.2. Quantitative and qualitative approach to the scenarios outcome

3.3.2.1. Attempted quantitative approach

To try to find out what are the potential outcomes of these scenarios, a quantitative approach was firstly considered. The effort data publicly available was to be used to calculate potential landings in case of a closed UK EEZ (with the calculation of geographical Catch Per Unit of Effort (CPUEs)). This idea was inspired by the method used to calculate the potential effects of marine protected areas (Greenstreet, Fraser and Piet, 2008). However, this data is not available with the precision needed (down to the species). Furthermore, the use of CPUE in the pelagic sector might be delicate due to the schooling behaviour of pelagic fish that influences the relationship between fishing effort and catches (Coers, Raakjær and Olesen, 2012). Another quantitative method would have been to calculate potential landings without effort data and according to a set of rules. This method was found to be not accurate enough and its results would have had serious flaws. Thus, no quantitative method was adopted in this report. The work therefore focused on qualitative data obtained through bibliographical work and the circulation of a questionnaire to stakeholders.

3.3.2.2. Qualitative approach

Following the identification of the factors, a bibliographical work was conducted to understand their substance for each of the three stocks.
In addition to the reading of bibliographical work, it seemed important to collect the views and perspectives of the people that will be affected by these changes (see box: Stakeholder's participation and knowledge). Taking advantage of the Pelagic Advisory Council's stakeholders network, a questionnaire was prepared and circulated to them. This work was conducted after meeting most of them during a workshop in Denmark in the beginning of June 2018. The qualitative information collected is very interesting because it assembles outlooks from diverse stakeholders: the fishing industry, and scientists, from the EU27 and the UK.

Stakeholder's participation and knowledge.

The idea to have stakeholders' input to the subject was very much influenced by the context of working in an institution like the Advisory Councils. Indeed, the structure of the AC is built as a forum for stakeholders to provide advice to the European Commission. 60% of the seats are allocated to the fisheries sector and 40% to the other interests. The Pelagic Advisory Council works on a consensus based approach and boasts important achievements such as the implementation of a management plan (including a harvest control rule) agreed to by all members, deemed precautionary enough by ICES (at the time) and followed by the Commission (Hegland and Wilson, 2009). Some improvement in the participatory process of the ACs is still needed in the representation of stakeholders (Linke and Jentoft, 2016) and non-EU parties and in the effectiveness of the working relation with EU managers (Coers, Raakjær and Olesen, 2012). Yet, the participatory framework between scientists, fishermen and environmental NGOs creates important mutual understanding, ability to reach compromises and synergistic work (Ounanian and Hegland, 2012). The scientific contribution of the industry is surely encouraged through the existence of the ACs. The major desired outcome of this is progress of scientific data and knowledge (Mackinson et al., 2011).

The use of a questionnaire, a prescriptive survey technique was chosen. This is because the goal of the process was to obtain precise answers on specific points. These answers completed the bibliographical information previously gathered. They also highlighted what are the key factors according to the stakeholders. Finally, the questionnaire gave people the possibility to add other factors that might have been forgotten.

The targeted audience was chosen to be as broad as possible without excluding the views of UK members. The questions were drafted in a way that people from the catching sector, processing sector, NGOs, managers and scientists could answer them.

A guide was developed to define the framework of this questionnaire (Annex 3). A first version of the questionnaire was send to one of the stakeholders (Producer's Organisation) to get some feedback on it. After some discussions with the surveyed person, an updated version of the questionnaire was drafted. It was then sent to 51 people with a 2 weeks deadline. The response rate to the email was of 45% and to the actual questionnaire of 24% (12 people). Two respondents completed only the first section about fisheries and stock health. The answers for mackerel seemed to be more developed than for the other stocks. This probably reflects a greater interest for this stock. Most of the respondents were from the EU27 but one third of them were from the UK (Scotland mainly) (Figure 6). The main area of work of the people who answered the survey was the catching sector but there were answers from a wide variety of sectors. Some stakeholders were included in more than one category when they defined themselves as belonging to several (e.g. "catching/science"). It is worth noting that no stakeholder from NGOs answered the questionnaire.

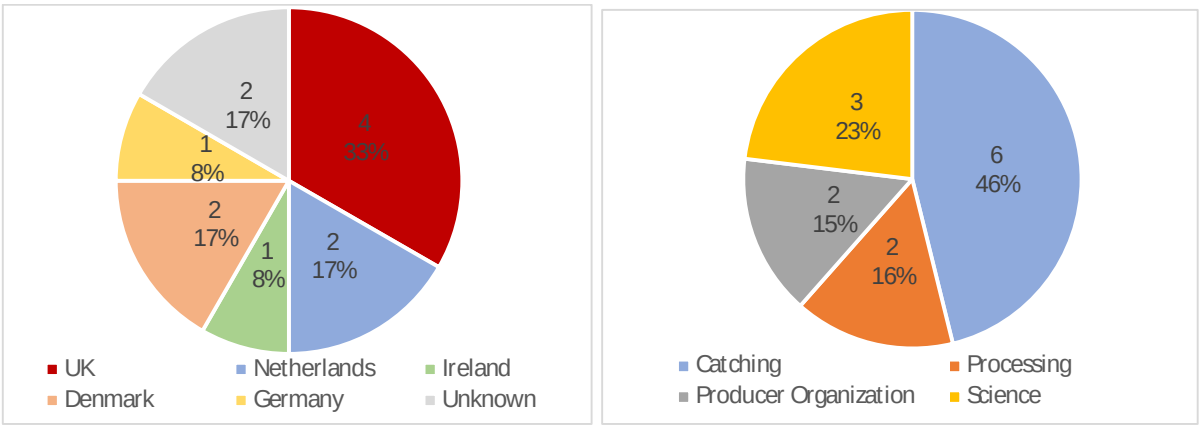


Figure 6: Institution's origins (left) and area of work (right) of the respondents to the questionnaire

In order to interpret the questionnaire's answers, the answers were summarized in a table for each fish stock. It incorporates all qualitative answers from the respondents and highlights the consensus areas and disputed points. The majority opinion is important as it might reflect a global feeling but with such a small sample, it is also imperative to take into account all the panel of answers given.

Bolstered by the outcome of the questionnaire and the bibliographical work, efforts were made to draft potential outcomes of scenarios S2 and S3 (the outcomes of the two others (S1 and S4) seemed very straightforward).

4. Overview of the current situation and diagnostic

4.1. Study of the pelagic landings

4.1.1. Least concerned stocks

As it was identified through the reading of the ICES advice, 2 of the PelAC stocks will not be directly affected by the changes triggered by Brexit: the Southern Horse Mackerel and the Western Baltic Spring Spawning Herring. Around 21600 t of Southern Horse Mackerel and 37500 t of WBSS Herring are landed each year by the EU27 fleet. These stocks are only landed by the EU27 fleet, from the EU27 EEZ (and to a lesser extent, in "other waters"). Therefore, there will not be any direct consequences on them. They might be affected however, in the case of deferred fishing effort that was originally targeting another stock.
Three other fish stocks are not likely to be very much directly affected by Brexit because of their low total landings from within the EU27+UK waters (Atlanto-Scandian Herring), their low value (Boarfish) or because they are mainly fished by the UK fleet in the UK waters (Irish Sea Herring). They could still play an important role in the negotiations and might eventually be affected by agreements between the UK and Norway.

4.1.2. Dependency favouring the EU27

Of the seven remaining stocks, Western Horse Mackerel is the one for which the EU27 fleet is the least dependent on the UK waters (Figure 7). On the other hand, the UK fleet depends on the EU27 waters for this fishery as 46% of the fleet's catches are from EU27 waters. When looking in absolute terms, the EU27 still lands more fish from the UK EEZ than the UK fleet from the EU27 waters. In recent years, the landings were less important and the most important reduction came from the South of the British Isles (Figure 8).

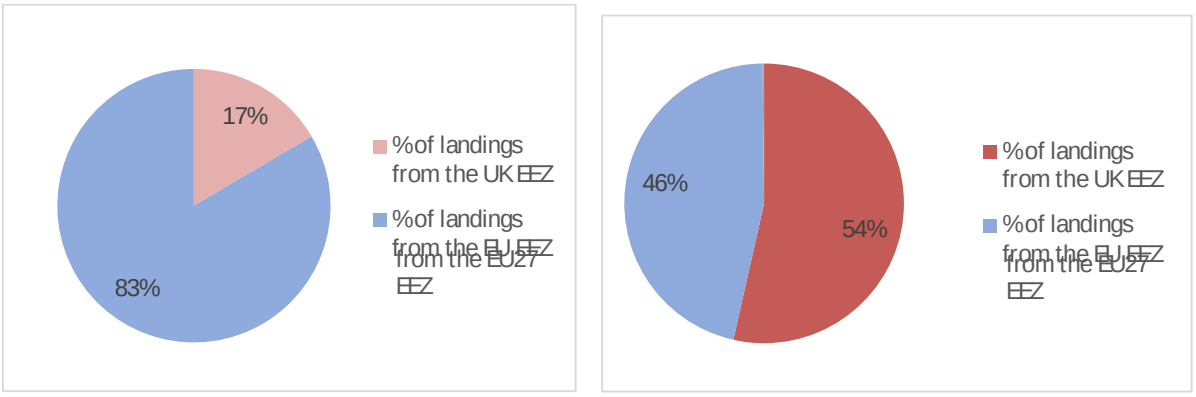


Figure 7: Mean proportion of EU27 (left) and UK (right) fleets landings of Western Horse Mackerel by area (2011-2016)

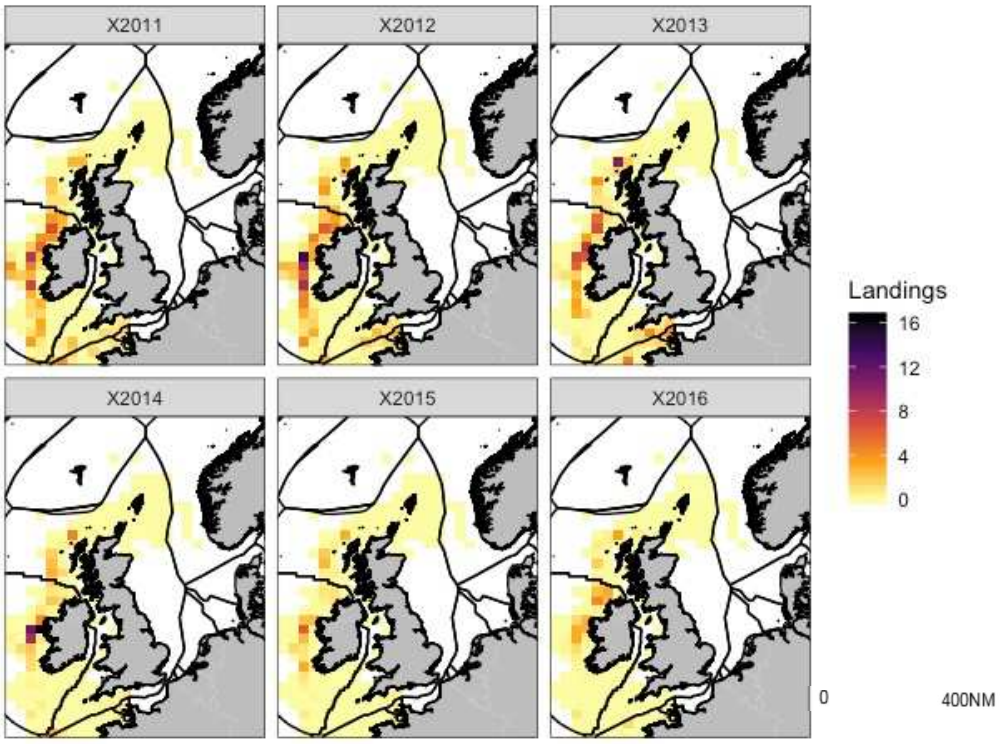


Figure 8: Western Horse Mackerel landings per ICES rectangles (in 000t) per year

Blue Whiting is mainly caught in the Spanish, Irish and UK EEZs (Figure 9). The UK fleet depends on the EU27 EEZ for 77% of its landings and the EU27 fleet depends on the UK one for 37% of its landings (Figure 10). There is an important interdependency, globally leaning in favour of the EU27 in proportion terms. This unbalanced dependency in proportion hides the fact that the EU27 fishes close to 27000 tonnes more in the UK waters than they reciprocally do (respectively 42510 tonnes and 15607 tonnes). This interdependency is clearly visible when looking at the landing origin distribution map. Recently, the landings off Scotland's North-western coast increased significantly (Figure 11).

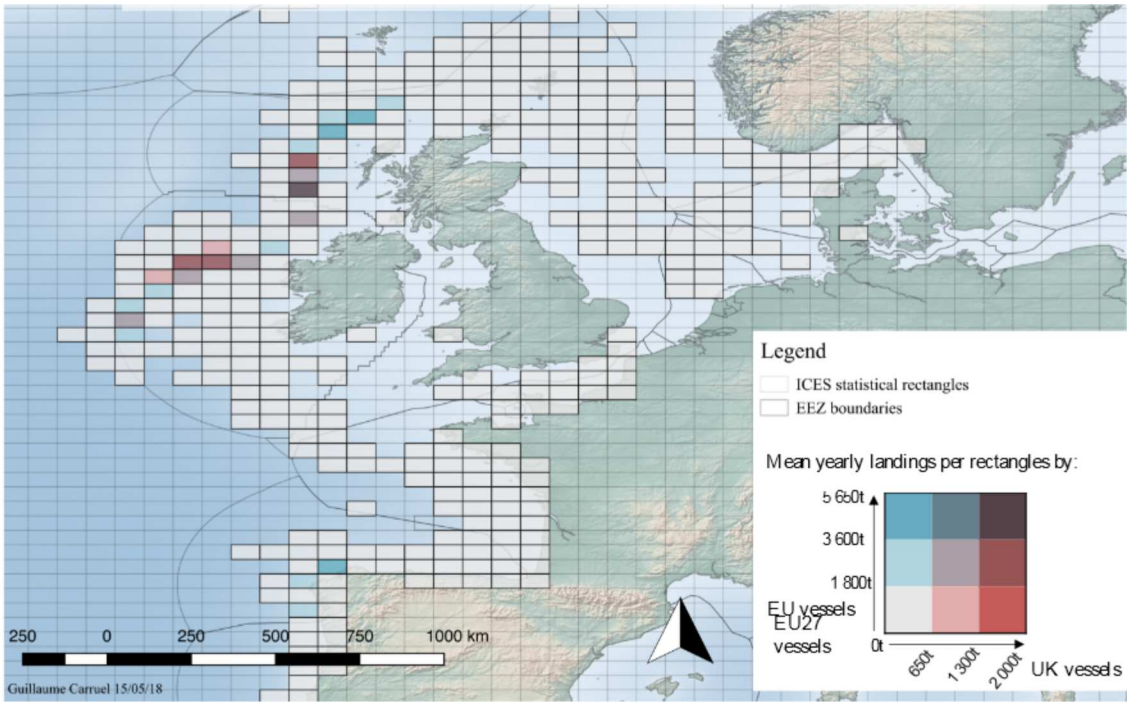


Figure 9: Map of Blue Whiting mean yearly landings origins by EU27 and UK vessels (2011-2016)

