UK Fisheries Audit

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UK Fisheries Audit

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Executive Summary

The UK's decision to leave the EU and to regain control of its waters has considerable implications for the management of North East Atlantic Fisheries. The results derived from the implementation of new UK domestic regulations and international fisheries agreements will have a direct impact on the status of fish stocks and the socio-economic performance of fishing fleets. There is an opportunity and a responsibility for the UK, as an independent coastal state for the first time in over 40 years, to lead the way in achieving sustainable fisheries.

The key objective of this report is to provide an evidence-based snapshot of the status of UK fish stocks and the UK fishing sector's recent exploitation history of those stocks, by the time the UK abandons the EU fisheries policies. In doing so, the report provides a baseline for future evaluations of the UK's progress and/or setbacks in sustainable fisheries management.

The turnover of UK fisheries in 2019 was about £1 billion with the majority derived from over 24 metres vessels operating from Scotland. Most of the UK fisheries landings from the North East Atlantic in 2019 (618,000 t) came from UK waters (81% by

live weight or around 500,000t and 87% by value). Around 27% of EU catches in the North East Atlantic were also typically taken from UK waters between 2012 and 2016, amounting to approximately 700,000 tonnes[a].

Stocks critical to UK fisheries include quota and non-quota species, with the latter not subject to EU Total Allowable Catches (TACs) – the primary management mechanism for North East Atlantic fisheries. Pelagic quota species such as mackerel and herring caught by over 10 m vessels dominate UK landings by volume (54%). Non-quota shellfish such as scallops and crab are also key contributors (21%), with the remaining 25% comprised of demersal species. Smaller inshore vessels (10 m and under) which dominate the UK fleet by number (74%), rely on non-quota species (shellfish comprise >80% of landings by volume and value).

Of the 104 UK stocks audited, 82 of which are quota stocks shared mainly with the EU, 35.6% were healthy in terms of stock size (43.9% of shared stocks) relative to the MSY reference point $B_{trigger}$, whereas 20.2% were in a critical condition (15.9% of shared stocks). Data limitations mean the status of the remaining 44.2% (40.2% of shared stocks) cannot be determined, leaving them at greater risk of unsuitable management decisions.

Analysis of the exploitation status revealed that 37.5% of the audited stocks were sustainably exploited prior to the UK leaving the EU (42.7% of the 82 shared stocks). However, 28.8% were being overfished (25.6% of the shared stocks) ($F>F_{MSY}$), whilst another 33.6% were data limited and so cannot be adequately assessed (31.7% of shared stocks).

[a] Data for the non-UK fleet in UK waters are not available for the period since 2016.

In order that the implications of any management actions or policy decisions by the UK government following Brexit can be considered in greater depth, more detailed benchmarks for a selection of stocks are provided. Those stocks were selected according to their economic status (the 'top 10') or their performance: the 5 most sustainably and 5 most unsustainably fished in terms of stock size and fishing mortality rate. Separately, a more detailed examination of the recent exploitation and management history of all the cod stocks fished by the UK is provided given ongoing concerns over the status of this iconic fish species.

Only 3 of the 'top 10' were healthy and sustainably exploited (North East Atlantic mackerel, North Sea haddock and West of Scotland Nephrops). Two of the stocks are overexploited and their biomass is below safe biological reference points as a result (North Sea cod, Southern North Sea edible crab). For the remaining stocks there is a mixed picture, including data limitations for North Sea anglerfish (monkfish) and scallops in the English Channel.

The 5 best performing stocks are typically caught in relatively small quantities and are of relatively low value to the UK fishing industry, except for Western English Channel common sole which attracted the highest price per tonne of all the focus stocks. Zero catches have been advised for 3 of the 5 worst performing stocks – Irish Sea whiting and cod in the Celtic Sea and West of Scotland.

The challenges of rebuilding depleted stocks are highlighted by a focus on the cod stocks. North Sea cod is once again subject to emergency management measures. With climate change also likely to be affecting cod's resilience to fishing mortality, effective recovery plans are needed more urgently than ever. However, because the majority of the cod stocks are primarily caught as bycatch in valuable mixed fisheries, such measures will require a shift in fisheries management priorities.

Lagging full policy implementation and persistent political decisions to set TACs above scientifically advised catch levels are still pending issues for fisheries management, and key contributing factors to the ongoing overfishing of North East Atlantic fish stocks, including Atlantic cod. For the 'top 10' and 5 worst performing stocks, the majority of TACs for the period 2016-2020 were set above levels advised by ICES. Conversely, the TACs for the top performing stocks were mainly set at, or commonly below, scientifically advised levels.

The report investigates a number of other specific issues associated with UK fisheries and their management which have negative implications for the environment and sustainable fishing. Potential opportunities for improvements following the UK's departure from the EU, as well as further risks, are highlighted. For example, the UK has the opportunity to demonstrate better practice by accommodating the

ecological importance of species when implementing or influencing future management strategies, as highlighted by the implications of overfishing of sandeels for the North Sea fish, cetacean and seabird populations.

In response to the findings of the UK fisheries audit, Oceana sets out policy recommendations for the UK Government. Overarching to these is ensuring sustainable fisheries is the primary goal of the UK's fisheries policies and plans, in order to fulfil the objectives of the UK Fisheries Act and achieve the UK government's aspiration to set 'a gold standard for sustainable fishing around the world', as well as meeting UK international biodiversity and sustainability commitments.

1. Introduction to the UK Fisheries Audit

This report by Macalister Elliott and Partners was commissioned by Oceana as part of its ongoing campaign for sustainable fisheries in Europe, to set a benchmark of the state of UK fisheries as the UK leaves the EU.

The UK left the European Union on 31 January 2020, when it entered a transition period that ended on 31 December and during which the EU fisheries rules still applied. The UK is now developing its own legal framework for fisheries management, including domestic regulations (e.g. UK Fisheries Act[1]) and international agreements (like the ones with the EU[2] or Norway[3]). The adoption of this new governance system, still ongoing, and the decisions derived from its implementation could have a considerable impact on the status of fish stocks and the marine environment in the North East Atlantic, as most of the commercially important fish stocks in this region are shared between the UK and other third parties.

The UK Government stated its commitment to become a world leader in fisheries management by 'setting a gold standard' following its departure from the EU[4] as well as continuing to uphold the vision of 'clean, healthy, safe, productive and biologically diverse seas' set out in the UK's Marine Strategy[5]. It is vital the government deliver on these objectives in order to achieve sustainable fisheries and healthy marine ecosystems– the key components of Good Environmental Status (GES)[b,5]. Such achievements are also essential if the UK is to support prosperous domestic fishing fleets and coastal communities, as well as meet its commitments and obligations under international law such as the United Nations Convention on the Law of the Sea (UNCLOS), the Convention on Biodiversity (CBD) and the United Nations Sustainable Development Goal (SDG) 14.

Within the last decade, the overfishing rate for fish populations in European Atlantic waters has dropped from roughly 66% to 38%, while biomass has continued to increase[6]. This progress, while insufficient given the UN and EU commitment to completely end overfishing by 2020, is a positive trend that has come about due to the strong EU fisheries regulatory framework, including the CFP. This encouraging trend has not only had a positive effect on the recovery of stocks but also on the socio-economic performance of the European fleet[7]. It is essential that this trend continues and accelerates so that overfishing finally becomes a thing of the past, and so that marine ecosystems are given the chance to rebound and build resilience to large-scale threats such as climate change.

[b] GES is defined as the environmental status of marine waters where these provide ecologically diverse and dynamic ocean and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations.

There is an opportunity for the UK, as a fully independent coastal state for the first time in over 40 years, to lead the way in sustainable fisheries. In doing so, the UK can demonstrate the importance and value of implementing the best management standards, collaboration across national and international borders, and long-term holistic environmental management. Failing in doing so will rapidly compromise the progress made during past years.

1.1 Objectives of the report

The key objective of this report is to provide an evidence-based snapshot of the status of UK fish stocks, shared stocks included, and the UK fishing sector's recent exploitation history of those stocks, by the time the UK abandons the EU fisheries policies. In doing so, the report will provide a baseline for evaluating the UK's progress and/or setbacks in the sustainable management of fish stocks and the objective to bring an end to overfishing.

The report collates and presents the range of biological and socio-economic evidence that should underpin management decisions, like the setting of TACs or the proposal of fisheries management plans, and fisheries management frameworks. The breadth of the study helps contextualise decisions for individual stocks, while the case studies provide evidence of the implications of those decisions. In addition, evidence gaps are highlighted, which the UK government will need to prioritise in order to achieve sustainable management.

1.2 Report structure

The report is structured in seven sections. After this first introductory section the report continues with a brief overview of the EU and UK fisheries management system to set the scene for the following analyses (Section 2).

In Section 3 an overview of the current exploitation and stock size status of 104 stocks (corresponding to 70 management units) is provided, including a geographical breakdown by sea basin. Alongside the stock status, there is a snapshot of the recent landings by the UK fleet in UK waters of each species by volume and value. Within this broader overview, key socio-economic information is also presented.

Section 4 takes a closer look at a selection of stocks. Firstly we look at the environmental, management and economic data for the 'top 10' stocks for the UK fishing sector – selected primarily based on landings statistics (volume and value), but with additional factors such as the UK's quota share and scientific data availability also taken into account. A similar review is undertaken for the five most sustainably and five most unsustainably fished stocks (based

on recent indicators of their exploitation and population status) – the 'best' and 'worst' performers. Finally, we further consider some of the stocks of greatest concern, focusing on the exploitation and management history of the cod *(Gadus morhua)* stocks.

Section 5 delves into some specific issues associated with the UK fishing industry and its management through five environmental impact case studies. For each, some opportunities and risks posed by EU Exit are considered.

Finally, Section 6 summarises the report's overall conclusions and in Section 7 Oceana provides its associated policy recommendations.

2. Management of fisheries in UK waters

This section provides a brief overview of key components of the UK fisheries management system as was under the CFP, as context to the snapshot of the status of UK fish stocks, shared stocks included, by the time EU fisheries rules stop applying to the UK. It then goes on to provide a brief introduction to the UK fisheries management framework from 2021, as far as it is understood to date.

2.1 Key observations

- **Negotiations for North East Atlantic TACs cover over 50 commercial species with 200 different stocks distributed across the various fishing areas within Atlantic coastal states' 200nm EEZs as well as on the high seas. The UK fishing fleet shares many of these stocks with the EU and other third party nations.**
- **The majority of UK fisheries landings from the North East Atlantic in 2019 (618,000 t, valued at £979 million) came from UK waters (81% by live weight and 87% by value). The second most important waters for the UK fleet were those of the EU, accounting for an additional 15% of landings (8% by value).**
- **On average, around 27% of EU catches in the North East Atlantic were also taken from UK waters between 2012 and 2016. In fact, EU vessels landed more fish from UK waters than the UK fleet, although the UK fleet's landings had higher value.**
- **When the UK was part of the EU, TACs for stocks under exclusive EU competence were set by the EU Agriculture and Fisheries Council (AGRIFISH), which included the UK's Fisheries Minister. Bilateral and multilateral negotiations also took place annually between third parties and the European Commission. The allocation of the agreed TACs among EU member states was subject to a fixed percentage of each TAC known as the relative stability key.**
- **The fundamental objective of the reformed CFP is to restore and maintain fish stocks above biomass levels that can produce their MSY by 2020. Progress towards that MSY objective has been made but it is yet to be met for all stocks, many of which the UK shares with the EU fleet and other third parties.**
- **The UK's departure from the EU means it no longer has to adhere to the CFP objectives and rules. For the shared stocks the UK will now directly negotiate bilateral and multilateral agreements, like those recently adopted with the EU and with Norway.**
- **The new domestic Fisheries Act is the main framework regulation for the devolved management of the UK's fish and shellfish resources and fisheries.**
- **The 2020 Fisheries Act contains the principles and basis for setting exploitation rates for UK**

fish stocks, negotiating management measures for shared stocks and permitting access of non-UK fishing vessels to UK waters, etc. There are concerns that the sustainability objectives are more flexible than those required by the CFP.

- **The UK must now meet its duties within the Act to develop Fisheries Management Plans which maintain stocks at or above MSY or restore them to levels capable of producing MSY, as well as plans for data deficient stocks.**
- **The system of quota allocation between the four UK fisheries administrations and their respective fleets based on Fixed Quota Allocation (FQA) units, and separate management of the under 10 m quota pools, will largely continue. This means the historical quota limitations for the 10 m and under fleet, despite their dominance by number, is likely to continue.**
- **Any additional quota gained through the new negotiations process may be subject to an amended, yet to be decided, system. NGOs are advocating for preference to be given to low-impact fishers.**

2.2 Legal framework for fisheries management decisions

2.2.1 EU fisheries management framework under the CFP

The basis and principles upon which the UK negotiated annual fishing opportunities and managed the UK fleet's activities for three decades were primarily those set out in the CFP and the multiannual management plans developed under the CFP.

The fundamental objective of the reformed CFP (2013)[8], which is the set of rules through which the EU fisheries will continue to be managed, is to restore and maintain fish stocks above biomass levels that can produce their MSY[c]. To achieve this, the MSY exploitation rate (F_{MSY}) should have been achieved by 2015 where possible and by 2020 at the latest for all stocks.

[c] For details, see: *https://www.documents.clientearth.org/wp-content/uploads/library/2015-09-08-maximum-sustainable-yield-in-the-common-fisheries-policy-ce-en1.pdf*

As such, the scientific advice on fishing opportunities provided by ICES, upon which the Commission's proposals are based, has the objective of achieving MSY[9].

Progress towards the MSY objective has been made but it is yet to be met for all stocks[10,11]. In 2019, the Landing Obligation[d] which in Atlantic waters affects stocks subject to catch limits, was introduced in full after a phased introduction from 2015. Discarding of unwanted catch is now only permitted under certain conditions, and instead all catches must be landed and counted against quota allocations (where applicable)[12].

MSY as the key CFP objective

Article 2(2) of the CFP Basic Regulation[13] reads as follows:

"The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.

In order to reach this objective of progressively restoring and maintaining populations of fish stocks above biomass levels capable of producing maximum sustainable yield, the maximum sustainable yield exploitation rate shall be achieved by 2015 where possible and on a progressive, incremental basis at the latest by 2020 for all stocks."

MSY is a theoretical maximum yield (catch) that can be taken from a stock in the long term under constant environmental conditions when that stock is at the biomass reference point B_{MSY} (in theory, the stock size at maximum population growth rate). The fishing mortality rate that should lead to B_{MSY}, on average (all other things being equal), is called F_{MSY}.

[d] The Landing Obligation means that all EU vessels must now land all of their catch which is subject to quota limits, including for example non-target species and below minimum size target species (termed 'unwanted catch'). There are some exemptions for certain fisheries and species, for example where there is scientific evidence of high discard survival.

For some fisheries, additional management measures are specified though regulations under the umbrella of the CFP. In recent years, the most important EU fisheries and stocks have been managed through regional multiannual plans (MAPs). Of particular relevance for the UK were the North Sea MAP[14] and the Western Waters MAP[15] which cover demersal fish stocks and their fisheries around UK waters.

Each plan contains goals for fish stock management, including an MSY objective, and in some cases specific conservation rules. For select fisheries, such as scallop dredging, EU management measures take the form of 'input control' by restricting effort through fleet capacity and/or time spent at sea (see Case Study 5 in Section 5).

2.2.2 UK fisheries management framework

As an EU Member State, alongside conforming to the requirements of the CFP, additional management measures for UK fisheries catching stocks shared with the EU fleet are specified by the UK and devolved administrations (Scotland, Wales, Northern Ireland). All UK registered vessels that fish commercially in UK waters require a licence which varies depending on factors such as vessel length, area and species fished. The purpose of the UK licencing system is to limit fishing effort by restricting the size of the UK fleet.

Management of inshore fisheries (0-6nm) is also devolved within the UK. In England, inshore fisheries are managed by ten Inshore Fisheries and Conservation Authorities (IFCAs) and regulated by IFCA bylaws[e]. In devolved nations, national fisheries authorities manage the inshore waters. Non-quota species (predominantly shellfish, except for *Nephrops norvegicus*) are only regulated through national legislation and policies (on a devolved basis).

The new Fisheries Act[1] is the main framework regulation for the management of the UK's fish and shellfish resources and fisheries now the UK has left the EU. This regulation contains for example the principles and basis for setting exploitation rates for UK fish stocks, negotiating management measures for shared stocks and permitting access of non-UK fishing vessels to UK waters. There are Fisheries Objectives[f] which cover various sustainability objectives, including a commitment to best management standards such as MSY. However, as these are not firm duties there are concerns that they are more flexible than those required by the

[e] Which for example specify effort limitations through fishing permits, gear requirements, minimum landing sizes and temporal and/or spatial closures, including to protect the features of Marine Protected Areas. *http://www.association-ifca.org.uk/*

[f] The fisheries objectives are: (a) the sustainability objective, (b) the precautionary objective, (c) the ecosystem objective, (d) the scientific evidence objective, (e) the bycatch objective, (f) the equal access objective, (g) the national benefit objective, and (h) the climate change objective.

CFP. This has the potential to undermine the UK Government's previous assurances of commitment to gold standards of fisheries management as well as the UK's international obligations on sustainability and biodiversity. Implementation of the legislation is now in progress such as the development of the UK Fisheries Statement and the Secretary of State Fisheries Statement, and it is hoped that further commitments to MSY are made there. There are also duties to develop Fisheries Management Plans to maintain stocks at or above MSY or restore them to levels capable of producing MSY, as well as plans for data deficient stocks.