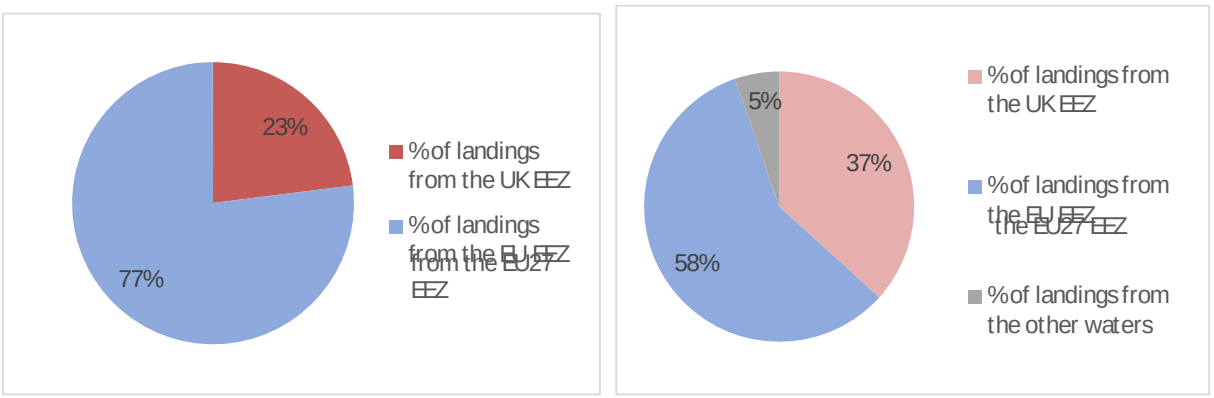


Figure 10: Mean proportion of UK (left) and EU27 (right) fleet landing origins for Blue Whiting by area (2011-2016)

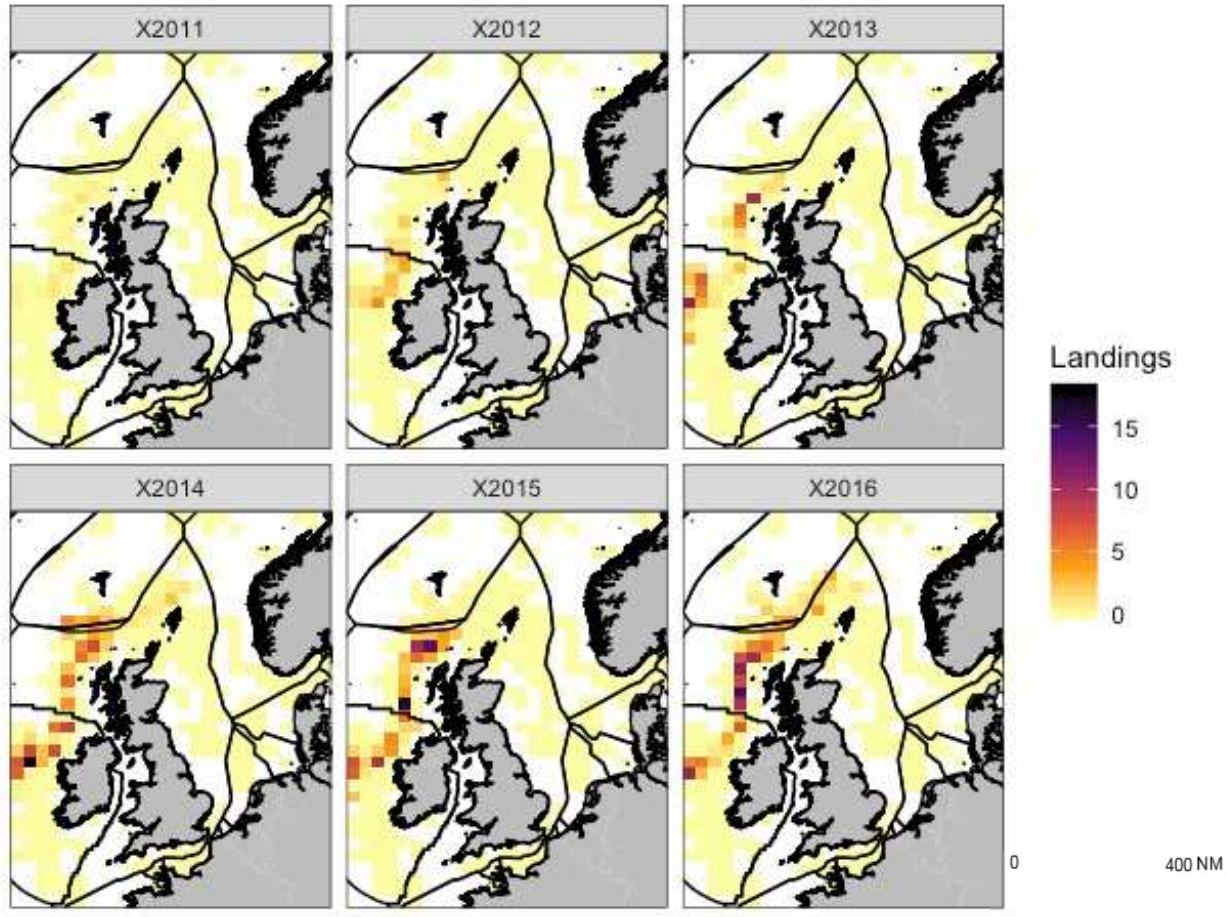


Figure 11: Blue Whiting landings per ICES rectangles (in 000t) per year

4.1.3. Dependency favouring the UK

Celtic Sea Herring is mostly fished by the EU27 fleet (almost 100% of all landings) and 6aNS7bc Herring mostly fished by the UK fleet (56% of all landings) (Figure 12). For these two stocks, there is a strong dependency of the EU27 fleet on the UK waters. Indeed, the EU27 lands on average more than 7000t (CS Herring) and 7300t (6aNS7bc Herring) per year from the UK waters. This last figure is to be put into perspective with the fact that the quota for this herring stock was set to a monitoring TAC of 5800t in 2016 which drives the mean down (ICES Advisory Committee, 2017c).

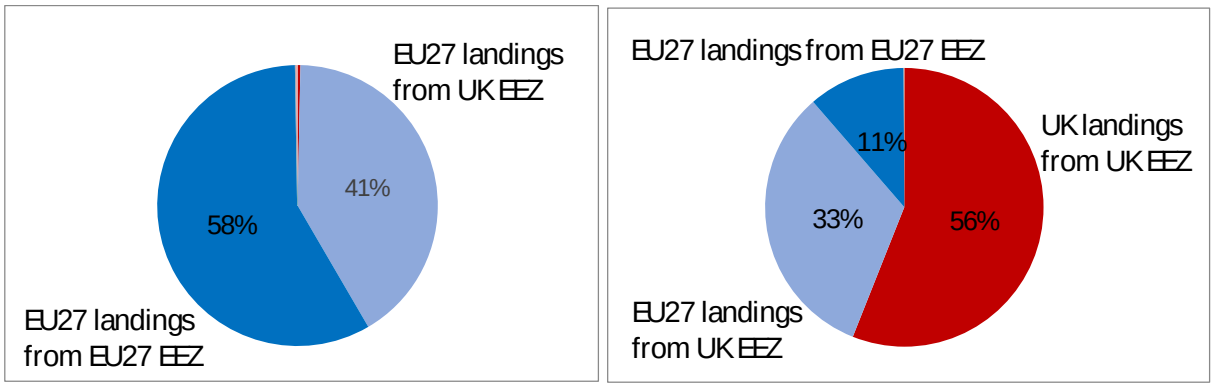


Figure 12: Mean landing proportions by fleet and area for Celtic Sea Herring (left) and 6a7bc Herring (right)

On the other hand, the North Sea Autumn Spawning Herring, the North Sea Horse Mackerel and the Northeast Atlantic Mackerel stocks are landed more evenly by the EU27 and the UK fleets. These stocks are also largely fished by the EU27 fleet in the UK waters (from 57% of the fleet landings for North Sea Horse Mackerel to up to 84% for North Sea AS Herring) which creates a dependency (Figure 13).

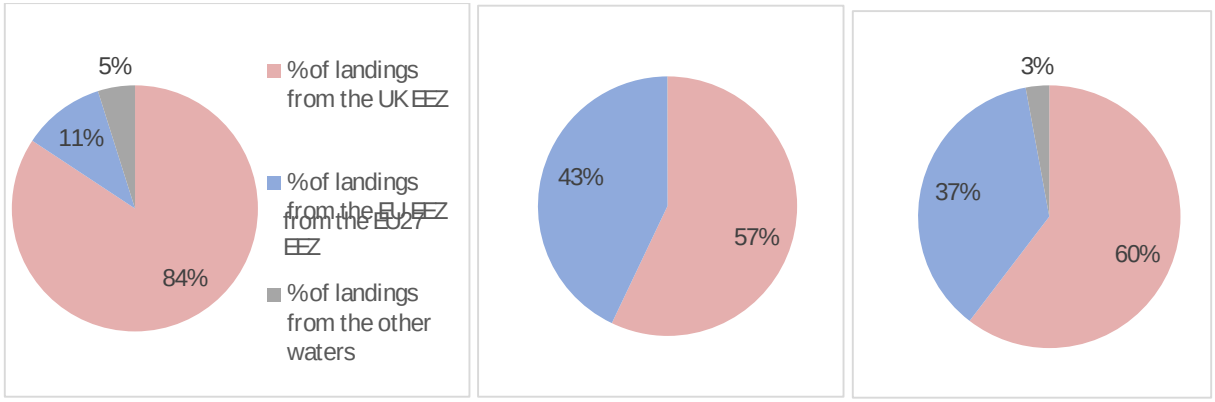


Figure 13: Mean proportion of EU27 fleet landing origins by area for North Sea Autumn Spawning Herring (left), North Sea Horse Mackerel (centre), and Northeast Atlantic Mackerel (right)

For NS AS Herring, the EU27 vessel fishing in UK waters occurs all along the eastern and southern coasts of Great-Britain but more significantly near Scotland and in the Channel (Figure 14). A growing quantity of herring seem to be landed from the north-eastern part of the UK EEZ (Figure 15). The NS Horse Mackerel catches of the EU27 fleet occur mostly in the Channel in ICES rectangles straddling between the UK and EU27 EEZs (Figure 16). Finally, EU27 catches of Northeast Atlantic Mackerel in UK waters take mainly place in the North-East (around the Shetlands) and North-West of Great-Britain (off the outer Hebrides). Lower landings have occurred in 2016 from the Irish EEZ. (Figure 17).

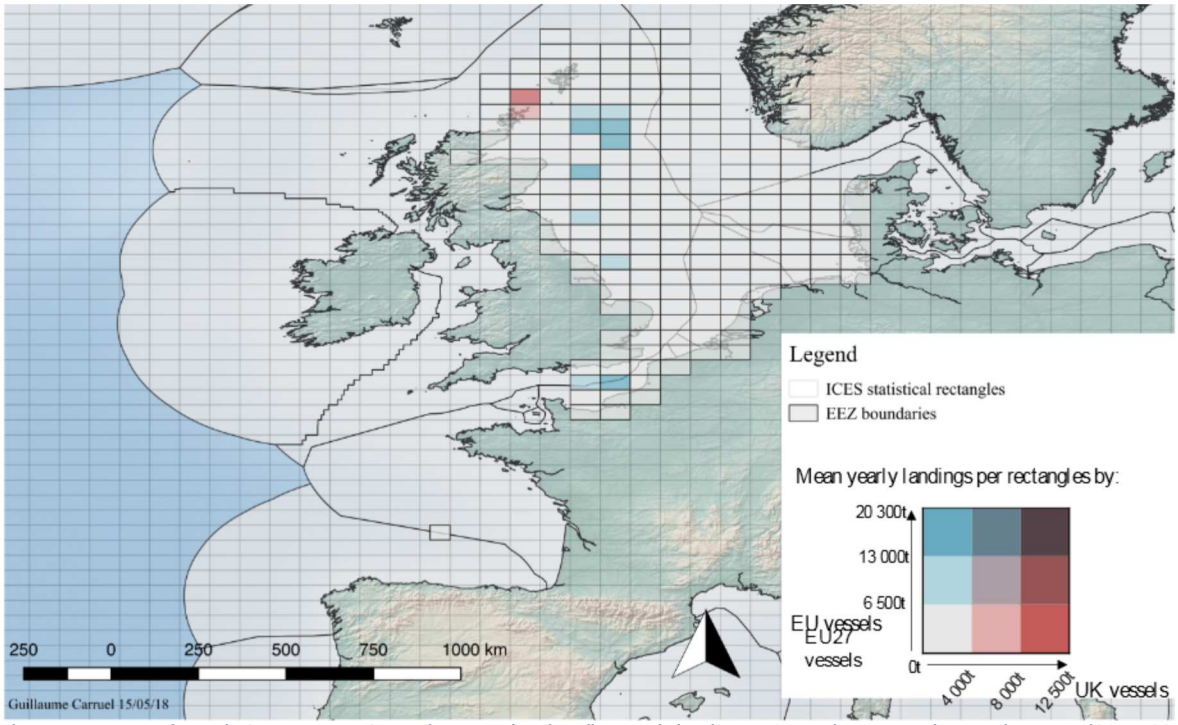


Figure 14: Map of North Sea Autumn Spawning Herring landings origins by EU27 and UK vessels, yearly mean (2011-2016)

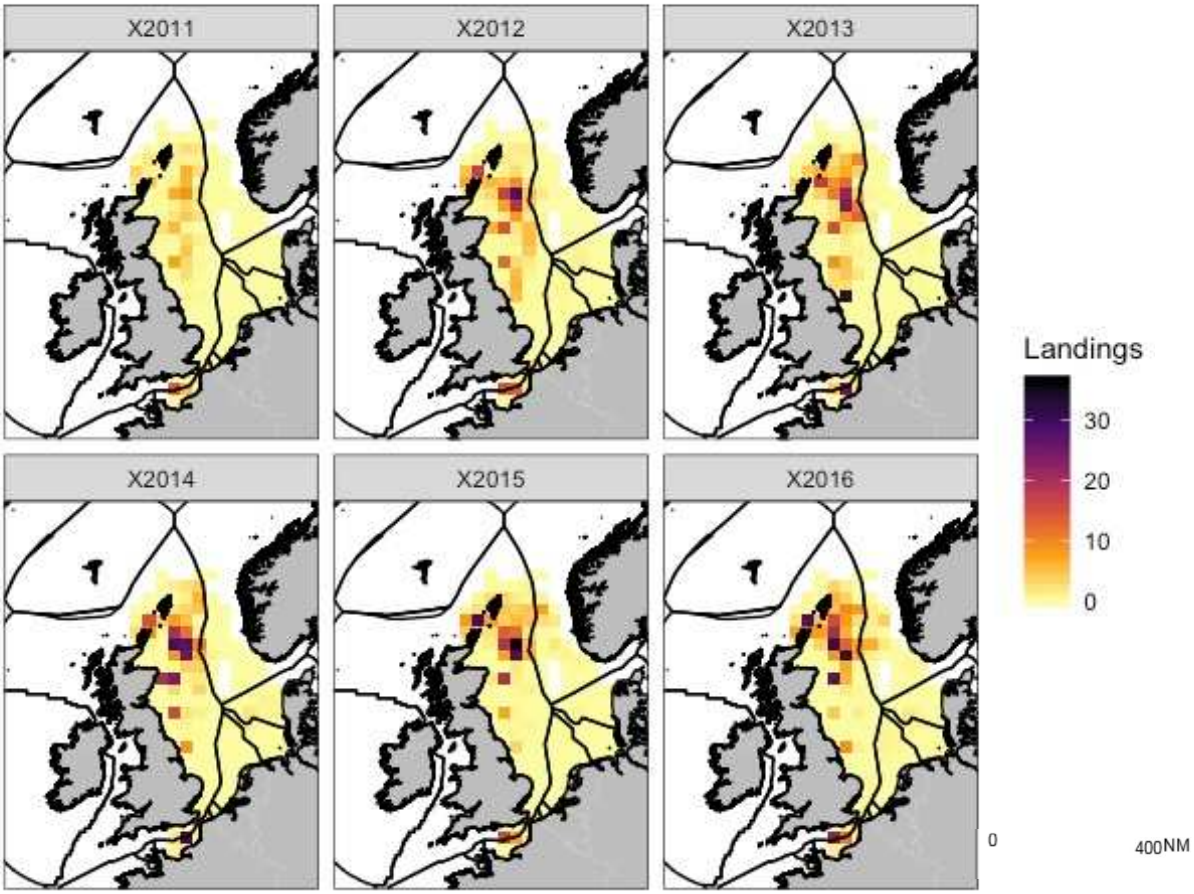


Figure 15: Maps of North Sea Autumn Spawning Herring landings (in 000t) per year

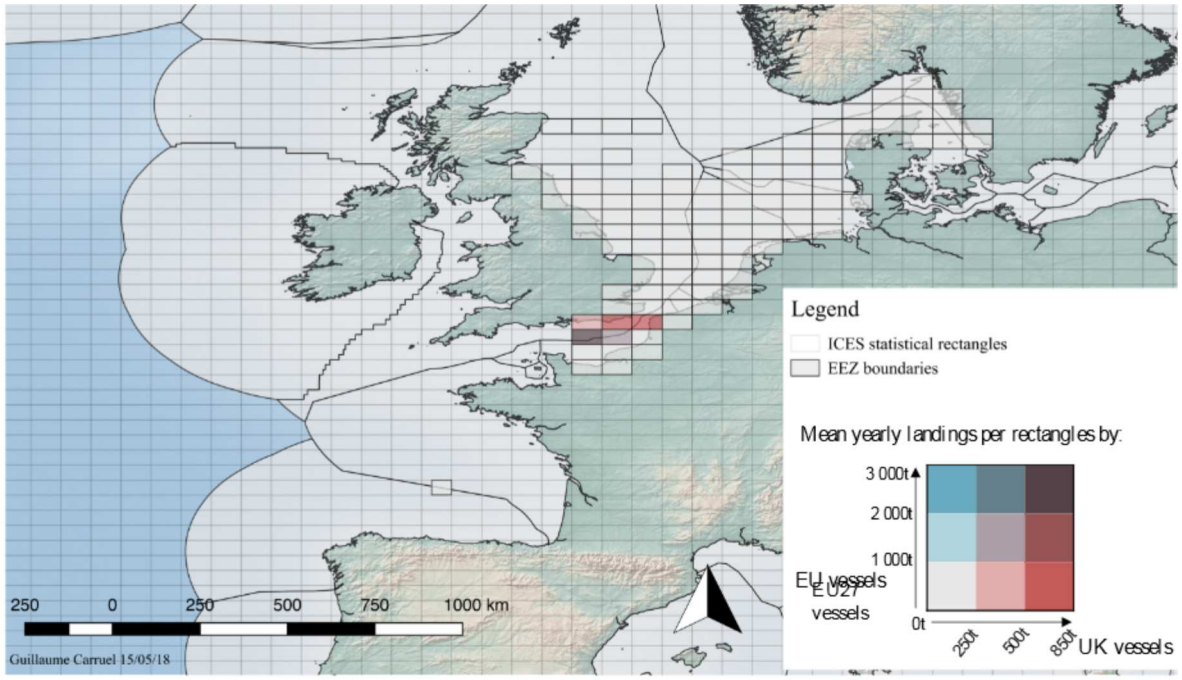


Figure 16: Map of North Sea Horse Mackerel mean yearly landings origins by EU27 and UK vessels (2011-2016)

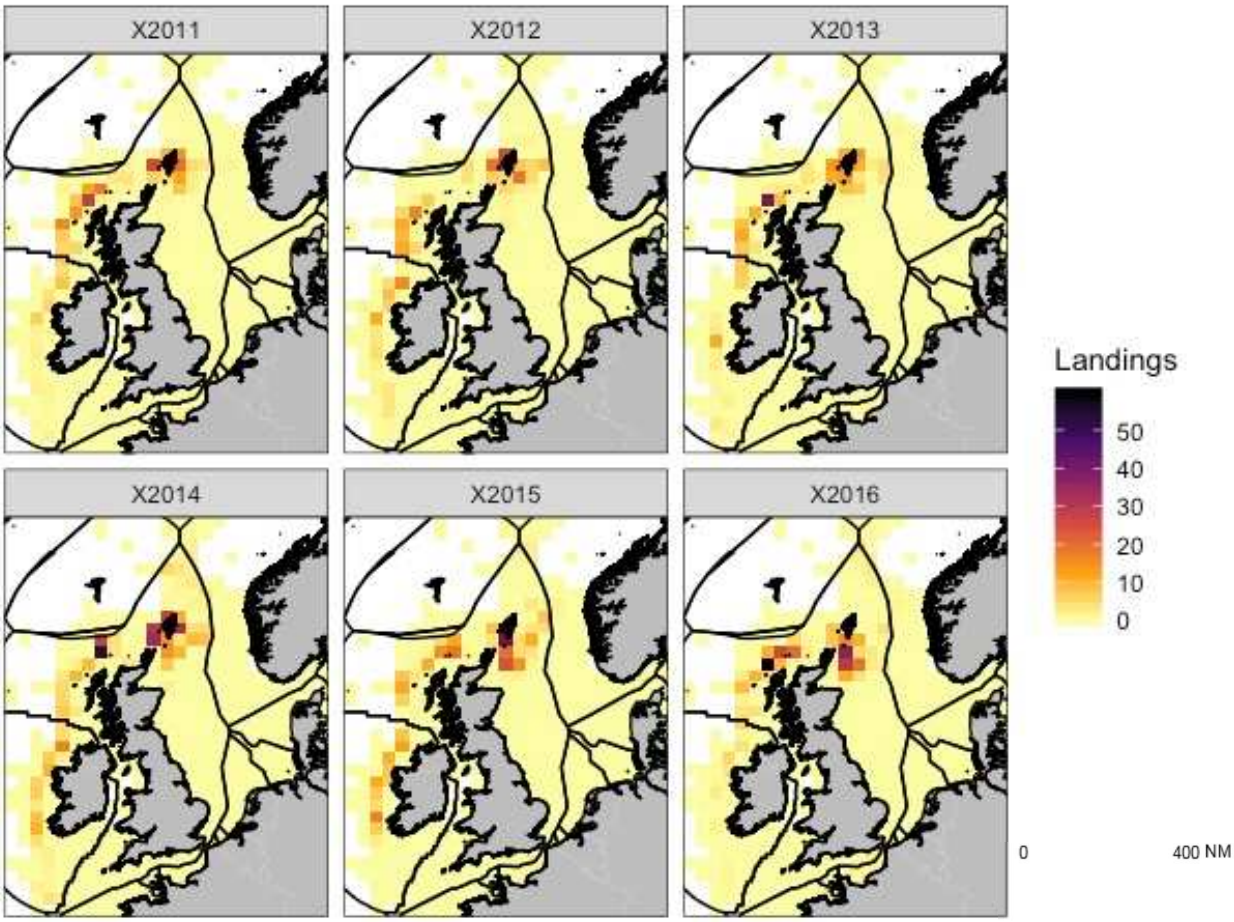


Figure 17: Maps of Northeast Atlantic Mackerel landings origins per year (in 000t)

4.2. Study of the sharing of quotas and quota swaps

The repartition keys inherited from the relative stability can be easily calculated from the fish quota of any given year (Table 3). Globally, on the stocks studied here, the EU27 obtains 75% of the fishes.

Table 3: Quota share per stock attributed to the EU27 and the UK in 2016

	AS Her	NS AS Her	WB SS Her	6aN S7bc Her	CS Her	IS Her	NS HM	W HM	S HM	B Whiting	NEAtl Mack	BF
EU	78%	80%	100%	57%	100%	26%	89%	92%	100%	82%	53%	94%
UK	22%	20%	0%	43%	0%	74%	11%	8%	0%	18%	47%	6%

Some stocks are largely distributed to the EU27 (more than 90% of the quota for Western Baltic Spring Spawning Herring, Celtic Sea Herring, Southern Horse Mackerel, Western Horse Mackerel, Boarfish). Others are really shared between the UK and the EU27. Most of the quota share go to the EU27 for: Atlanto-Scandian Herring, North Sea AS Herring, North Sea Horse Mackerel, Blue Whiting, and to the UK for Irish Sea Herring. A somewhat balanced repartition exists for herring in VIaNS-VIIbc and Northeast Atlantic Mackerel.

Swaps in quota can occur at different levels: at the country level, the producers organisation, or the fishing company. The quota swaps reported on the Pelagic Advisory Council document are the country level ones. They are negotiated and agreed between countries in order to obtain fishing opportunities that correspond better to their fleets and their catches. For 2016, swaps occurred between the UK and other EU member states and significantly changed the quota repartition for North Sea Horse Mackerel (the UK increased its quota share from 11% to 46%), C. Sea Herring (the UK increased its share by 3 percentage points), VIaNS-VIIbc Herring (the UK increased its quota share from 43% to 47%) and Western Horse Mackerel (the UK share decreased by 2 percentage points) (Annex 4). There might have also been swaps with other countries like Norway that explain why globally, the quota share of the total stocks after swaps is still around 75%EU27-25%UK.

Some differences exist between quotas before and after swaps. They might prefigure areas where the historical allocation key would not correspond anymore with the actual fishing taking place. This is true for North Sea Horse Mackerel, C. Sea Herring, VIaNS-VIIbc Herring and Western Horse Mackerel, Irish Sea Herring, Atlanto-Scandian Herring, and North Sea AS Herring. Other changes in the quota allocation might be desirable for one of the parties involved but do not take place as swaps require both parties to agree on the exchange.
For several stocks, some important differences appear between the quota share after swaps and the landing shares (Annex 4). These differences are shown in the column "quota consumption" and can have various reasons. First of all, other swaps could have occurred at different levels and are not displayed here. Second, there could have been difficulties to catch the intended amount of certain fish stocks (weather, abundance, distribution, other). Third, the market prices of some species might have been too low economically speaking to target them. Fourth, the differences could be due to by-catch from other fisheries authorized to do so in the Council Regulation establishing fishing opportunities' footnotes (for example, demersal fisheries like the Faroese sprat fisheries in the Union waters of IIa and IV is authorized to fish a 4% by-catch of herring) (Council Of The European Union, 2016). Fifth, the quota top ups are not taken into account here. Alternatively, there could have been landing in excess of the quotas (non-compliance). Finally it is possible that there are mismatches between the two different data sources. It is therefore hard to draw any definitive conclusions from these figures.

4.3. Diagnostic: 3 heavily dependent stocks

The fisheries for these 12 stocks are all distinct by the volume of the landings, the fleets targeting it, the location where they take place and the consecutive importance for the EU27 and UK fleet (Table 4). Three types of stocks have been identified. The first one includes the stocks that are the least concerned by the Brexit changes: Southern Horse Mackerel, Western Baltic SS Herring, Atlanto-Scandian Herring, Boarfish and Irish Sea Herring. The second group identified is the stocks for which the UK fleet, according to its 6 last years' fishing pattern, is dependent in on the EU27 waters. This dependency exists in terms of proportion of the fleet total landings. This group includes Western Horse Mackerel and Blue Whiting for which an important part of the UK landings depends on the EU27 waters. Finally a last group of fish stocks shows an important dependency of the EU27 fleet on catches made in the UK EEZ. This is the case for Celtic Sea Herring, 6aNS7bc Herring, Northeast Atlantic Mackerel, North Sea Horse Mackerel, North Sea Autumn Spawning Herring.

Table 4: Volume (t) and proportion (of all of the stock landings) of fish stocks caught by the fleets in the EU27 & UK waters

Fish stock	EU27 fleet in EU27 water		UK fleet in EU27 waters		EU27 fleet in UK waters		UK fleet in UK waters	
S Horse M	21 598t	100%	0t	0%	0t	0%	0t	0%
WB SS Her	37 412t	93%	0t	0%	0t	0%	0t	0%
AS Herring	0t	0%	0t	0%	57t	0%	16t	0%
Boarf	84t	13%	257t	40%	5t	1%	293t	46%
IS Herring	12t	0%	40t	1%	40t	1%	3 791t	93%
W Horse M	94 792t	78%	3 888t	3%	18 807t	15%	4 500t	4%
B Whiting	67 167t	49%	15 607t	11%	42 510t	31%	4 665t	3%
CS Herring	9 925t	58%	42t	0%	7 039t	41%	54t	0%
6a7bc Her	2 532t	11%	2t	0%	7 319t	33%	12 583t	56%
NA Mack	79 511t	19%	30 285t	7%	130 865t	31%	178 212t	42%
NS HM	3 131t	30%	1 021t	10%	4 122t	40%	2 132t	20%
NS AS Her	26 766t	9%	1 486t	0%	207 512t	67%	60 340t	20%

Table 5: Mean percentage of EU27 landings from the UK EEZ's for each fish stock (2011-2016)

Fish stocks	Boarfish	Irish Sea Herring	Western Horse Mackerel	Blue Whiting	Celtic Sea Herring	6aNS7bc Herring	Northeast Atlantic Mackerel	North Sea Horse Mackerel	North Sea Autumn Spawning Herring
% of EU landings from the UK EEZ	6%	62%	17%	37%	41%	74%	60%	57%	84%

These tables show that the biggest EU27 fleet dependency is for North Sea AS Herring, 6aNS7bc Herring, Celtic Sea Herring, North Sea Horse Mackerel, Northeast Atlantic Mackerel (Table 4, Table 5). The Celtic Sea Herring stock has small landing volumes compared to other stocks. Special conditions apply to 6aNS7bc Herring which is under a monitoring TAC for now as the stock needs to recover. Therefore, the scope of the following factors and scenario study was narrowed down to these three stocks that show a great dependency and represent very important landing volumes and values: Northeast Atlantic Mackerel, North Sea Horse Mackerel, North Sea AS Herring.

5. Scenarios' outcomes influencing factors

5.1. Identification of the factors affecting the scenarios

The scenarios' factors were explored for S2 and S3. S1 requires no particular attention as it implies that no major change would occur. S4 is not explored in depth here. It is likely that no fishing access to the UK waters and no deal on the quota share would result in an increased total fishing effort. This scenario would imply too much complexity to be analysed in the current study.
For the two scenarios, information was needed to formulate the potential outcomes.

5.1.1. Factors relevant for the scenario "no access and deferred effort" (S2)

In respect of the scenario S2 of no access and deferred effort, the factors correspond to potential aspects that will impact the EU27 fleet.