The Fisheries Management Plan process (Clauses 6(3-4) of the UK´s Fisheries Act)

(3) The plan must specify whether the available scientific evidence is sufficient to enable the relevant authority or authorities to make an assessment of the stock's maximum sustainable yield and -

(a) if it is, must specify policies of the relevant authority or authorities for restoring the stock to, or maintaining it at, sustainable levels or for contributing to its restoration to, or maintenance at, sustainable levels;

(b) if it is not, must -

(i) specify policies of the relevant authority or authorities for maintaining or increasing levels of the stock,

(ii) specify the steps (if any) that the relevant authority or authorities propose to take to obtain the scientific evidence necessary to enable an assessment of the stock's maximum sustainable yield to be made, and

(iii) where no such steps are proposed, state the reasons for that.

(4) In determining the policies to be specified under subsection (3)(b)(i), the relevant authority or authorities must adopt the precautionary approach to fisheries management (within the meaning of section 1 [of the Act]).

2.3 Decision making process

The primary management mechanism for North East Atlantic fisheries targeting commercial species are 'output controls' in the form of TACs, while fisheries for non-quota species are typically controlled through 'input controls' in the form of fishing effort management (Figure 1). Both management systems are intended to restrict fishing mortality to levels that are consistent with the requirements of the regulations and agreements in place.

During the time the UK was part of the EU those TACs for stocks under exclusive EU competence were set by the EU Agriculture and Fisheries Council (AGRIFISH), which included the UK's Fisheries Minister, and were specified within the annual TAC and Quota Regulations[g]. Those decisions are based on the European Commission's fishing opportunities proposals and subsequent Member State negotiations during AGRIFISH Council meetings. The allocation of the agreed TACs among EU member states, commonly known as quota, was subject to a fixed percentage of each TAC known as the relative stability key.

In the case of stocks shared between the EU and other third parties, bilateral and multilateral agreements, including agreements on TACs and quotas, are typically made annually. In these cases, the European Commission represented the interests of the EU in the negotiations with the third parties through a mandate adopted by the AGRIFISH Council, UK included. Examples of these agreements include the fisheries agreement with Norway for the shared demersal and pelagic stocks or the North East Atlantic Fisheries Commission (NEAFC) agreements with coastal states (e.g. Norway, Faroe Islands, Greenland, Iceland and Russian Federation) for widely distributed stocks.

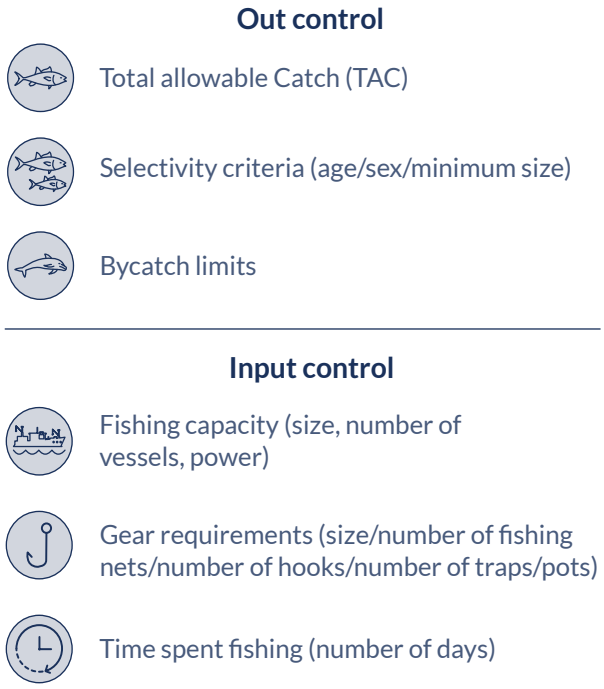


Figure 1: Input and output control examples

Negotiations for North East Atlantic TACs cover over 50 commercial species with 200 different stocks distributed across the various fishing areas within

[g] For example: Council Regulation (EU) 2020/123 of 27 January 2020 fixing for 2020 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. Available at: *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0123&from=EN*

Atlantic coastal states' 200nm Exclusive Economic Zones (EEZs) as well as on the high seas.

Since January 2021 when the transition period ended the UK has full autonomy to decide on the management measures to apply to its fisheries within its EEZ. For the shared stocks, which represent most of the stocks managed through catch limits, the UK will directly negotiate bilateral and multilateral agreements, like those recently adopted with the EU and with Norway. As before leaving the EU, the UK will continue having full discretion in the distribution of fishing opportunities among its fishing fleet.

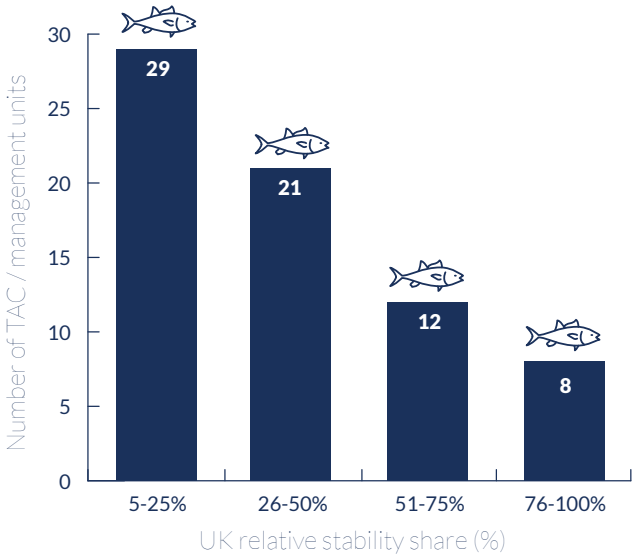


Figure 2: Distribution of UK relative stability share by management

TAC allocation and application

Relative Stability is an allocation key used to share out fishing opportunities among EU Member States. It was agreed in the early 1980s and has remained mostly unchanged since then. EU countries can exchange allocated quotas with other EU Member States.

Figure 2 shows the distribution of management units associated with quota stocks (only those included in this report – see Section 3.2) fished by the UK across different relative stability bands, illustrating the shared nature of those stocks.

For certain stocks, such as North Sea haddock *(Melanogrammus aeglefinus)* and whiting *(Merlangius merlangus)*, an additional allocation adjustment can be applied to the relative stability quota shares – the Hague Preference. Hague Preference can be invoked by the UK and/or the Republic of Ireland when those stocks fall below a threshold level. The purpose of this CFP mechanism is to adjust national relative stability shares to account for the needs of certain fisheries-dependent areas in northern parts of the UK and the Republic of Ireland[16]. Those adjustments come at the expense of other Member States[17].

Many TACs are associated with specific conditions. For example, they can only be used for bycatches and not for directed fisheries, and/or a proportion of the quota can be used flexibly across different TAC areas, and/or they can only be used within certain geographical limits.

In-year adjustments can, and often are, made to the TACs as a result of amended scientific advice, for example. Once a Member States' quota share has been used, that Member State is responsible for closing the fishery.

2.4 Allocation of fishing opportunities in the UK

Member States set their own rules for how to allocate quotas amongst their nationally registered vessels (although they must meet certain EU criteria). For the UK the process is more complicated as like fisheries management, quota distribution is a devolved matter undertaken by each of the four fisheries administrations:

- **UK Government – England (Marine Management Organisation)**[h]
- **Scottish Government (Marine Scotland)**
- **Welsh Government**
- **Northern Ireland Executive (Department of Agriculture, Environment and Rural Affairs)**

The UK system, set out in the UK 'quota management rules'[17], is based on Fixed Quota Allocation (FQA) units, allowing for any national adjustments or application of special conditions, including 'underpinning' for the non-sector and under 10 m pools, where, for some stocks, there is a guaranteed minimum level allocated to those fleet segments.

FQAs represent a fixed percentage of the available quota attached to a fishing licence, based on historical average landings. Licenced vessels with a quota entitlement are divided into 3 groups, with each group associated with a number of FQA units (Figure 3).

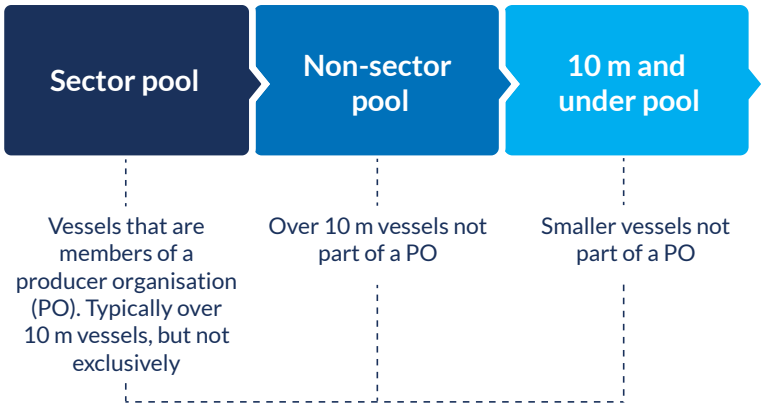


Figure 3: Breakdown of FQA allocation

[h] The Isle of Man and Channel Islands are treated as part of England for the purposes of apportioning UK quota amongst the fisheries administrations

Each fisheries administration receives a quota allocation (in tonnes, t) from the UK government for each stock based on their proportional share of the 3 groups (Figure 3)[i]. Penalties can be applied to unauthorised overfishing of quota allocations by a producer organisation (PO) or fisheries administration.