The first category of factors is the current dependency of the fleet and the potential opportunities. The dependency can be studied through the data obtained in the first part of the report, by looking at the ratio of the EU27 fleet's landing from the UK waters compared to EU27 waters, and the percentage of landings from other waters. This tells how much of the effort is to be deferred.
The opportunities are linked to historical fishing grounds (that are not exploited anymore) and future distribution change (for instance climate change driven or related to other drivers). This is to try to anticipate the appearance of new fishing areas. The potential opportunities are also reflected by the fishing vessels characteristics (in order to foresee the possibility for the fleet to modify its target species and fishing area), and the existence of fishing grounds for this stock outside of EU27 and UK waters (this last factor is to reflect the possibility of negotiations with other third countries on a new or extended access and quota for the EU27 fishing fleet).
Finally, the fishing effort applied to these migratory fishes could also be deferred on the same stock at another life stage or season. This last alterative fishing opportunities might be very hypothetical regarding the minimum conservation reference sizes prescribed by the CFP. This calls for data on the distribution of juvenile fish, and on the adult stock.

The second category of factors is the abundance of the resource and of the users.
The abundance of the resource now and in the near future can be considered through the biomass of the fish stock, the fishing pressure applied to it, the productivity, and the TACs in place. The ICES stock advice provides valuable information on this and the category of this advice is important to look at to evaluate the reliability of this data.
The abundance of users is also to be considered in this scenario as it will influence the number of vessels looking for new opportunities and the possibilities to see successful international negotiations for new access or quotas. The number of other fishing nations, their proportion of the catches, and the characteristics of international agreements in relation to these stocks will therefore be looked at.

In addition to these two categories, numerous external factors will undoubtedly influence this scenario. Both the factors in the fishery area but external to these particular stocks and those in completely different areas, will be addressed in section 5.1.3..
With all this information, it will be possible to evaluate the feasibility of a deferred effort and the issues that might arise.

5.1.2. Factors relevant for the scenario "maintained access but quota renegotiations" (S3)

In respect of the scenario of maintained access but quota renegotiations, the factors will correspond to elements that might tilt the balance and potentially interfere in the negotiations. The same categories can be identified but other new factors can be added to the previous list. In the current dependency of the fleet and the potential opportunities, the current quota allocation needs to be outlined. It will be an important factor as it has been the basis for fishing opportunities for more than 30 years. Quota distribution will therefore be the starting point of the negotiations. The concept of zonal attachment will likely have a central role (Walmsley, 2016; Beukers-Stewart and O'Leary, 2017) as it was the case in the agreements between the EU and Norway (European Parliament Committee on Fisheries, 2017). The exact definition of this concept is complex and can be political. Looking at previous international negotiations can give an idea of what it encompasses. In the Agreed Report of joint EEC-Norway working group on the joint stocks in the North Sea, no precise definition of this concept is given but the parties agree that some factors need to be taken into account to define it (Paulsen and Marcussen, 1979). These factors are the ones presented in the Report Of The Norwegian - EEC Joint Scientific Sub-Group On The Distribution Of Shared Fish Stocks In The North Sea: The distribution of eggs and larvae, the distribution of juvenile fish, the distribution of the adult stock based on survey data, the distribution of commercial landings, spawning areas, the exploitation rate and management measures (ICES, 1979). They should therefore be studied here (the distribution of commercial landings and the exploitation rate and management measures can be considered to be already taken into account in other categories). The potential future distribution change (previously cited) are also of great interest to this scenario as it has been shown that changes in migration and distribution have negative impact on international fishing agreements (Bjørndal and Ekerhovd, 2014).

The second category of factors (abundance of the resource and of the users) will have to include the same factors as the one in the previous scenario. One particularly important factor will be the stock status as (low) abundance of the stock is linked to difficulties in achieving international cooperation (Bjørndal and Ekerhovd, 2014). The number of different fishing nations for a given stock is also significative in the quota share negotiations. As a matter of fact, other international fishing cooperation processes (such as the setting up of Regional Fisheries Management Organisations) are more complicated with an increased number of players (Bjørndal et al., 2000). It seems reasonable to think that this could apply to international fishing agreements.

Finally, external factors will also play a role here and will be addressed in the next section.

5.1.3. External factors of influence

There is a number of external factors within the maritime environment. They might mainly influence the long-term outcomes of the scenarios. The changes in the fishing pattern might induce modifications in the stocks behaviour and in the entire ecosystems (with the predator-prey mechanisms among other things). The management system adopted and the fishing effort resulting will also have an influence on this. Maritime environment factors also include climate modifications (long term such as climate change and short term such as weather pattern), will also undoubtedly influence the outcomes.

Other factors are linked to the broader negotiations. One of them is the importance of the EU27 market access (at minimal cost and "frictionless" border check) for the UK seafood industry. This need for access will certainly play an important role in the negotiation. Another thing is the fact that the EU27 negotiator link the 4 freedoms together as indivisible: freedom of movement of goods, people, services and capital over borders. Finally, the risk of having no Brexit deal (and consequently no access) is also an important part of the negotiation process (European Union Committee, House of the Lords, 2016).

A significant information in case of negotiation is the value of the stocks (linked to market price). It can therefore be expected more heated discussions around mackerel than horse mackerel.

Other factors are significant when negotiating around common pool resources access and use. According to Hannesson, the sharing of numerous stocks can help achieving positive agreements and cooperation between the parties, provided that each party is a major player in one of the stocks (Hannesson, 2013). As shown previously, the EU27 and the UK share numerous stocks. Even if the UK seems to be a dominant player for some stocks, the EU27 may be considered dominant for others (other fisheries sector, Blue Whiting, Western Horse Mackerel). This could lead to a beneficial cooperation in the management of the stocks.

Finally the existence of the North-East Atlantic Fisheries Commission as a forum to enhance cooperation between the fishing countries might play a key role in allowing for good collaboration between the parties (North-East Atlantic Fisheries Commission, 1980).

Most of the identified factors are relevant for both scenarios (Annex 5). The bibliographical data gathered in section 2.3. was summarized according to the factors presented hereabove (Annex 6).

5.2 Stakeholders' perception of the factors: outcome of the questionnaire

The answers of the questionnaire were compiled into the following tables. They show a great diversity of answers that must be linked to the broad origins and various working areas of the respondents. They give some ideas of the existing points of view of the PelAC stakeholders and highlight different impressions considered as important.

5.2.1. North Sea Autumn Spawning Herring

Fisheries and stock health	Bycatch: Mackerel, Norway pout, sand eel and sprat fisheries as catching herring. Stock's health: Globally perceived to be in a better state than before (50% of answers), but some stakeholders prefer not to give assumptions on this or refer to the ICES advice. One respondent on the other hand thinks that the stock is at a lower level than 10 years before. Future evolution of the stock's health: Uncertain, respondents describe anything from a decreasing health (lower biomass) to a better recruitment and health or stability. Greatest threat to the stock: Overfishing (5/12 respondents), environmental modifications, change in recruitment, by-catch from other fisheries, species interaction and no international fishing agreement. Difference between geographical areas: No major one, except for the decrease of the Downs component (IVc, VIId - Channel)

EU27 dependency on the UK waters	Perceived dependency of the EU27 fleet: Considered to be important by a large majority of stakeholders. They all think that this was always the case except one respondent (more on Norwegian waters). Perceived dependency of the UK fleet: Two types of answers, either "no dependency" or life cycle dependency (nursery area in the EU27 waters). Other dependent countries: Norway and the Faroe Islands, but to a lesser extent.
Potential opportunities for the EU27 fleet outside the UK EEZ	Area not fished anymore: Most respondent do not recall any, two point out the nursery areas of the North Sea [the area have been closed to fishing since at least 1998 (Council Of The European Union, 1998). New fishing grounds development conditions: Increase in stock size (spatial expansion) and climate change related modifications. Limitation to it: Low biomass, stock behaviour (feeding migration, spawning area), ecosystem change (food productivity, …), constraining management measures and market. Alternative fisheries: Fishing for herring in VIb [this area does not correspond to the current definition of North Sea Autumn Spawning Herring] and in IIIa and fishing younger herrings.

5.2.2. North Sea Horse Mackerel

Fisheries and stock health	Bycatch: The sprat, herring, Norway pout, mackerel and other demersal trawl fisheries (in the Channel and Southern North Sea) catch NS Horse Mackerel. Stock's health: Globally perceived to be at a low health level (low biomass,...) with some rebuilding trend (better recent recruitment). One stakeholder says that it is in good health. Future evolution of the stock's health: Foreseen to be somewhat stable. Some respondents say that it is difficult to answer this and others that the stock might grow with better recruitment. Greatest threat to the stock: Bad recruitment and overfishing are the most often quoted. By-catch, climate change, species interaction, environmental impact are also mentioned. Difference between geographical areas: Linked to the questions of stock identity in the west of the Channel (in VIIe, where Western Horse Mackerel can be found). Northern part of the stock's distribution area perceived to be in a better state (compared to the central North Sea -IVb-)
EU27 dependency on the UK waters	Perceived dependency of the EU27 fleet: Believed to be real even if the appreciation of it ranges from "low" to "fairly high" and from "33%" to "~80%" of catches. Historically, this seem to have always been the case. Perceived dependency of the UK fleet: According to the majority, no reciprocal dependency. On the opposite, two people think that there is such reciprocal dependency. Other dependent country: Only one answer mentions another fishing country: Norway (supposed to be less dependent).
Potential opportunities for the EU27 fleet outside the UK EEZ	Area not fished anymore: None except the German bight. New fishing grounds development conditions: Possible in VIIe if North Sea Horse Mackerel quota is given to fishermen (not only W Horse Mackerel). Climate change and expanding stock size and distribution could also favour new areas. Limitation to it: Management restriction (fishing rights, access, quotas), absence of rebuilding trend.

Potential opportunities for the EU27 fleet outside the UK EEZ	Alternative fisheries: Most stakeholder don't see any alternative except one mentioning EU27 waters in IVb and IIIa.

5.2.3. Northeast Atlantic Mackerel

Fisheries and stock health	Bycatch: Mackerel is a bycatch for various different pelagic and demersal fisheries (e.g. Western Horse Mackerel, herring -during winter-, sprat, and Norway pout). Stock's health: Thought to be good and has been like this for the last years. One respondent points out a recent decrease and another one highlights its poor growth. One refers to the ICES advice. Future evolution of the stock's health: Expected to be a stable healthy stock for most stakeholders but one of them foresees a decline in stock size. Some answers stress the difficulty to predict evolutions. Greatest threat to the stock: Thought to be overfishing. Not having any international agreement is also mentioned by several stakeholders. Climate change, species interaction, change in productivity (poor recruitment, density dependent decrease in growth) are also brought up. Difference between geographical areas: The majority of the answers note an expansion northward (and to a lesser extent, westward).
EU27 dependency on the UK waters	Perceived dependency of the EU27 fleet: Thought to be high or very high for most stakeholders even if some of them believe it is less than for herring. The majority thinks that this was historically always the case, but three people disagree (one thought that it was higher). Perceived dependency of the UK fleet: Not dependent on the EU27 waters except with regard to the spawning area. One respondent point out some fishing dependency in the West of Ireland and France. Other dependent countries: Norway, Iceland and the Faroe Islands are thought to also fish for this stock. The majority of stakeholders think that they are less dependent than the EU27 fleet and others that there is a similar dependency.
Potential opportunities for the EU27 fleet outside the UK EEZ	Area not fished anymore: Three respondent mentioned the North Sea. New fishing grounds development conditions: Stock behaviour, migration patterns, and changes in food productivity linked to climate change. The re-evaluation of the stock status in the North Sea is also seem as a potential opportunity. Limitation to it: Access to other EEZs, constraining management measures (quota limitations,…) and low biomass. Alternative fisheries: The only alternative mentioned is fishing in IVb and IIIa and switching to an industrial mackerel fishery.

5.2.4. Other factors

The stakeholders were also asked if they could think of other factors that were not addressed in the previous questions. The importance in the negotiations of trade and access to markets was highlighted. Furthermore, quota negotiations and management measures such as the landing obligation were also mentioned. Lastly, two stakeholders stressed the important role of third parties in the outcome of the negotiations (e.g. Norway and the Faroe Islands).

6. Outcome of the scenarios and consequences

The scenarios were explored in light of the bibliographical work conducted and the views of the stakeholders. As previously explained, S1 and S4 were not studied. Exploring S2 and S3 is of more interest as the outcomes might be different from stock to stock.

6.1. Scenario S2: no access with deferred effort

6.1.1. North Sea Autumn Spawning Herring

Being denied access to the UK EEZ would be a very important loss for the EU27 fleet. 80% of their landings originate from the UK waters and this heavy dependency is confirmed by the stakeholders. It seems to have been the case for a long period. The North Sea Autumn Spawning Herring is a highly variable stock in terms of distribution. This is shown by both historical (ounce occurring more in the eastern North Sea) and recent (the decrease in the downs component) catches but equally by the observed change in the distribution pattern that occurred since 1985. These changes are caused by environmental influences and will arguably continue because of climate change.

Several possibilities seem to emerge regarding the deferral of the fishing effort deployed by the mid-water-, otter-, pair-trawlers and the purse seiners of the EU27 fleet. This stock is in good health according to the stakeholders' perception and to the category one ICES advice. This means that an increase of the biomass is possible and could mean an expanded distribution area (that could also be out of the UK EEZ). The second one, is the existence of nursery areas for young herrings off the shores of The Netherlands, Germany and Denmark. The scientific survey shows the abundance of young fish in this area and stakeholders' mention it as an alternative opportunity. This seems to be a very hypothetical possibility as minimum conservation references sizes might not be fulfilled, and these areas are partly closed to protect juveniles. A third possibility could be to obtain large access to the Norwegian waters and try to fish more in the eastern North Sea. On the one hand, there are some historical fishing grounds there and some stakeholders claimed that more fishing could occur in area IIIa. On the other hand, the Norwegians might not be willing to grant full access to their waters as they would also have to defer their own fishing effort. Norwegians and Faroes vessels together caught 27% of the stock's total catch and these two nations are, to a lesser extent, also dependent on the UK EEZ access.

Scenario 2: North Sea Autumn Spawning Herring

- Important impact on the very dependent EU27 fleet
    - Highly uncertain behaviour (distribution & recruitment)
    - Deferred effort option might not compensate enough

6.1.2. North Sea Horse Mackerel

Would scenario S2 unfold, almost 60% of the EU27 landings of North Sea Horse Mackerel would be at stake. Nonetheless, more than 30% of the UK landings are from the EU27 waters and therefore there is a clear unbalanced but shared dependency for this stock. Like for most pelagic stocks, the variability of its distribution is important and there is an environmental influence on it.

The closure of the EEZ would trigger the deferral of the fishing effort mostly applied by the Dutch freezer trawler fleet. The EU27 fleet would conceivably easily fish the around 1000tonnes previously caught by the UK fleet. The somewhat bad state of the stock and poor data available (category 3 ICES advice, no MSYBtrigger value) might represent a challenge for this but better recruitments have been observed since 2013 and this could mean an expansion of the stock and its distribution. Another possibility could be the use of former fishing grounds. These are located in the south-eastern North Sea and were fished by the Danish fleet in the 1980's and 1990's. Horse Mackerel is present off the coasts of Belgium, The Netherlands, Germany and Denmark in spring and summer, when spawning. Finally, if it was proven and accepted that some North Sea Horse Mackerel (and not only W Horse Mackerel) can be found in area VIIe (western part of the Channel), a fishery could take place there. The absence of other fishing nation means that the EU27 fleet would be the only one deferring its effort.

Scenario 2: North Sea Horse Mackerel

- Fishing pressure already important & lack of scientific data
    - Potential deferred effort on former UK-fleet EU27-water fishing grounds & SE North Sea
    - Greatest threat is bad recruitment and overfishing preventing rebuilding

6.1.3. Northeast Atlantic Mackerel

If the EU27 fleet does not have access to the UK waters after Brexit, about 60% of its landings would be at stake (around 131000 tonnes). Reciprocally, only 14% of the UK fleets landings come from the EU27 waters (around 30300 tonnes). The EU27 would clearly be impaired.
The Northeast Atlantic Mackerel is also one of the two stocks that saw the greatest distribution change since 1985 and so these figures might not reflect future distribution and catch areas.
Would the EU27 fishing fleet need to find new fishing grounds, several possibilities would emerge. Fishing where the UK fleet used to might allow to recover around 30000 t. This would probably mean fishing earlier in spring in West Ireland. Conversely, the UK fleet would fish later, in the North of Scotland. Another possibility would be the increase of the fishing pressure by the EU27 fleet on the international waters (or even the Norwegian EEZ). These areas represent only about 3% of the EU27 fleet landings at the moment. This solution could prove to be difficult to execute as the high value of mackerel and the numerous parties interested in its fishery make it a coveted stock. Additionally, the nursery areas of the south-eastern North Sea (the Danish EEZ for instance) are not exploited right now but some stakeholders think that an industrial fishery could emerge there. This seems to be a very hypothetical possibility as minimum conservation references sizes might not be fulfilled. The central North Sea is a potential fishing area for mackerel too. It is protected right now because the North Sea component of the stock is believed to have a low biomass but might eventually recover. Finally, the good health and recent North-westward expansion of the stock could imply further distribution expansion. However, this is highly uncertain as the fishing pressure is above Fmsy,

the individuals' growth rate is observed to decline, and the stock is currently benefitting from better recruitment that might not last.

Scenario 2: Northeast Atlantic Mackerel

- High value stock. An EEZs closure will harshly impact the EU27
    - Several possibilities to find new fishing grounds (but hard to assess)
    - Important recent biomass and geographical expansion
    - International agreement and overfishing are the major concerns

6.2. Scenario S3: maintained access and quota renegotiations

6.2.1. North Sea Autumn Spawning Herring

In the case of a maintained access but a quota renegotiation, it is important to look at the initial share of the quota. For North Sea Autumn Spawning Herring, 80% of the EU27+UK share goes to the EU27 countries and no quota swap generally occur between the EU27 and the UK. This fish is largely caught in the UK EEZ as 80% of the EU27 catches come from there. Therefore, there is a heavy dependency of the EU27 fleet on the UK waters and an unbalanced quota in favour of the EU27.

Some factors would surely facilitate the reach of an agreement. One is the good health of the stock for which there is a lot of data (category one stock of ICES). Another one is the existing EU-Norway management strategy that dates back to 1998 and implies the pre-existence of a cooperative framework. The bargaining leverage held by the EU27 on this stock is the stock's life cycle dependency on nurseries located in the Dutch, German and Danish EEZ's.
Reaching an agreement would still certainly be challenging because of other factors. The absence of direct reciprocal fishing dependency for this stock could weaken the will to reach a common ground. The uncertainty in recruitment and the low productivity phase described by ICES could put some pressure on each party, not easing up compromises. The fact that Norway and the Faroes Islands (as a distant water fishing nation) combined caught 27% of the total catch in 2016, and that they have a limited but significant dependency on the UK waters, means that there will be a need for a multi-lateral agreement. This kind of 3 parties' agreement might be more difficult to reach than a simple bilateral one. Finally, the pre-existence of the EU-Norway management strategy might be of no use as this strategy was not followed by the parties in 2017.

Scenario 3: North Sea Autumn Spawning Herring

- The current 80% quota share for the EU27 will probably decrease
    - Low productivity, uncertain recruitment, additional players might hamper negotiations
    - Life cycle dependency & historical management strategy might balance this

6.2.2. North Sea Horse Mackerel

In the perspective of the unfolding of the S3 scenario, the North Sea Horse Mackerel quota share would be renegotiated. The current initial share is close to 90% to 10% with benefit to the EU27. However, quota swaps occur and, for instance in 2016, lead to a new share of 54% to 46% with an important reduction for the EU27. This 35-percentage point change shows the interest of the UK fishermen in this stock. As previously shown, there is an unbalanced but

shared dependency on this stock regarding the fishing area with 57% of the EU27 landings coming from UK waters and receptively 32% of the UK landings from the EU27 waters.

A number of factors could positively influence the reaching of an agreement. These are the reciprocal fishing interest, the absence of other fishing nations and the better recruitment since 2013 (that should ultimately have positive consequences on the biomass and may lead to higher TACs). The EU27 could expect a favourable agreement because of the spawning migration that takes place in the Belgian, Dutch, German and Danish waters in spring and summer.
The category three stock assessment of ICES carries some uncertainties. The stock is thought not to be in a good health by stakeholders and this could toughen the negotiations. One major concern of stakeholders is the pulse recruitment of this stock that is hard to predict. It could also have a negative impact by bringing additional pressure on the negotiators.

Scenario 3: North Sea Horse Mackerel

- EU27 currently swaps 35% of its quota to the UK, the quota share of the EU27 might decrease
    - No third country fish the stock, bilateral agreement likely to be reached
    - Greatest danger to the stock: overfishing and poor recruitment

6.3.3. Northeast Atlantic Mackerel

If a reciprocal access is granted to EEZs, the negotiations will be around the quota shares. The starting point could be the current ones. On the one hand, EU27 holds 53% of the Northeast Atlantic Mackerel quota and the UK 47%. The quota swaps do not generally change these figures a lot (+-1%). On the other hand, the geographical dependency of fishing is unbalanced and shows a high dependency from the EU27 with 60% of EU27 landings from the UK waters.

The stock's good health and high biomass as well as the fact that it is well known might be positive news for the reach of an agreement, but one should not forget that the geographical expansion of the last years caused the collapse of the international agreements. The reciprocal fishing interest could also pressure the parties to find an arrangement. The EU27 case to get a balanced deal could also rely on the stock's life cycle stage unfolding in its waters such as the nursery area in the Danish waters and the migration route through the west of the Irish EEZ.
One of the greatest challenges for this stock will be the handling of the international negotiations. Russia, Norway, Iceland, the Faroe Islands, Greenland together caught 58% of the 2016 total catch. These fishing nations will therefore play an important role. There is a history of non-cooperation with this stock, with the infamous "Mackerel War" of 2009. Still today, the 2014 three parties EU-Norway-Faroe Islands agreement, letting 15,6% of the quota to other fishing nations has not been followed for the last 3 years. The already high fishing pressure (above Fmsy) and the uncertainties of future stock behaviour (growth rate, recruitment) might press the negotiators and complexify the reach of an agreement.

Scenario 3: Northeast Atlantic Mackerel

- High interest for both parties, quota share might decrease a little for the EU27 or stay alike
    - Geographical fishing dependency balanced by across - EEZs life cycle
    - Numerous fishing nations, high fishing pressure, important distribution change, could mean difficulties to reach an international agreement

7. Discussion and broader considerations

7.1 Limits of the diagnostic

It is important to emphasize the fact that only landings from the EU27 and the UK fleets are taken into account in the diagnostic figures. For some stocks like Atlanto-Scandian Herring, Blue Whiting, Northeast Atlantic Mackerel, and to a lesser extend North Sea Autumn Spawning Herring, other fishing countries contribute to a lot of the total landings. These countries are mainly Norway, Russia, Iceland, and the Faroe Islands. Moreover, the data analysed here represents the landings and not the catches. The pelagic fisheries are considered not to be discarding a lot of by-catch but the bottom trawling that occurs sometimes in similar places could be catching extra fish from these stocks that are not taken into account here (Ovens, 2016). Similarly, on the data used, some limits can be identified from the STECF report 17-09 (Scientific, Technical and Economic Committee for Fisheries, 2017b). The main area where the data could be lacking accuracy is on landings by the smaller vessels which do not have the same reporting requirements as the bigger ones and for which the data gathering is different from one MS to another.

Finally, these results are based on means of landings for 6 years. Even if the fishing grounds seem to globally remain in the same areas, pelagic stock landings vary greatly between years (Figure 18, Figure 19). For instance, total catches for these stocks were 0,98 million tonnes in 2012 and 1,63 million tonnes in 2014. The Atlanto-Scandian Herring and Western Horse Mackerel stock landings have gone down. On the other side, the Northeast Atlantic Mackerel stock's landings have increased between 2013 and 2014 and have been stable since then and the North-Sea Autumn Spawning Herring and Blue Whiting stocks have increased.
These variations are linked to the management history and the evolution of the state of the stock. For example, for Blue Whiting, the important variations have several different reasons. In 2006, after 6 years of negotiations, an international agreement put an end to the olympic-style fishing occurring in the Blue Whiting fishery. The catches were reduced as the spawning biomass was falling and the quotas were minimal for 2011 (Bjørndal and Ekerhovd, 2014). The international agreement broke in 2015 because of disagreement between the EU and Norway, and the sum of unilateral quotas has been rising since then (Undercurrent News, 2015).

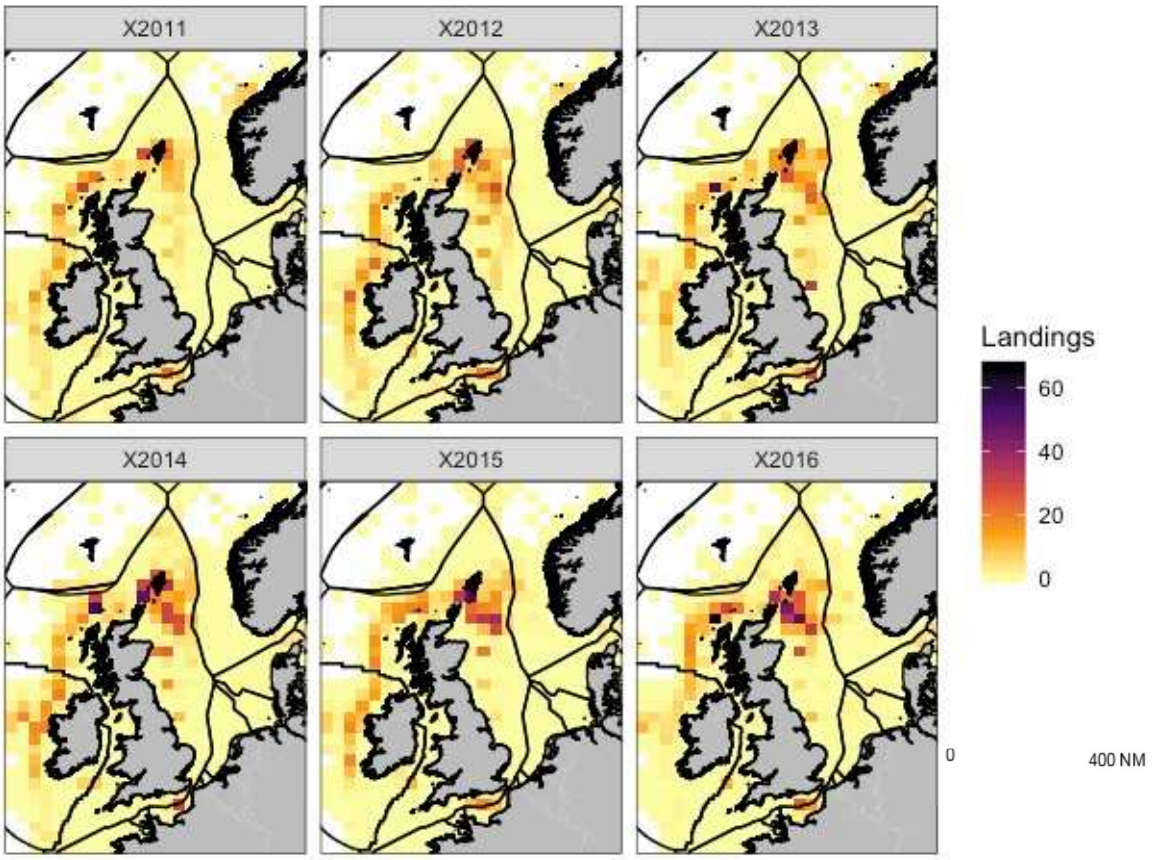


Figure 18: All stocks landings origin from the EU27 and UK fleets per ICES rectangle (in 000t) between 2011 and 2016

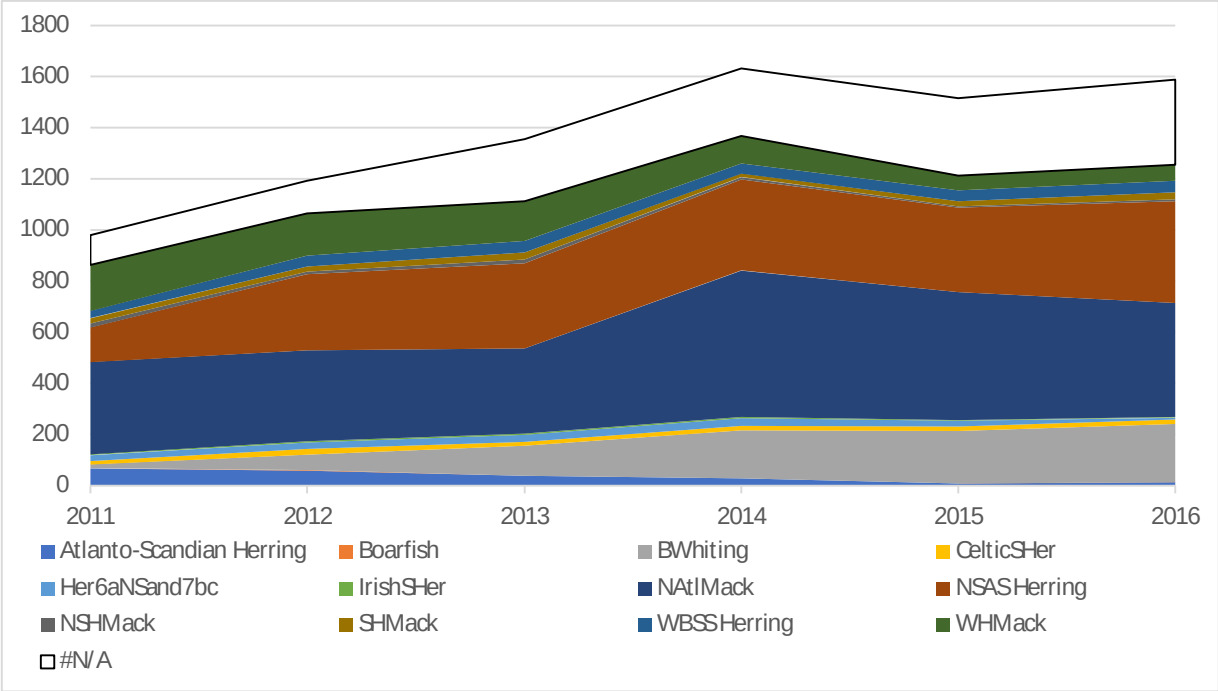


Figure 19: Annual landings (in 000 t) of the 12 fish stocks between 2011 and 2016 from the EU27 and UK fleets

Therefore, these results might not reflect future landings. This is even more true as fishermen might change their fishing habits (fishing grounds, species, etc.) according to the new rules and legislation in place in future years.