The 10 m and under pool is managed centrally by each fisheries administration, rather than quota allocations being associated with individual vessel licences. There are concerns over the limited availability of quota for 10 m and under vessels (they hold <2% of UK quota), despite their dominance by number (almost 80% of the UK fleet)[18,19], the impacts of which have the potential to be exacerbated by the UK's departure from the EU[20]. The UK government have said they do not intend to change the existing quota allocation methodology following Brexit[4], much to the disappointment of the 'under 10' sector and eNGOs who want to see a fairer and more sustainable distribution of fishing quota. However, the outcomes of UK Government consultations on the allocation of any additional quota between fisheries administrations, the crown dependencies and within England are pending[j]. NGOs are advocating for preference to be given to low-impact fishers.

Once allocated, quota does not remain static. Fisheries administrations and POs can undertake domestic and, currently, international (with other Member States) quota swaps and transfers[21]. Under the CFP, the UK could also 'bank' up to 10% of its quota or remaining uncaught quota (the lesser amount) for use the following year and could 'borrow' up to 10% of their end of year quota from next year's TAC. These quota movement flexibilities were important for the UK fishing industry, particularly as mitigation against choke[k] risks posed by the Landing Obligation[22].

However, the permitted permanent transfer of FQAs has led to the concentration of quota ownership by a limited number of both UK and foreign companies which needs to be redressed[23,24]. For example, 5 families own or control around 30% of UK fishing quotas and in England, around 50% of fishing quota is held by Dutch, Icelandic and Spanish companies[25].

[i] For example, *https://www.gov.uk/government/publications/these-are-the-fishing-quota-allocations-for-2020-for-england-and-the-uk*

[j] Consultations closed on 10 November 2020: *https://www.gov.uk/government/news/government-consults-on-new-measures-to-boost-the-fishing-industry-and-coastal-communities?utm_source=4fd7789e-4244-4280-a22e-fa64327a1a46&utm_medium=email&utm_campaign=govuk-notifications&utm_content=daily*

[k] Choke risks – Occur in mixed fisheries where a fishing vessel has low quota for one or more species (typically bycatch species) but quota still available for another (typically the target species). There is therefore a risk that if the vessel were to continue fishing for the stock(s) with available quota, catches of the stock(s) for which quota is no longer available would continue, therefore exceeding the catch limit(s). To avoid this, the (target) fishery would have to close prematurely.

2.5 Where the UK fleet catches fish

The majority of UK fisheries landings from the North East Atlantic in 2019 (618,000 t, valued at £979 million) came from UK waters (81% by live weight and 87% by value), and more specifically Scottish and English waters (61% and 16% of UK North East Atlantic landings, respectively). Around 27% of EU catches in the North East Atlantic were also taken from UK waters[26].

The second most important waters for the UK fleet were those of the EU, accounting for 15% of landings (8% by value) from North East Atlantic waters. The Irish EEZ provides the most important non-UK fishing grounds for the UK fleet (representing 11% by weight and 4% by value of landings originating from outside UK waters in 2019), followed by French, Danish and German EEZs.

Third non-EU country waters (primarily Norwegian, including Svalbard) accounted for 4% of landings and 5% of the value in 2019. These figures were similar for the period 2012-2016[26].

Non-UK fishing activity in UK waters

Under the CFP[I] there are historical arrangements for some Member States to fish quotas in each other's coastal (6-12nm) waters, as well as equal access rights to the EU's EEZ. For example, French vessels had the right to fish within multiple locations in the UK's coastal waters and conversely the UK had access to coastal waters of France, Germany and the Netherlands. From January 2021 the UK will control who has access to UK waters.

Based on an average of 2012-2016, EU vessels landed more fish from UK waters than the UK fleet (the EU fleet landed 56% of the 1.25 million tonnes of fish caught around the UK), although the UK fleet's landings had higher value (representing 57% of the total value of £1,156 million), mainly because the non-UK fleet's landings feature high volumes of lower value pelagic fish. The most important species caught by EU vessels in UK waters, by weight, were herring (247,000 t), mackerel (136,000 t) and sandeel (82,000 t)[26].

Around 27% of EU catches in the North East Atlantic are taken from UK waters. The EU Member State fleets that landed the largest quantities of fish from UK waters were Danish (235,000 t; £91 million), Dutch (157,000 t; £86 million) and French (111,000 t; £156 million). Danish and Dutch vessels landed a higher share of tonnage from UK waters than English vessels (19%, 13% and 11% respectively; compared to 28% for Scottish vessels). Overall, the EU fleet's activity in UK waters has historically been far higher than UK activity in European waters outside the UK EEZ[26].

Along with EU Member State fishing activity, Norwegian vessels landed on average 231,000 t (£145 million value) from UK waters each year between 2013 and 2016, which was roughly equal to France by value[26].

[I] Detailed in Annex 1 of the Basic regulation (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1380&from=EN)

3. Status of UK fish stocks and UK fishing industry as the UK left the EU

The objective of this section is to provide a snapshot of the status of UK, including shared, fish stocks in 2020 (or the most recent assessment year prior to that) based on indicators of exploitation and stock size. The broader context to this audit is presented through an overview of socio-economic characteristics of the UK fishing fleet, including recent import and export patterns.

The fishing fleet is supported by and connected to ancillary industries ranging from boat building and gear supply before vessels head to sea, to the post-harvest sector that processes and brings product to markets. Here, however, the focus is on the catching sector and the section draws on data compiled by the

UK Government, on Parliamentary briefing papers, and on data collected by Seafish[m], a non-departmental public body that supports the UK seafood sector.

The data are presented in aggregated form, at the most applicable stock, management unit or species level. Where possible and relevant, the analysis is broken down spatially (sea basin), politically (devolved fisheries administration) or by type of fishery (fish guild, vessel size).

3.1 Key observations

- **Stocks critical to UK fisheries include quota and non-quota species, with the latter not subject to EU TACs or ICES advice.**
- **Of the 104 stocks audited (82 of which are quota stocks shared with the EU), 35.6% were healthy in terms of stock size (43.9% of shared stocks), whereas 20.2% were in a critical condition (15.9% of shared stocks). Data limitations mean the status of the remaining 44.2% (40.2% of shared stocks) cannot be determined, leaving them at greater risk of unsuitable management decisions.**
- **37.5% of the 104 audited stocks were sustainably exploited prior to the UK leaving the EU (42.7% of the 82 shared stocks), while 28.8% were being overfished (25.6% of the shared stocks) and the exploitation status of another 33.6% (31.7% of shared stocks) cannot be assessed against MSY reference points to guide management decisions.**
- **Looking at stock size and exploitation status by sea basin, no region proved a bastion of sustainability. The West of Scotland fared best with 50% of stocks in a healthy state, compared to 24% in the North Sea - also the region with the highest proportion of overexploited stocks (36%).**
- **UK fisheries turnover about £1 billion per year with the majority derived from over 24 m vessels operating from Scotland.**
- **Pelagic quota species caught by the over 10 m vessels dominate UK landings by volume (54%). Non-quota shellfish such as scallops and crab are also key contributors (21%).**
- **Smaller inshore vessels (10 m and under) which dominate the UK fleet by number (74%) and have a far more limited geographical range than the over 10 m fleet, rely on non-quota species.**
- **Shellfish dominate 10 m and under vessel landings by volume and value (>80%).**
- **The geographic distribution of UK catch volume and catch value follow similar patterns.**
- **The UK is a net importer of seafood and the majority of UK catch is sold overseas, notably to markets within the EU (>720,000 t imported and >450,000 t exported).**

[m] *https://www.seafish.org/about-us/who-we-are-and-what-we-do/*

3.2 Methodology

3.2.1 Health of the stocks and exploitation status

The UK typically received a share of over 90 TACs for shared stocks when in the European Union[n]. A sub-selection of those management units is considered in this report, based on a UK relative stability share of ≥5%. ICES provide scientific advice on stock status and fishing opportunities for most stocks subject to EU TACs (quota stocks)[27]. That advice is based on stock assessments tailored to the level of data available for each stock (for which 6 categories are defined), leading to different approaches being applied to enable advice to be produced. These include the ICES MSY advice rule or management plan/strategy approach[o], or where data requirements are not fulfilled, the precautionary approach[9].

The following species have also been included in the analyses in this report due to their importance to UK fisheries, but they are not subject to EU TACs (non-quota stocks) and / or ICES advice:

- **Cockles** *(Cerastoderma edule)*
- **King scallops** *(Pecten maximus)*
- **Edible crab** *(Cancer pagurus)*
- **Lobster** *(Homarus gammarus)*
- **Whelks** *(Buccinum undatum)*
- **Seabass** *(Dicentrarchus labrax)*

Instead, where available, scientific assessments for specific stocks undertaken by IFCAs or Centre for Environment, Fisheries and Aquaculture Science (Cefas) were used.