7.2 Discussions around scenarios

Several external factors were identified previously as possibly impacting the deferring of effort or the quota renegotiations. Their importance should not be overlooked. The scenario outcomes carry a lot of uncertainties, they are of economical, behavioural (fishermen catch strategy), biological (ecological) and negotiation-related nature. The deferral of effort could be targeted toward other species and because of the complexity (it would depend on the gears of the vessels, their characteristics, their operating areas, fishermen knowledge and quota availability) this is not taken into account here.

One of the main drivers for reaching a balanced agreement and reciprocal access could be the zonal attachment concept (in the sense used before -taking into account the same criteria as those used in negotiations with Norway-). Nevertheless, the definition itself of zonal attachment is very much debated and considered to be highly political (for instance, what relative weight to give to catch data and biomass data?, what about the suitable habitat area presented in the July 2018 white paper? (Department for Environment, Food & Rural Affairs, 2018)). An agreement relying only on this notion and with no timely re-consideration is not likely to last long. Indeed, zonal attachment is dynamic. Moreover, the pelagic species, as seen previously, are particularly subject to various changes in distribution, spawning area, migration route patterns, etc. Therefore, a review mechanism on a set time basis seems necessary for long term application of an agreement. If the changes are important, the new conditions might not suit all parties and might also lead to a breakdown of the agreement. Finally, using solely zonal attachment as a way to divide TAC share might not be acceptable in the first place as a minority player will get a worse outcome than in the absence of cooperation (Bjørndal and Ekerhovd, 2014).

These scenarios do not cover all the potential outcomes and in particular, the case of a partial access & quota renegotiation is not explicitly covered. Its outcomes might look like something between S1 and S2.

7.3 Broader considerations on the expected consequences of Brexit

A reflexion must be conducted on what is the "UK fleet". In this study, the UK fleet corresponds to boats registered in the UK. Alternative criteria could be taken into account and could have a more precise reflection on the economic weight of such fleet. These criteria could include the vessel owner's nationality, the nationality of crew members, the home port (or the most common landing port). The large international companies operating in the pelagic fisheries sector in the EU mean that the attribution of landings to one country can be tricky. These interconnections also exacerbate the uncertainties of the Brexit outcomes in the sector.

An additional remark can be made regarding the quota renegotiations. If changes in the quota repartition between the EU27 and the UK were to happen, they might trigger willingness for changes in all the quota shares within the EU27.

Latest negotiation news

In July 2018 the UK government published its white paper on fisheries. It reaffirms the will to limit access to the British waters and to renegotiate the quota in a "fairer and more scientific" way with a "new methodology". The UK negotiators want to separate the fisheries talks and the negotiations on market (Department for Environment, Food & Rural Affairs, 2018). This last provision opposes clearly the views of the European Parliament PECH committee that stated that "the free movement of fisheries products" should be linked to "free access to waters and resources" (European Parliament Committee on Fisheries, 2017).

Conclusion

In the pelagic fisheries sector it is easy to state that there is an important dependency of the EU27 fishing fleet on the UK waters. That said, various situations exist and Brexit scenarios do not have the same outcomes and meaning from stock to stock.
Some of the pelagic fish stock where the biggest dependency exist are North Sea Autumn Spawning Herring, Northeast Atlantic Mackerel and North Sea Horse Mackerel. Reciprocally, the UK fleet also fishes in the EU27 waters and 46% of Western Horse Mackerel and 77% of Blue Whiting landings come from the other European EEZs. Globally, in absolute terms the EU27 is fishing a lot more pelagic fish and so lands almost always more fish from the UK EEZ than the UK fleet from the EU27 waters.

Numerous factors will influence the outcomes of the negotiation whether the question is around access of vessels to the respective EEZs or quota share modification or both. These are linked to the current dependency of the fleet and the potential opportunities outside of the respective EEZs. Another important group of factors will be the abundance of the stocks (in terms of biomass and geographic distribution) and the abundance of users interested in the fishery. Finally, plenty other external factors within the maritime environment and outside will play an influential role in the negotiations.

The Brexit scenarios presented focused on a prohibited access to the UK EEZ and on a quota renegotiation which are the two main uncertainties in the fisheries catch sector. Looking at the outcomes of the scenarios it is clear that all lead to worse outcome than the current situation for the European fishermen.
The status- quo scenario of no change is unlikely to happen as the UK government made it clear several times since March 2016. A no deal scenario would be catastrophic for the industry across the border as it will probably mean an increased fishing pressure (which is often identified as the greatest threat to these stocks) in a race for fishing. The consequences of such behaviour are well known and would surely condemn many stocks to collapse.
The scenario with no access to EEZs would require fishermen to defer their fishing effort to other areas. It will surely not be possible to recover the total amount currently caught with the same effort as they will have to fall back on second-choice fishing grounds. The fishing on juvenile fish or spawning stocks might provide an alternative that might prove itself unsustainable. Finally, the climate change and environmental sensibility of these stocks migration pattern might reveal new fishing opportunities in the future.
The scenario of quota renegotiation will imply new rounds of negotiations with other fishing nations for most of the stocks. The current quota share for the three stocks identified as very dependent to the UK waters is in favour of the EU27 and this might change in the future. Arguments for the EU27 to keep important quota might rely on the life cycle of those stocks that cross EEZ borders several times.

This study also shows that for all the stocks that are at stake, the life cycle does not respect human boundaries. International cooperation will be required regardless of the negotiations outcomes and international agreements will need to be respected. In 1995, the United Nations (UN) Fish Stock Agreement called for cooperation on straddling fish stock issues by the elaboration of conservation and management measures (United Nations, 1995). The same year, the FAO code of conduct advised on elaborating (among other propositions) bilateral arrangement to achieve effective conservation and management of the resource and to ensure compatibility of the measures taken with the rights competences and interest of the States concerned (Food and Agriculture Organization, 1995). Additionally, the 2006, 2010, and 2016

Reports of the resumed Review Conference on the Agreement for the Implementation of the Provisions of the UN Convention on the Law of the Sea all addressed international cooperation related to migratory and straddling fish stocks (United Nations, 2006, 2010, 2016). The stakeholders seem to be aware of this as overfishing and international cooperation are the most common answers to the question of the nature of the stocks' future threats.

The existence of stakeholder forums like the Pelagic Advisory Council, where both EU27 and UK members of the industry and the NGOs meet with a constructive approach of finding common grounds for the conservation and sustainable exploitation of fisheries resources might provide a way forward. Empowering the stakeholders in the negotiations (especially in the case of a no-deal scenario but also in the other cases) might allow the outcome to be less dramatic as it might be as they together fully grasp the significance of the situation.

Bibliography

Andersen, J. L., Nielsen, M. and Lindebo, E. (2009) 'Economic gains of liberalising access to fishing quotas within the European Union', Marine Policy, 33(3), pp. 497–503. doi: 10.1016/j.marpol.2008.11.004.

Andersen, P., Andersen J. L., Hoff A. and Stahl, L. (2017) The economic consequences for the Danish fishery following the United Kingdom's decision to leave the European Union. IFRO Report no. 263. Department of Food and Resource Economics, University of Copenhagen, p. 53. Available at: https://static-curis.ku.dk/portal/files/185875666/IFRO_Report_263.pdf

Beukers-Stewart, B. D. and O'Leary, B. C. (2017) Post-Brexit Policy in the UK: A New Dawn? Fisheries, Seafood and the Marine Environment, University of York, p. 14. doi: 10.13140/rg.2.2.35329.76641.

Beukhof, E. and Pastoors, M. (2018) 'PFA horse mackerel research'. The Hague, The Netherlands, 11 April. Available at: https://www.pelagic-ac.org/media/pdf/PELAC%2020180412%20PFA%20horse%20mackerel%20research_v2.pdf.

Bjørndal, T., Kaitala, V., Lindroos, M. and Munro, G. R. (2000) 'The management of high seas fisheries', Annals of Operations Research, pp. 183–196. doi: 10.1023/A:1018925302021.

Bjørndal, T. and Ekerhovd, N.-A. (2014) 'Management of Pelagic Fisheries in the North East Atlantic: Norwegian Spring Spawning Herring, Mackerel, and Blue Whiting', Marine Resource Economics, 29(1), pp. 69–83. doi: 10.1086/676286.

Balsfoort, G. van (2018) 'pers. com'.

Brunel, T., Farrell, E. D., Kotterman, M., Kwadijk, C., Verkempynck, R., Chen, C. and Miller, D. (2016) Improving the knowledge basis for advice on North Sea horse mackerel: Developing new methods to get insight on stock boundaries and abundance. Wageningen Marine Research report C092/16. Wageningen, The Netherlands: IMARES Wageningen UR, p. 57. Available at: http://library.wur.nl/WebQuery/wurpubs/fulltext/393795

Brunel, T. (2018) 'The Biology, assessment and recent dynamics of Northeast Atlantic mackerel'. Joint seminar with the Mid Atlantic Fishery Management Council, Hirtshals, Denmark, 4 June. Available at: https://www.pelagic-ac.org/media/pdf/NEA%20mackerel-%20biology,%20assessment,%20dynamics.pdf.

Coers, A. (2009) Position paper on the CFP Reform. Pelagic Advisory Council, p. 36. Available at: https://www.pelagic-ac.org/media/pdf/0910PRAC18%20Position%20paper%20on%20CFP%20reform%20-%20AS%20PRINTED.pdf.

Coers, A., Raakjær, J. and Olesen, C. (2012) 'Stakeholder participation in the management of North East Atlantic pelagic fish stocks: The future role of the Pelagic Regional Advisory Council in a reformed CFP', Marine Policy, 36(3), pp. 689–695. doi: 10.1016/j.marpol.2011.10.017.

Corten, A. A. H. M. (2001) Herring and climate: Changes in the distribution of North Sea herring due to climate fluctuations. University of Groningen. Available at: https://www.rug.nl/research/portal/en/publications/herring-and-climate(52b699e2-c87f-4dd8-9015-b359c72fce89).html

Council Of The European Communities (1970) Regulation (EEC) No 2141/70 of the Council of 20 October 1970 laying down a common structural policy for the fishing industry, L 236/1. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31970R2141&from=EN

Council Of The European Union (1998) Council Regulation (EC) No 850/98 of 30 March 1998 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms, OJ L. Available at: https://eur-lex.europa.eu/legal-

content/EN/TXT/?uri=CELEX%3A01998R0850-20140101.
Council Of The European Union (2016) Council Regulation (EU) 2016/72 of 22 January 2016 fixing for 2016 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union waters, and amending Regulation (EU) 2015/104, OJ L. Available at: http://data.europa.eu/eli/reg/2016/72/oj/eng
Department for Environment, Food & Rural Affairs (2009) A review of the effectiveness of the Economic Link, p. 83. Available at: http://randd.defra.gov.uk/Document.aspx?Document=MF1207_9064_FRP.pdf
Department for Environment, Food & Rural Affairs (2018) Sustainable fisheries for future generations. Fisheries White Paper Consultation Document, Cm 9660, p.60. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/722074/fisheries-wp-consult-document.pdf.
European Parliament Committee on Fisheries (2017) Research for PECH Committee - Common fisheries policy and Brexit: workshop. Brussels, Belgium (PE, 601.981), p. 164. Available at: http://www.europarl.europa.eu/RegData/etudes/STUD/2017/601981/IPOL_STU(2017)601981_EN.pdf
European Parliament and Council Of The European Union (2013) Regulation (EU) No 1380/2013 of the European Parliament and the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC, L 354/22. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R1380.
European Union Committee, House of the Lords (2016) Brexit : fisheries. Report of session 2016-17 8th. Authority of the House of the Lords, p. 65. Available at: https://publications.parliament.uk/pa/ld201617/ldselect/ldeucom/78/78.pdf
Flanders Marine Institute (2016) 'Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 9. Available online at http://www.marineregions.org/'. VLIZ. doi: 10.14284/242.
Food and Agriculture Organization (1995) Code of Conduct for Responsible Fisheries. Rome, Italy. Available at: http://www.fao.org/3/a-v9878e.pdf.
Food and Agriculture Organization (2017) FAO Yearbook. Fishery and Aquaculture Statistics. Rome, Italy, (FAO Yearbook. Fishery and Aquaculture Statistics, 2015), p. 197. Available at: www.fao.org/3/a-i7989t.pdf
Greenstreet, S. P. R., Fraser, H. M. and Piet, G. J. (2008) 'Using MPAs to address regional-scale ecological objectives in the North Sea: modelling the effects of fishing effort displacement', ICES Journal of Marine Science, 66(1), pp. 90–100. doi: 10.1093/icesjms/fsn214.
Hannesson, R. (2013) 'Zonal attachment of fish stocks and management cooperation', Fisheries Research, (140), pp. 149–154. doi: 10.1016/j.fishres.2013.01.001.
Hegland, T. J. and Wilson, D. C. (2009) 'Participatory modelling in EU fisheries management: Western Horse Mackerel and the Pelagic RAC', Maritime Studies, 22 June, pp. 75–96. Available at: http://www.marecentre.nl/mast/documents/MastVol8-1_def-Heglannd_Wilson_000.pdf
Hoefnagel, E., de Vos, B. and Buisman, E. (2015) 'Quota swapping, relative stability, and transparency', Marine Policy, 57, pp. 111–119. doi: 10.1016/j.marpol.2015.03.012.
ICES (1979) Report Of The Norwegian - EEC Joint Scientific Sub-Group On The Distribution Of Shared Fish Stocks In The North Sea. C.M. 1979/H:61, Bergen, Norway, p. 107. Available at:

https://brage.bibsys.no/xmlui/bitstream/handle/11250/103525/CM_1979_H_61.pdf?sequence=1&isAllowed=y
ICES (2017) Final Report of the Working Group on Mackerel and Horse Mackerel Egg Surveys. WGEGS Report CM 2017/SSGIEOM:18. Vigo, Spain, p. 134. Available at: http://ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SSGIEOM/2017/WGMEGS/WGMEGS%202017.pdf
ICES (2018a) ICES Species Fact Sheet Herring. ICES- FishMap. Copenhagen, Denmark: ICES publishing, p. 8. Available at: http://www.ices.dk/explore-us/projects/EU-RFP/EU%20Repository/ICES%20FIshMap/ICES%20FishMap%20species%20factsheet-herring.pdf
ICES (2018b) ICES Species Fact Sheet Horse Mackerel. ICES- FishMap. Copenhagen, Denmark: ICES publishing, p. 6. Available at: http://www.ices.dk/explore-us/projects/EU-RFP/EU%20Repository/ICES%20FIshMap/ICES%20FishMap%20species%20factsheet-horsemackerel.pdf
ICES (2018c) ICES Species Fact Sheet Mackerel. ICES- FishMap. Copenhagen, Denmark: ICES publishing, p. 7. Available at: http://www.ices.dk/explore-us/projects/EU-RFP/EU%20Repository/ICES%20FIshMap/ICES%20FishMap%20species%20factsheet-mackerel.pdf
ICES Advisory Committee (2017a) EU request on distributional shifts in fish stocks. ICES Special Request Advice. Copenhagen, Denmark: ICES publishing, p. 7. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/Special_requests/eu.2017.05.pdf
ICES Advisory Committee (2017b) Herring Assessment Working Group for the Area South of 62 deg N (HAWG). ACOM ICES CM 2017/ACOM:07. Copenhagen, Denmark: ICES publishing, p. 856. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/HAWG/01%20HAWG-%20Report%20of%20the%20Herring%20Assessment%20Working%20Group%20for%20the%20Area%20South%20of%2062%20deg%20N.pdf
ICES Advisory Committee (2017c) ICES Advice 2017 Herring (Clupea harengus) in divisions 6.a and 7.b–c (West of Scotland, West of Ireland). Copenhagen, Denmark: ICES publishing, p. 10. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/her.27.6a7bc.pdf
ICES Advisory Committee (2017d) ICES Advice 2017 Herring (Clupea harengus) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel). Copenhagen, Denmark: ICES publishing, p. 19. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/her.27.3a47d.pdf
ICES Advisory Committee (2017e) ICES Advice 2017 Horse mackerel (Trachurus trachurus) in divisions 3.a, 4.b–c, and 7.d (Skagerrak and Kattegat, southern and central North Sea, eastern English Channel). Copenhagen, Denmark: ICES publishing, p. 7. Available at: https://www.pelagic-ac.org/media/pdf/North%20Sea%20horse%20mackerel%202018.pdf
ICES Advisory Committee (2017f) ICES Advice 2017 Mackerel (Scomber scombrus) in subareas 1–8 and 14, and in Division 9.a (the Northeast Atlantic and adjacent waters). Copenhagen, Denmark: ICES publishing, p. 14. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/mac.27.nea.pdf
ICES Advisory Committee (2017g) Report of the Working Group on Widely Distributed Stocks (WGWIDE). ACOM ICES CM 2017/ACOM:23. Copenhagen, Denmark: ICES publishing, p. 12. Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGWIDE/02%20WGWIDE%20Report%20-%20Executive%20Summary.pdf