For many quota stocks, the ICES stock unit and EU management unit (TAC area) do not fully align (a management unit can encompass multiple stocks, or a single stock can occur in multiple management units). Whereas biological monitoring and scientific assessment are based on the stock's geographical distribution, TAC areas or management units are aligned with ICES Divisions[p].

As a result of this mismatch, and the additional non-quota stocks, the report presents data for the following number of stock and management units (details provided in Appendix 1):

- **Number of stock units: 104, which includes:**
  - **Number of non-quota stock / management units: 22**

- **Corresponding number of management units (TACs): 70**

[n] Plus additional TAC shares for deep sea species and stocks fished in Norwegian and other international waters.

[o] Where the plan/strategy has been agreed by all relevant management parties and it has been evaluated by ICES to be consistent with the precautionary approach.

[p] For a detailed evaluation of this issue, see *https://www.documents.clientearth.org/wp-content/uploads/library/2016-12-02-mismatch-between-tacs-and-ices-advice-ce-en.pdf*

The analyses of exploitation and stock size status are based on stock unit. Information relating to landings and TAC are necessarily based on the management unit or for some data sources, are only available at the species level.

Indicators of stock exploitation and stock size status are derived from the most recent ICES advice or alternative ('Other') stock assessments. These indicators are based on assessments of the stock size and fishing rates against MSY reference points or proxy reference points, where available. Such reference points provide benchmarks against which the effectiveness of the management approach can be evaluated. The proportion of stocks for which the indicators are based on proxy reference points is stated to show the relative distribution of lower and higher confidence assessments. Further details on the indicator methodology are provided in Appendix 2.

The corresponding year of advice, and so reference period for the audit, varies between stocks due to the frequency and timing of advice provision. For 54% of stocks, the reference year for stock status is 2020, whereas it is 2019 for 25%, 2018 for 11% and 2017 for 11%. For most stocks assessed by ICES, the reference point for exploitation status is one year earlier than stock status[q] whereas for non-quota stocks the reference period is the same for both indicators.

The stock and exploitation status results (% of stocks assessed as each of the four categories for each indicator) are also provided on a regional basis, by sea basin: North Sea, English Channel, Celtic Sea, Irish Sea and West of Scotland, as these represent the broad TAC areas (ICES Subareas/Divisions). Many stocks (and some management units) overlap with more than one sea basin and therefore their indicator status is duplicated spatially.

3.2.2 Socio-economic statistics

The analyses of UK vessels landings (weight, tonnes (t) and value, GBP (£)) by species and vessel size category, were derived from the MMO's latest landings dataset based on catches in the UK EEZ only[26]. Mapped landings (by weight, value and vessel size category) were instead based on the MMO's UK sea fisheries annual statistics report for 2019[19]. The same data source provided imports and exports, employment and fleet size statistics, supplemented by additional data from Seafish.

[q] Because ICES advice estimates the spawning stock biomass at the beginning of the year to which the advice applies (advice year) (or at spawning time the year before the advice year for some stocks), based on the fishing mortality in the previous year

3.3 Results

3.3.1 Stock status overview

From the 104 stocks assessed as part of this analysis, **37 (35.6%) were deemed to have a 'healthy' stock size, whilst 21 (20.2%) were considered to be a in a critical condition** (Figure 4).

Of these stocks classified as healthy or critical, 43 (74.1%) were based on a full quantitative or analytical ICES assessment, and 15 (25.9%) were based on proxies for MSY reference points.

Similarly, when looking at exploitation status, **39 stocks (37.5%) were identified as being sustainably exploited, while 30 stocks (28.8%) were classed as being overfished** in the most recent year of assessment (Figure 4). A higher proportion (33.3%, n=23) of exploitation indicator assessments were based on proxy reference points and therefore were associated with lower confidence.

Indicators for stock biomass and fishing mortality were unavailable for 39.4% and 28.8% of stocks for the respective assessment types. Therefore, a large proportion of fisheries management decisions are being made with incomplete data. A number of those stocks with data too limited to appoint reference points were the non-quota shellfish species. However, a variety of catch-controlled species were also data limited, including several stocks of Nephrops, anglerfish (Lophiidae), and more recently cod *(Gadus morhua*) in the Irish Sea.

Stock status indicators

Stock status indicators are based on the most recent assessments of stock size and fishing mortality rate (exploitation status) relative to MSY reference points ($B_{trigger}$ and F_{MSY}, respectively). Further details are provided in Appendix 2.

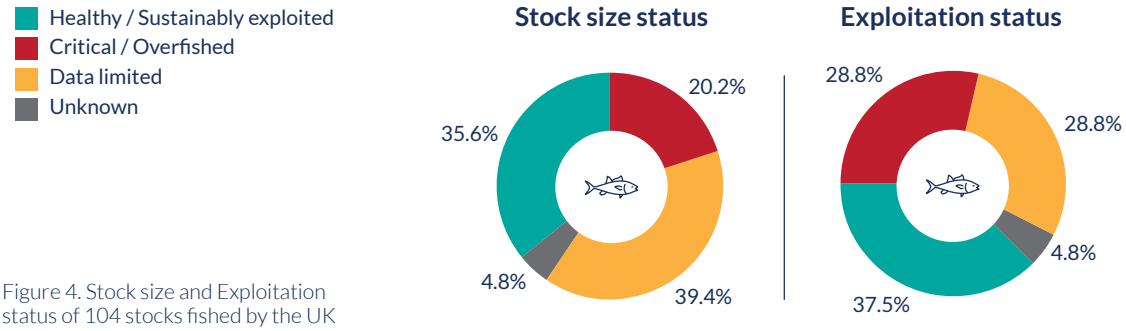


Figure 4. Stock size and Exploitation status of 104 stocks fished by the UK

The stock size and exploitation status of the remaining 4.8% of stocks is completely unknown due to lack of scientific assessment. Surprisingly, these were not just non-quota stocks (whelks, *Buccinum undatum*) but one stock each of herring *(Clupea harengus)*, plaice *(Pleuronectes platessa)* and saithe *(Pollachius virens)*, although all are relatively minor stocks for the EU.

Status of the shared stocks

For the 82 shared (quota) stocks considered in the audit, 43.9% (n=36) were assessed as having a healthy stock size, whilst 15.9% (n=13) were in a critical condition with stock biomass below MSY reference points.

Compared to the full list of audited UK stocks, a slightly higher proportion (42.7%, n=35) of the shared stocks were being fished at a sustainable rate as the UK left the EU, although 25.6% (n=21) were still being overfished (Figure 5).

The majority of these stock size and exploitation status assessments (85.7% and 80.4%, respectively) were based on a full quantitative or analytical ICES assessment, rather than proxy reference points.

However, MSY-based indicators for stock size and fishing mortality rate were unavailable for 30 (36.6%) and 23 (28%) of the shared stocks, respectively due to data limitations. These included several stocks of Nephrops, anglerfish and more recently cod in the Irish Sea. For a further 3 stocks (3.7%) (of herring, saithe and plaice), no scientific assessment was available at all to inform sustainable fishery management decisions.

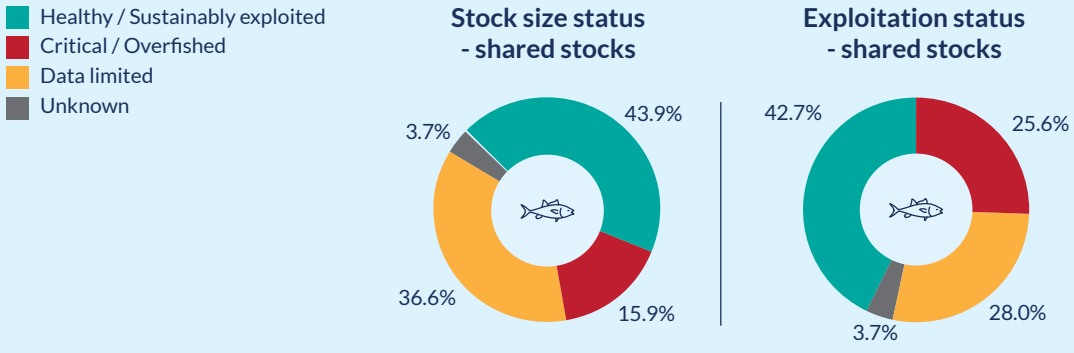
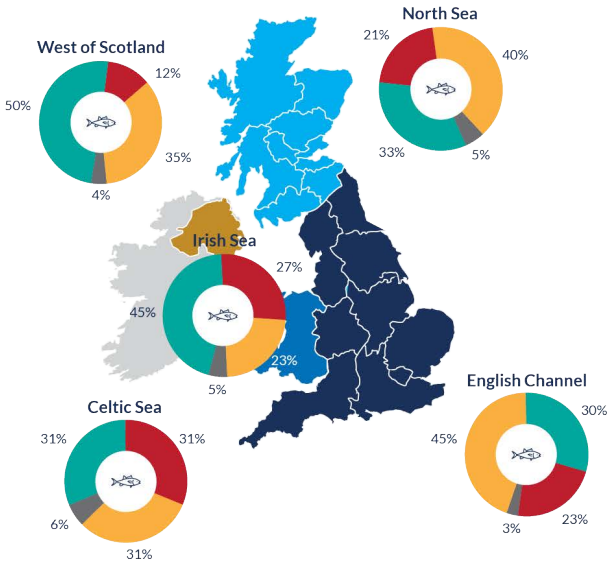


Figure 5. Stock size and Exploitation status of 82 shared stocks fished by the UK

When aggregating the data by sea basin[r], no region proved a bastion of sustainability though the **West of Scotland fared best with the highest proportion of stocks in a healthy condition (50%), followed by the Irish Sea (45%).** The English Channel, North Sea and Celtic Sea all had between 30% and 37% of their stocks assessed as healthy (Figure 6). **The West of Scotland had the fewest stocks in a critical condition (12%), whilst the size of 31% of stocks in the Celtic Sea was assessed as critical.** Stocks with limited data, which prevented associated reference points being appointed, was highest in the North Sea and English Channel where 40-45% of stocks assessed had incomplete data, compared to 23% in the Irish Sea.