Jansen, T., Campbell, A., Kelly, C., Hátún, H., Payne, M. R. and Peck, M. (2012) 'Migration and Fisheries of North East Atlantic Mackerel (Scomber scombrus) in Autumn and Winter', PLoS ONE, 7(12), e51541, p. 9. doi: 10.1371/journal.pone.0051541.
Jansen, T., Kristensen, K., Kooij van der, J., Post, S., Campbell, A., Utne, K. R., Carrera, P., Jacobsen, J. A., Gudmundssdottir, A., Roel, B. A. and Hatfield, E. M. C. (2015) 'Nursery areas and recruitment variation of Northeast Atlantic mackerel', ICES Journal of Marine Science: Journal du Conseil, 72(6), pp. 1779–1789. doi: 10.1093/icesjms/fsu186.
Jourdain, J. (2018) 'pers. com'.
Linke, S. and Jentoft, S. (2016) 'Ideals, realities and paradoxes of stakeholder participation in EU fisheries governance', Environmental Sociology, 2(2), pp. 144–154. doi: 10.1080/23251042.2016.1155792.
Mackinson, S. et al. (2011) 'Engaging stakeholders in fisheries and marine research', Marine Policy, 35(1), pp. 18–24. doi: 10.1016/j.marpol.2010.07.003.
North-East Atlantic Fisheries Commission (1980) 'Convention on Future Multilateral Cooperation in North-East Atlantic Fisheries'. London, United-Kingdom. Available at: https://www.neafc.org/system/files/Text-of-NEAFC-Convention-04.pdf
NWWAC Advice Drafting Group on the Landing Obligation (2018) 'NWWAC Choke Mitigation Tool template'. Available at: https://www.pelagic-ac.org/02135/
Olafsdottir, A. H., Slotte, A., Jacobsen, J. A., Oskarsso, G. J., Utne, K. R. and Nøttestad, L. (2016) 'Changes in weight-at-length and size-at-age of mature Northeast Atlantic mackerel from 1984 to 2013: effects of mackerel stock size and herring stock size', ICES Journal of Marine Science: Journal du Conseil, 73(4), pp. 1255–1265. doi: 10.1093/icesjms/fsv142.
Ounanian, K. and Hegland, T. J. (2012) 'The Regional Advisory Councils' current capacities and unforeseen benefits', Maritime Studies, 11(1), p. 10. doi: 10.1186/2212-9790-11-10.
Ovens, M. (2016) Greater North Sea Ecoregion Fisheries overview. Copenhagen, Denmark: ICES publishing. p. 38. doi: 10.17895/ices.pub.3721.
Paulsen, T. S. and Marcussen, M. (1979) Agreed Report of joint EEC-Norway working group on the joint stocks in the North Sea. Nantes, France, p. 5.
Pelagic Advisory Council (2018) Working Group I meeting. Minutes. The Hague, The Netherlands: Pelagic Advisory Council, p. 8. Available at: https://www.pelagic-ac.org/media/pdf/Minutes%20WGI%2001.03.2018%20.pdf
Scientific, Technical and Economic Committee for Fisheries (2017a) The 2017 Annual Economic Report on the EU Fishing Fleet (STECF 17-12). JRC107883. Luxembourg: Publications Office of the European Union, p. 492.
Scientific, Technical and Economic Committee for Fisheries (2017b) Fisheries Dependent Information- Classic (STECF-17-09). JRC Science for Policy Report JRC107598. Luxembourg: Publications Office of the European Union, p. 848.
Sobrino, J. M. and Sobrido, M. (2017) 'The Common Fisheries Policy: A Difficult Compromise Between Relative Stability and the Discard Ban', The Future of the Law of the Sea. Springer, Cham, pp. 23–43. doi: 10.1007/978-3-319-51274-7_2.
Symes, D. (1997) 'The European Community's common fisheries policy', Ocean & Coastal Management, 35(2–3), pp. 137–155. doi: 10.1016/S0964-5691(97)00030-6.
The Member States of the EU (2007) Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:12007L/TXT.
United Nations (1995) The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA), A/CONF. New-York, USA. Available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/CONF.164/37&Lang=E.

United Nations (2006) Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 22 to 26 May 2006, A/CONF. New-York, USA. Available at: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N06/422/95/PDF/N0642295.pdf?OpenElement.

United Nations (2010) Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 24 to 28 May 2010, A/CONF. New-York, USA. Available at: http://www.un.org/depts/los/convention_agreements/reviewconf/review_conference_report.pdf.

United Nations (2016) Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York, 23 to 27 May 2016, A/CONF. New-York, USA. Available at: https://undocs.org/A/CONF.210/2016/5.

Walmsley, S. (2016) Brexit, Where next for the UK fisheries? London, UK: ABP Marine Environmental Research Ltd, p. 7. Available at: http://www.abpmer.co.uk/media/1487/white-paper-brexit-where-next-for-uk-fisheries.pdf

Walter, T. (2010) 'The EU's Common Fisheries Policy: A Review and Assessment', European Union Miami Analysis. Vol. 7, No. 7, May, p. 9. Available at: http://aei.pitt.edu/29777/1/WalterFisheries2010EUMAedi.pdf

Westberg, A. K. and Verborgh, J. (2017) Agreed Record of the Fisheries Consultations between Norway and the European Union for 2018. Available at: https://www.pelagic-ac.org/media/afbeeldingen/EU_Norway%20agreed%20records%20for%202018.pdf

Websites list

BBC (2016) 'UK votes to leave the EU', 24 June. Available at: http://www.bbc.com/news/politics/eu_referendum/results (Accessed: 23 March 2018).

BBC (2018) 'The UK and EU agree terms for Brexit transition period', 19 March. Available at: https://www.bbc.co.uk/news/uk-politics-43456502 (Accessed: 10 April 2018).

Clayton, A. (2017) 'How Will Brexit Affect Efforts to End Overfishing?', The Pue Charitable Trusts, 29 April. Available at: http://pew.org/2ns9yFb (Accessed: 27 March 2018).

EUFA (2018) 'The European Fisheries Alliance – Today marks one year since European alliance created to secure fair Brexit deal for the fisheries industry', European Fisheries Alliance EUFA, 22 March. Available at: https://fisheriesalliance.eu/the-european-fisheries-alliance-today-marks-one-year-since-european-alliance-created-to-secure-fair-brexit-deal-for-the-fisheries-industry-2/ (Accessed: 26 March 2018).

Fishing For Leave (2018) 'Primary Points', Fishing For Leave. Available at: http://ffl.org.uk/primary-points/ (Accessed: 16 March 2018).

ICES (2005) ICES Statistical Areas, ICES Metadata Catalogue. Available at: http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/c784a0a3-752f-4b50-b02f-f225f6c815eb (Accessed: 9 April 2018).

Jensen, H. M. (2009) ICES Statistical Rectangles, ICES Metadata Catalogue. Available at: http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/81f68a99-9b91-4762-80d3-31c069731f44 (Accessed: 9 April 2018).

JRC (2018) Joint Research Center Data Dissemination, STECF JRC EC. Available at: https://stecf.jrc.ec.europa.eu/data-dissemination (Accessed: 9 April 2018).

Marti, C.-P. (2018) 'The Common Fisheries Policy: Origins and Development', Fact Sheets on the European Union. The European Parliament, July, p. 5. Available at: http://www.europarl.europa.eu/factsheets/en/sheet/114/the-common-fisheries-policy-origins-and-development (Accessed: 19 July 2018)

Patterson, T. (2013) World Relief Map, US National Park Service, Shaded Relief. Available at: http://www.shadedrelief.com/world_relief/home.html (Accessed: 9 April 2018).

Pelagic Freezer-trawler Association (2018) 'PFA plan of action', pelagicfish. Available at: https://www.pelagicfish.eu/plan-of-action (Accessed: 18 July 2018)

Perrotte, D. (2017) 'Les pêcheurs européens se mobilisent pour peser sur le Brexit', Les Echos.fr, 23 March. Available at: https://www.lesechos.fr/23/03/2017/LesEchos/22410-072-ECH_les-pecheurs-europeens-se-mobilisent-pour-peser-sur-le-brexit.htm (Accessed: 13 March 2018)

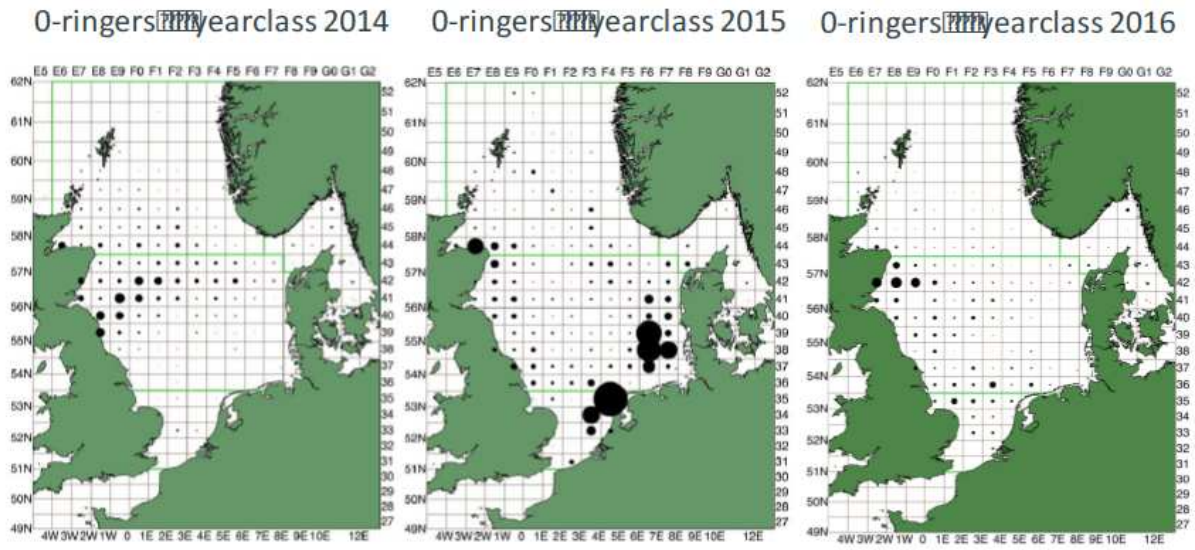
QGIS Development Team (2002) QGIS A Free Open Source Geographic Information System. Available at: https://qgis.org/en/site/index.html (Accessed: 9 April 2018).

R Core Team (2016) R: A Language and Environment for Statistical Computing. Available at: https://www.r-project.org (Accessed: 23 April 2018).

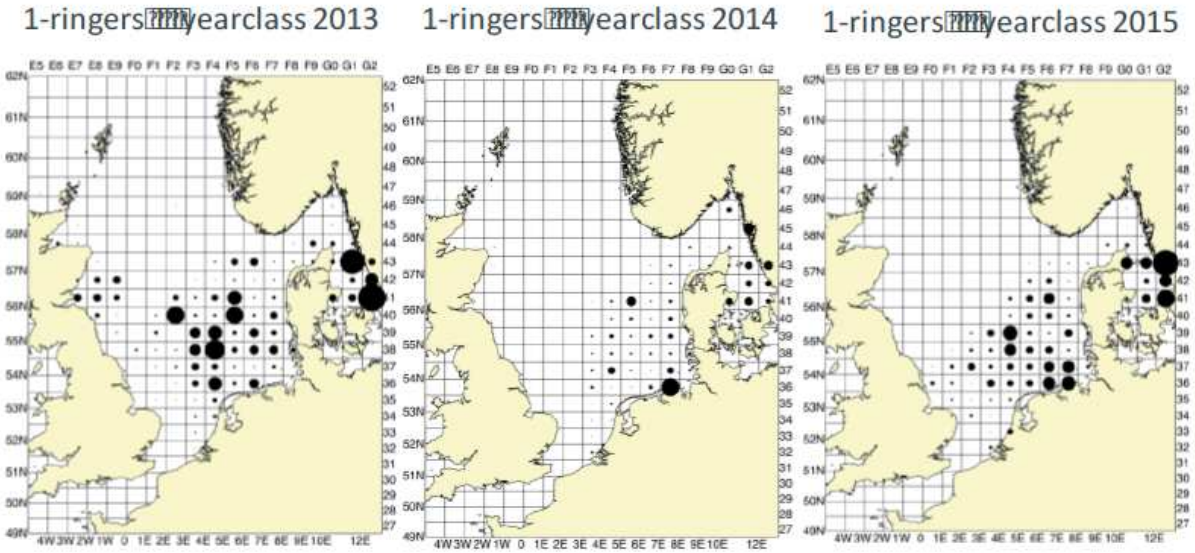
Undercurrent News (2015) 'No agreements on Northeast Atlantic herring; blue whiting', 26 January. Available at: https://www.undercurrentnews.com/2015/01/26/no-agreements-on-northeast-atlantic-herring-blue-whiting/ (Accessed: 23 April 2018).