Nearly 60% of the stocks fished by the UK in the Irish Sea are considered to be sustainably exploited (Figure 6). The number of stocks being overfished was greatest in the English Channel and North Sea (33-36%), whilst the West of Scotland and the Irish Sea had the lowest proportion of stocks categorised as overfished (18-23%).



Stock Size

Stock size status
- Healthy
- Critical
- Data limited
- Unknown

Exploitation status

Exploitation status
- Sustainably exploited
- Overfished
- Data limited
- Unknown

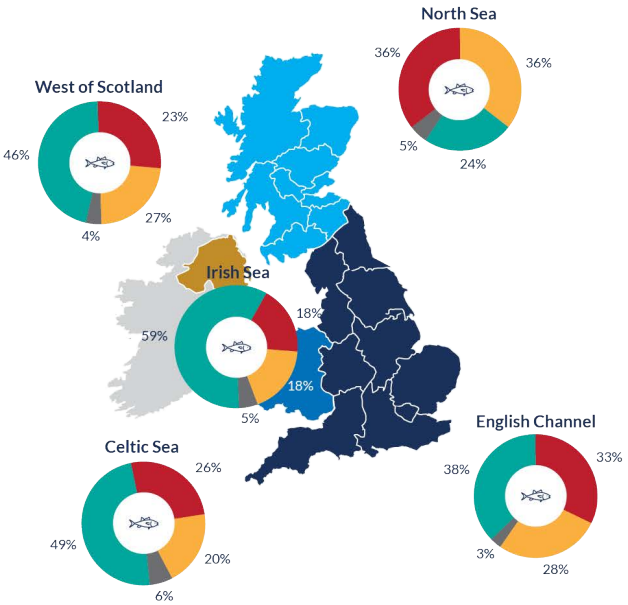


Figure 6: Stock size and exploitation status of stocks by sea basin

[r] Whilst the total number of stocks represented here remains 104 some of those are duplicated across sea basins because the indicator assessments are based on ICES biological stock units rather than TAC areas, which tend to be restricted to an ICES Subarea or Division (and therefore sea basin). The following number of stocks are included in each sea basin: West of Scotland - 26, North Sea - 42 English Channel - 40, Celtic Sea - 35 , Irish Sea - 22.

3.3.2 Composition and distribution of UK landings

Mackerel *(Scomber scombrus)* accounted for the largest volume of landings in weight from UK waters in 2019 and was predominantly caught by vessels of over 10 m in length. Herring *(Clupea harengus)* followed with landings of 71,000 t whilst Nephrops, haddock, and King scallops *(Pecten maximus)* also made a substantial contribution to the UK's annual landings by weight (20-30,000 t per stock) (Figure 7)[S].

For smaller vessels (10 m and under), shellfish dominated their landings, highlighting the smaller

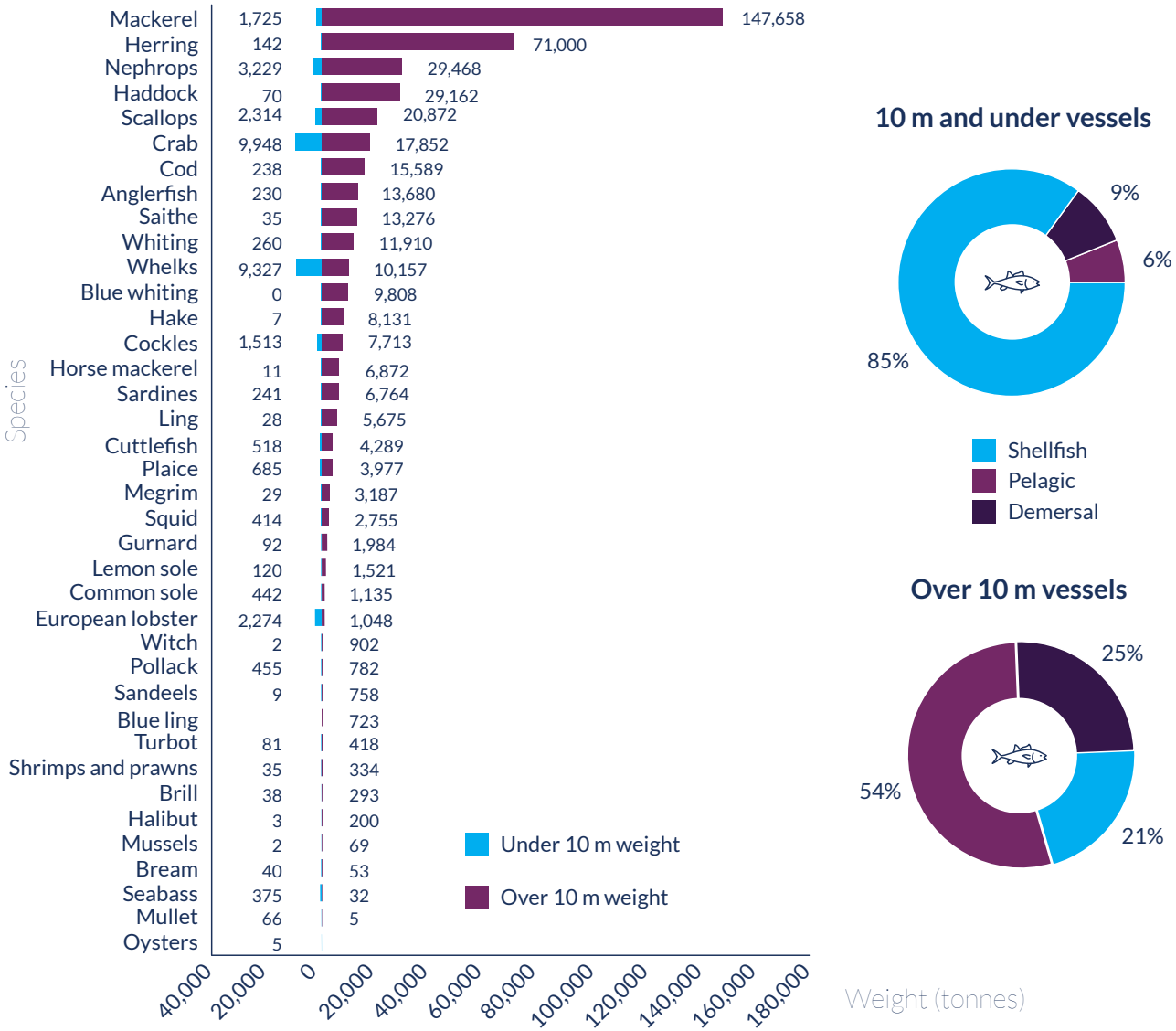


Figure 7: Weight of UK vessel landings (tonnes) from UK waters by vessel length in 2019

[S] The values presented here are for UK vessels fishing in the UK EEZ only; for species such as mackerel and blue whiting, total UK landings are significantly higher when catches from outside the UK EEZ are included.