Annexes

Annex 1: Juvenile North Sea Autumn Spawning Herring distribution

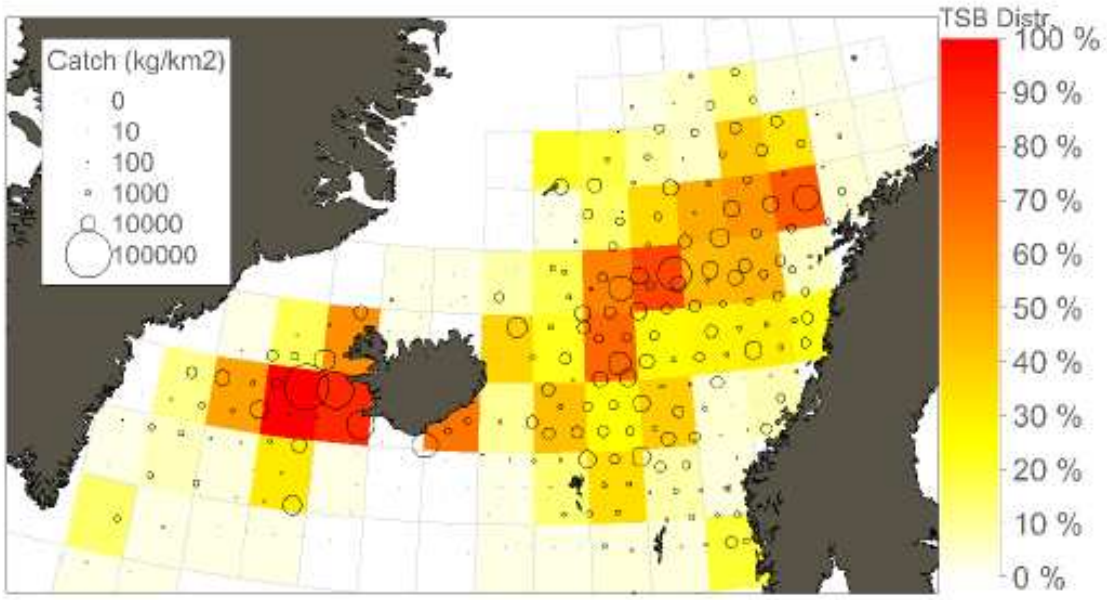


North Sea herring. Distribution of 0-wr herring, year classes 2014-2016. Density estimates of 0-ringers within each statistical rectangle are based on MIK catches during IBTS in January/February 2015-2017. Areas of filled circles illustrate densities in no m^{-2}, the area of the largest circle represents a density of 7.59m^{-2}. All circles are scaled to the same order of magnitude of the square root transformed densities (ICES Advisory Committee, 2017b).

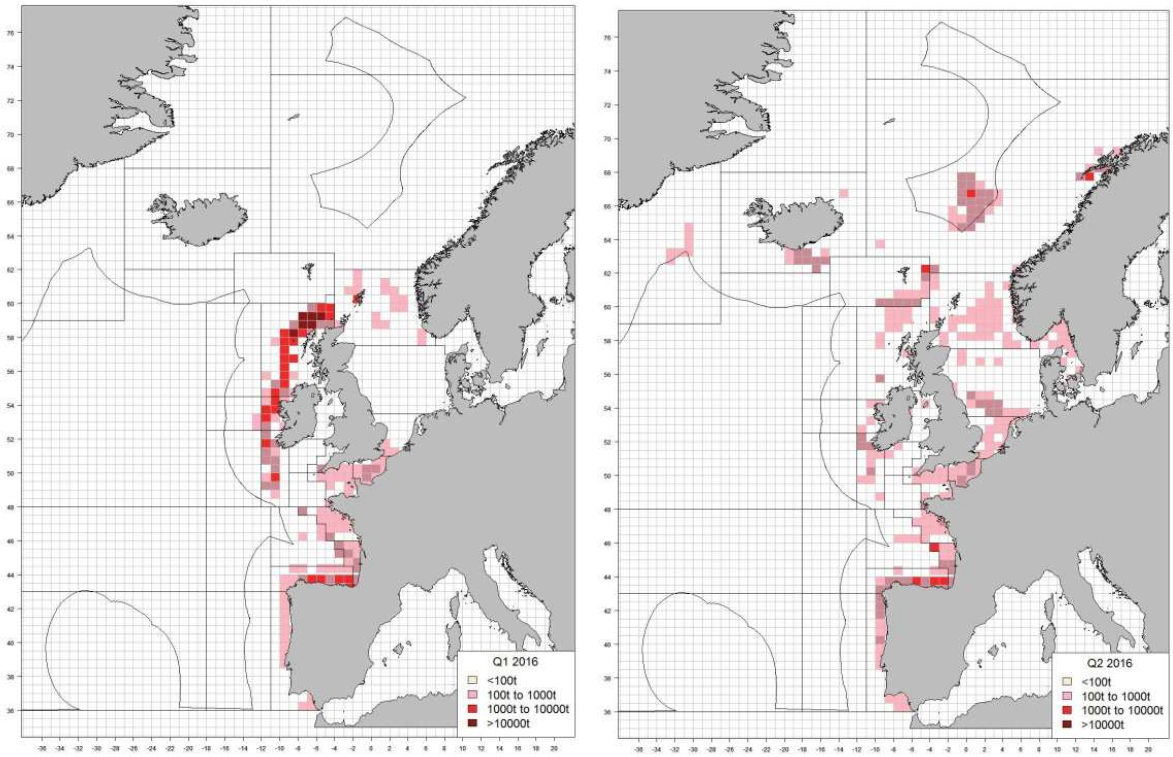


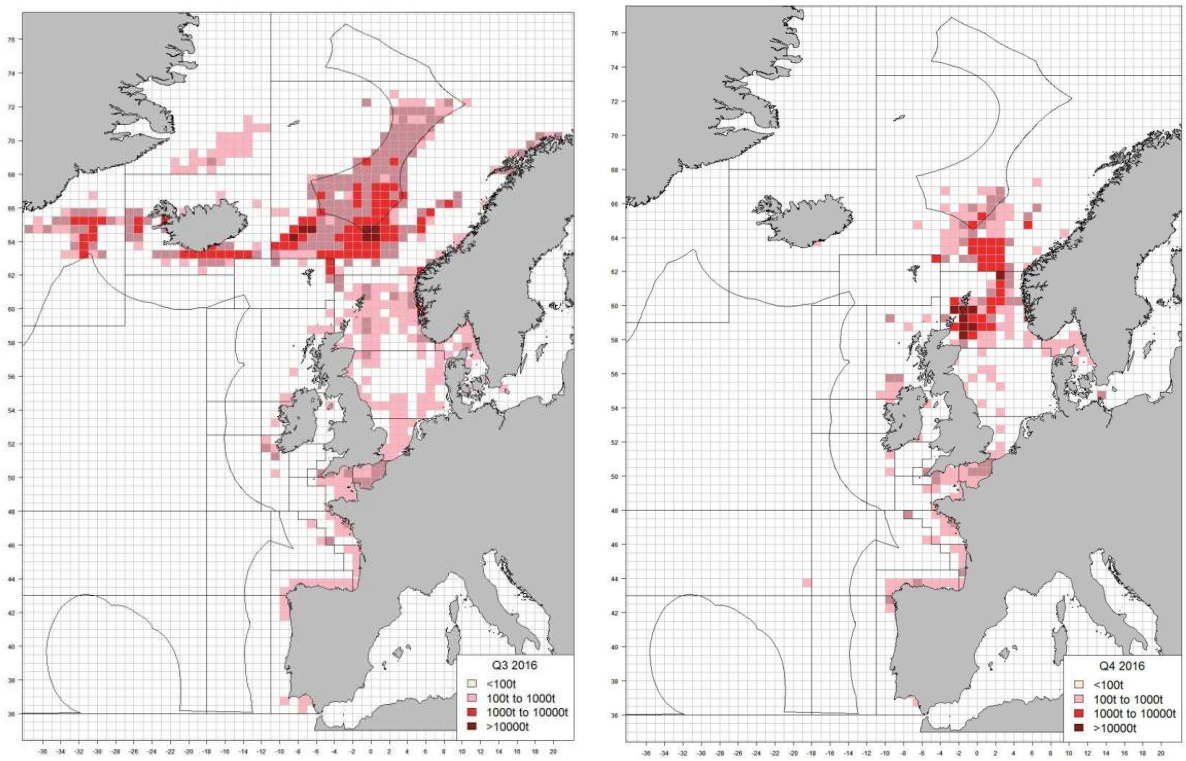
North Sea herring. Distribution of 1-wr herring, year classes 2013-2015. Density estimates of 1-wr fish within each statistical rectangles are based on GOV catches during IBTS in January/February 2015-2017. Areas of filled circles illustrate numbers per hour, scaled proportionally due to the square root transformed CPUE data, the area of the large circle extending across the border of a rectangle represents 99045h^{-1} (ICES Advisory Committee, 2017b).

Annex 2: Northeast Atlantic Mackerel adult distribution



Mackerel catch rates from surface trawl hauls (circles size represents catch rate in kg/km^2) overlaid on mean catch rate per rectangle (1ºlat.x2ºlon.) f rom IESSNS survey in 2017. White rectangles indicate zero-observations and yellow-red colour scale represent the biomass distribution (illustrated as cumulative fractions, e.g. the sum of all areas with the colour corresponding up to 40% represents 40% of the total biomass in the entire survey) (ICES Advisory Committee, 2017g)





Northeast Atlantic Mackerel. Commercial catches in 2016, Quarter 1, 2, 3, and 4 (ICES Advisory Committee, 2017g)

Annex 3: Questionnaire guide directed to the PelAC stakeholders

1. Context of the project and framework :

I am a master's student in fisheries management carrying out a 6 months internship at the Pelagic Advisory Council.
The context of this study is my master's thesis on the potential consequences of Brexit on the pelagic fish stocks managed by the Pelagic Advisory Council.
I already started to work on an overview of the current situation with, among other things, some landing data from the JRC. I am now focusing on different exit scenarios with a qualitative approach. The information I gathered through the first part of the study and the bibliography would need input from the fishermen and the industry in order to be more comprehensive. The main goal here is to identify factors that could interfere in the negotiations and features that could influence a the scenarios outcome.

2. Questionnaire: Four sections with define objective and 22 questions

Each section's questions will be asked for the three fish stocks identified as the most impacted by Brexit. These are North Sea Autumn Spawning Herring, North Sea Horse Mackerel, and Northeast Atlantic Mackerel.
The first three sections correspond to the two important categories of factors identified that will play a role in all the scenarios:

- Section one corresponds to questions on the fisheries' and stock's health
- Section two corresponds to questions on the EU27 fleet's dependency on UK waters
- Section three corresponds to questions on the potential opportunities for the UE27 fleet outside of the UK EEZ.

Finally section four allows the respondent to identify other factors of impact and interference and asks for some general identification details.

Section 1. Fisheries and stocks health

Objective: Obtain a the qualitative input of the stakeholders regarding the trends of the fish stock and its future state. Identify more precisely areas, stocks, species and fisheries at risk (of low biomass) in future years.

- A. Is the stock a bycatch species of other fisheries? Which ones?
- B. What is your perception of the stock's health now? Compared to 10 years ago?
- C. What evolution of the stock's health do you foresee in 3 to 5 years?
- D. According to you, what would be the greatest threat to the stock's good health?
- E. Did you notice any difference in the stock's state between various geographical area?

Section 2. EU27 fleet dependency on the UK waters

Objective: Identify the stakeholders' feeling of dependency (to be confronted with the percentages and figures previously calculated). Add some qualitative input to nuance the calculated outcomes linked to the EU27's dependency.

- A. How do you perceive the dependency of the EU27 fleet on UK waters for this stock?
- B. Historically, was it always the case?
- C. Would you say that the UK fleet is dependent on EU27 waters for this stock?
- D. Are there any non-EU countries fishing this stock? Do they have the same dependency as the EU27 on UK waters? (more?, less?)

Section 3. Potential opportunities for the EU27 fleet outside the UK EEZ

Objective: Identify all possibilities that the EU27 fishermen might have outside from the UK EEZ (other fishing grounds, other species, etc). The industry's answers are particularly important as it can be expected that the fishermen themselves will know best where they can reasonably find viable alternatives or not. It will be interesting to see what kind of positive or negative factors are quoted the most (climate change?, quota distribution?, distance to port, to market, fishing pressure limit, international cooperation, …)

- A. Are there some former fishing grounds for this stock that you can think of and that are not fished anymore?
- B. What could allow the development of new fishing grounds for this stock?
- C. What could limit the development of new fishing grounds for this stock?
- D. In the event of a UK EEZ closure, can you think of the development of an alternative fishery for the EU27 fleet? (Which species? Where? What obstacle to this development?)

Section 4. Other factors and contact details

Objective: Identify other stocks, and other factors of interference in the negotiations and factors of impact in the event of an EEZ closure. Obtain general information on the respondents.

- A. Is there other elements, that we didn't talk about, that could influence the negotiations/talks around fishing access, and quotas?
- B. Where is your company/institution based?
- C. In which area do you work in (catching sector, processing sector, NGO, scientific institution, …)?
- D. If you wish to receive the results from this study, please enter your email address here.

Thank you very much for your answer!

Annex 4: Quotas, swaps and landings in 2016

Quota shares before and after swaps, landings shares and quota consumption in 2016. Only includes EU and UK quotas, and catches. In bold, swaps that changed the quota share for 2% or more; and difference between quota share after swap and landing share superior to 20%. In italics, herring and horse mackerel stocks for which a simplification of the geographical information has been used in catch data and that might lead to incoherencies.

	Quota share before swap (EC data)		Quota share after swap (Pelagic Ac data)		Landings share (JRC data)		Quota consumption (incl swap)	
	EU	UK	EU	UK	EU	UK	EU	UK
Atl-S Herring	78%	22%	78%	22%	66%	34%	49%	89%
NS AS Herring	80%	20%	80%	20%	29%	71%	10%	103%
WB SS Herring	100%	0%	100%	0%	100%	0%	88%	0%
6aNS, 7bc Herring	57%	43%	53%	47%	51%	49%	76%	80%
Celtic Sea Herring	100%	0%	97%	3%	97%	3%	88%	89%
Irish Sea Herring	26%	74%	26%	74%	5%	95%	14%	88%
NS Horse Mackerel	89%	11%	54%	46%	41%	59%	50%	87%
W Horse Mackerel	92%	8%	94%	6%	97%	3%	45%	22%
S Horse Mackerel	100%	0%	100%	0%	100%	0%	38%	0%
Blue Whiting	82%	18%	82%	18%	83%	17%	101%	89%
N Atl Mackerel	53%	47%	54%	46%	51%	49%	94%	106%
Bf	94%	6%	94%	6%	83%	17%	0%	1%

Annex 5: Summary table of the relevant factors for each scenario

Category	Sub-category	Factor	Relevant for scenario 1	Relevant for scenario 2
Current dependency of the fleet and the potential opportunities	EU dependency on the UK	Ratio of EU fleet landings from the UK EEZ/EU waters		
		% of EU fleet landings from other waters		
		Quota distribution		
	Potential opportunities for the EU fleet	EU fleets characteristics		
		Fishing area outside of the EU and UK waters		
		Historical fishing grounds		
		Distribution change		
	Zonal Attachment	Distribution of eggs and larvae		
		Distribution of juvenile fish		
		Distribution of the adult stock based on survey data		
		Spawning area		
Abundance of the resource and of the users	Stock status	ICES stock category (advice 2017)		
		ICES fishing mortality (F) (advice 2017)		
		ICES size of the stock (B) (advice 2017)		
		Agreed TAC trend (2011-2016)		
		Stock productivity		
	International fishing and cooperation	Other fishing nations in 2016		
		Other fishing nations % of the stock's catches in 2016		
		Countries in the international agreement		
		Date of the agreement		
		Agreement TAC advice followed?		
External factors				