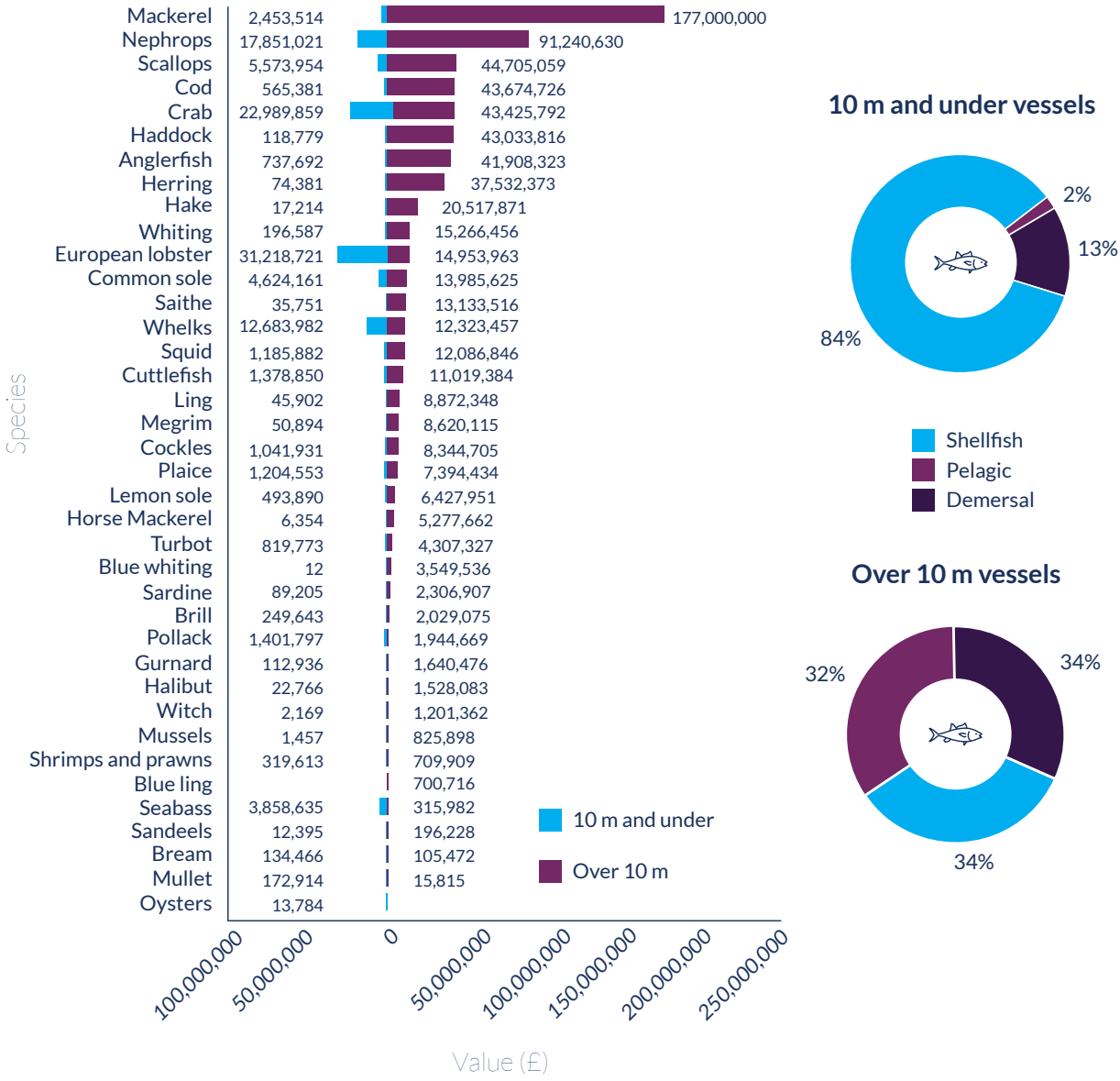


Figure 8: Value of UK vessel landings (£) from UK waters by vessel length in 2019

inshore vessels' current reliance on non-quota species. The significant landings of mackerel and herring for the over 10 m fleet is reflected by pelagic stocks comprising 54% of landings overall. The remaining 56% of landings for the over 10 m fleet was split almost equally between shellfish and demersal species such as cod, haddock and anglerfish (21% and 25% respectively).

There are obvious similarities between the ranked list of species by landings weight (Figure 7) and by landings value (Figure 8). For example, **the substantial contribution of mackerel to the UK fishing industry remains evident.** Nephrops ranks higher based on value than weight however, reflecting its status as one of the most valuable species caught by the UK fishing industry. There are also differences for key species such as herring, whereby landings by value are not as significant as by weight, which in

turn affects the proportional contribution of pelagic species to the over 10 m vessel category. Conversely, scallops, cod and crab all place higher in terms of landings value.

Oysters, mullet, bream and seabass are low ranking for landed weight and landed value. These are aggregate figures for the UK and a low ranking should not be associated with low importance, particularly for localised fisheries.

Hotspots of UK fishing activity in 2019 are evident in terms of weight (tonnes) and value (£ million) of landings (mapped by their origin). **The largest volume of fish was caught in the northern North Sea,** specifically areas off north-east Scotland near Shetland and in the **Celtic Sea west of Ireland** (Figure 9). This is largely driven by the presence of large volumes of pelagic species such as mackerel, herring and blue whiting *(Micromesistius poutassou)*, and aggregations of demersal species such as cod, anglerfish and haddock. Smaller hotspots are present in the English Channel, reflecting important demersal and shellfish fisheries.

Landings value follows a similar geographic distribution with visible hotspots in the northern North Sea, the English Channel and Irish Sea (latter more pronounced than trends by weight), although not to the west of Ireland (Figure 10). The value of landings in the English Channel appear distinctly higher than corresponding areas for landed weight, in part explained by the valuable English Channel common sole *(Solea solea)* fishery, and highly

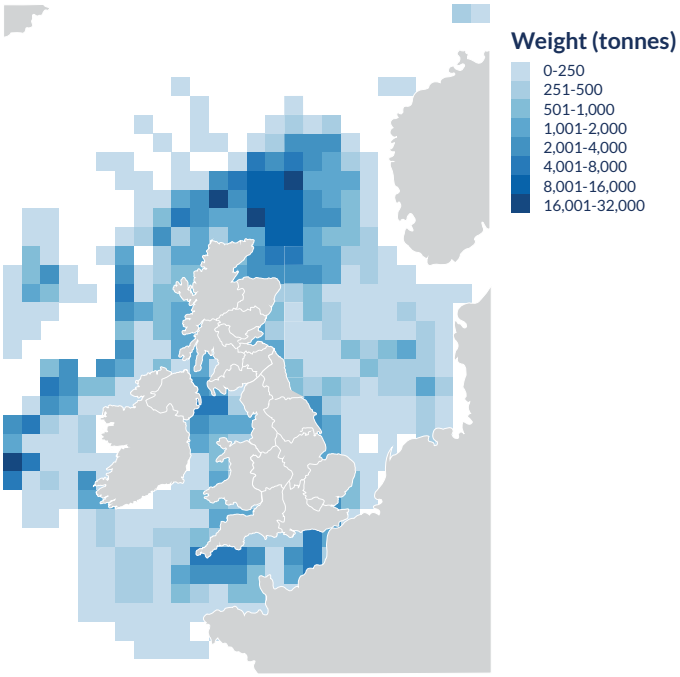


Figure 9: Geographic distribution of total UK vessel landings origin by weight (tonnes) in 2019

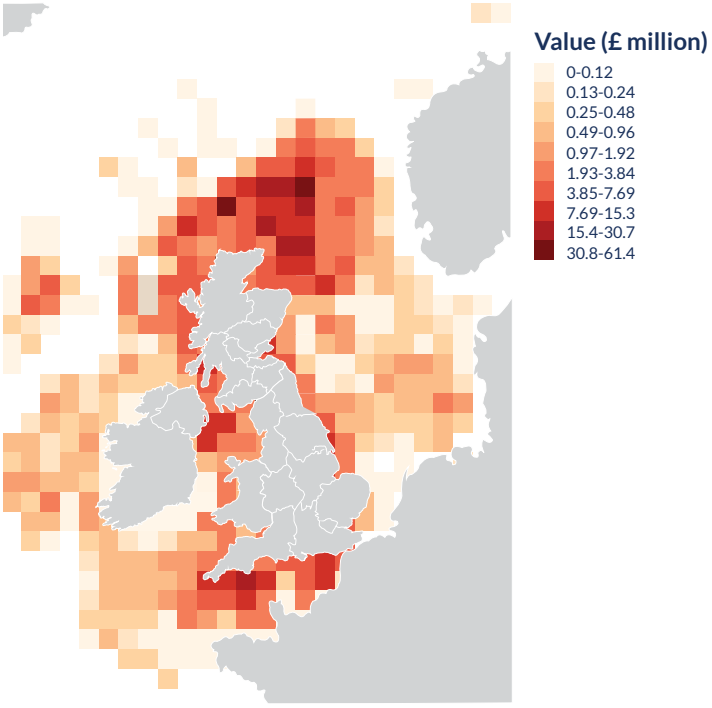


Figure 10: Geographic distribution of total UK vessel landings origin by value (£ million) in 2019

priced shellfish fisheries. High value spots in the Irish Sea are likely due to the high value Nephrops fisheries and the scallop fisheries around the Isle of Man.

Clear geographic differences are visible when mapping the distribution of landings by the 10 m and under and over 10 m vessel categories (Figures 11 and 12). **The capacity of larger vessels to exploit offshore waters is evident relative to the smaller vessel category for which fishing grounds are typically coastal.** The over 10 m vessels comprise about 25% of the total fleet by number of vessels, yet the extent of the over 10 m fishing grounds is noticeably greater than the grounds fished by the 10 m and under vessels.

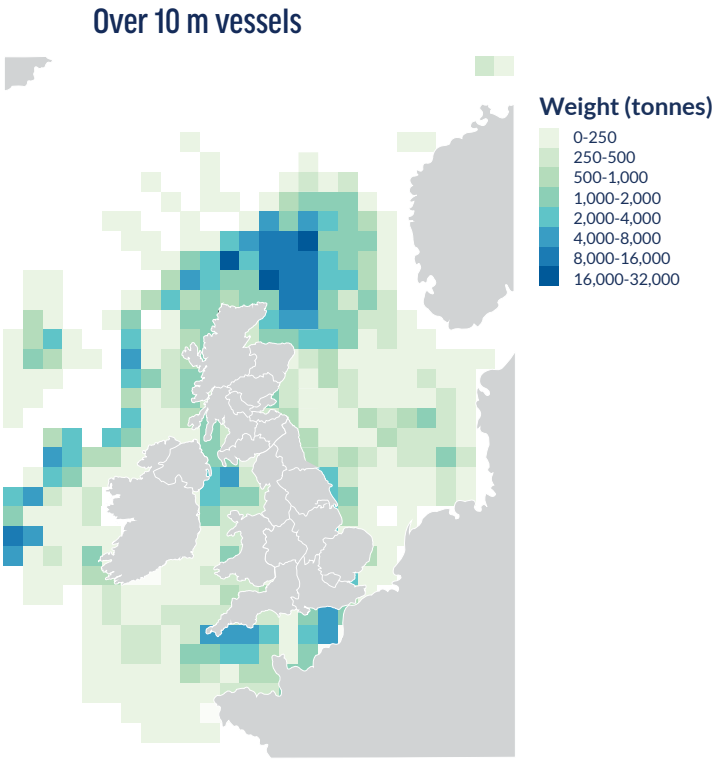


Figure 11: Geographic distribution of landings origin in 2019 by weight (tonnes) for UK vessels over 10 m in length

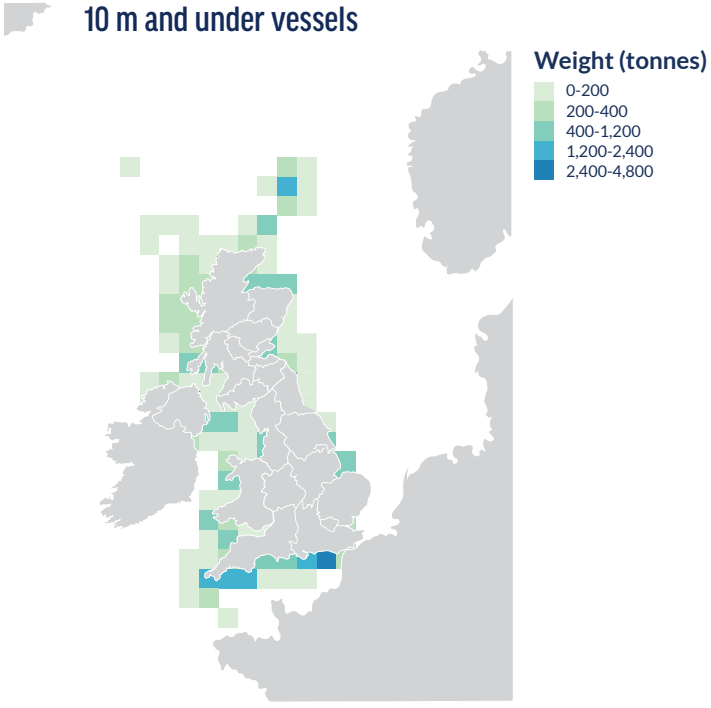


Figure 12: Geographic distribution of landings origin in 2019 by weight (tonnes) for UK vessels 10 m and under in length

3.3.3 Overview of socio-economic characteristics of the UK fishing industry

In 2019, the UK Government recorded 5,668 licensed fishing vessels[19]. Seafish provides a more detailed analysis of fishing vessels that are active and reported 4,491 vessels, of which about 1,500 (33%) are low activity vessels earning less than £10,000 per year[28].

The 10 m and under vessel size category comprises 74% of the UK's fleet. The distribution of the fleet by nation in 2019 is shown in Figure 13. Approximately 51% of the active fishing vessels use static or passive fishing gear[28]. The importance of particular stocks varies between the over and under 10 m fleets, with the latter largely reliant on stocks that are present in or migrating through coastal waters.

Masked within the two size categories is a diversity of vessel types, capacities, and fishing gears. Seafish categorises the UK fleet based on a combination of vessel power, gear type, target species and region. This results in characterisations and economic profiles for 30 fleet segments, which range from trawlers (demersal, pelagic, beamers, Nephrops, dredges) to seine vessels (demersal, pair-trawl seiners), potting and trap vessels, netting vessels

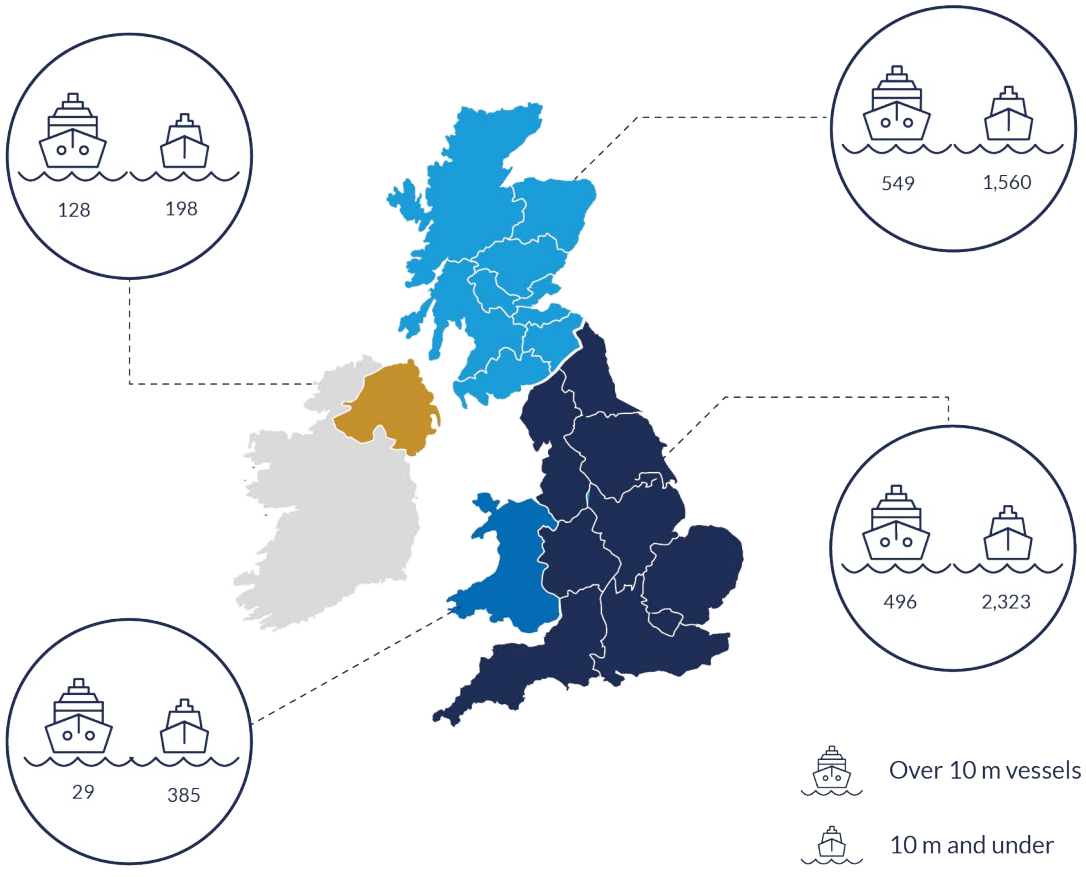


Figure 13: Distribution of the UK fishing fleet by devolved nation in 2019

(gill nets, drift net, fixed nets), longliners, and hook and line vessels. The need for greater granularity in fleet statistics is recognised by the UK Government, which, as of September 2019, was in the process of commissioning advice about how to better classify small-scale or low impact fishing[29,30].

The number of active fishing vessels is greatest in England (47% of the UK fleet), followed by Scotland (38%). In terms of days spent at sea, vessels registered in Scotland are most active. Scottish registered vessels also contribute the majority of landings by weight and value, and the importance of the over 10 m fleets becomes apparent. For example, vessels over 24 m in length landed about 80% of the total weight landed by Scottish vessels[28]. Most landings are made into UK ports, with the Scottish ports of Peterhead, Lerwick and Fraserburgh being particularly important in terms of volume. In 2019 the UK reported the second largest volume of landings of all EU Member States[31].

As with most EU Member States, there has been a reduction in UK fleet capacity over recent decades. The fleet has decreased by about one third since the mid-1990s[32]. Meanwhile there has been an increase in vessels equipped to target non-quota species (e.g. crabs (typically *Cancer pagurus*), lobster *(Homarus gammarus)*, cuttlefish *(Sepia officinalis*), whelks). These are supported by strong markets in the EU and also by relatively novel high demand markets in China.

The impact of the COVID-19 pandemic on these markets is working through the system now. As of October 2020, research teams, such as the Scottish Association for Marine Science, were in the process of understanding how 'COVID-shock' has impacted the seafood sector. The other major factor related to export markets is of course Brexit and the end of the transition period.

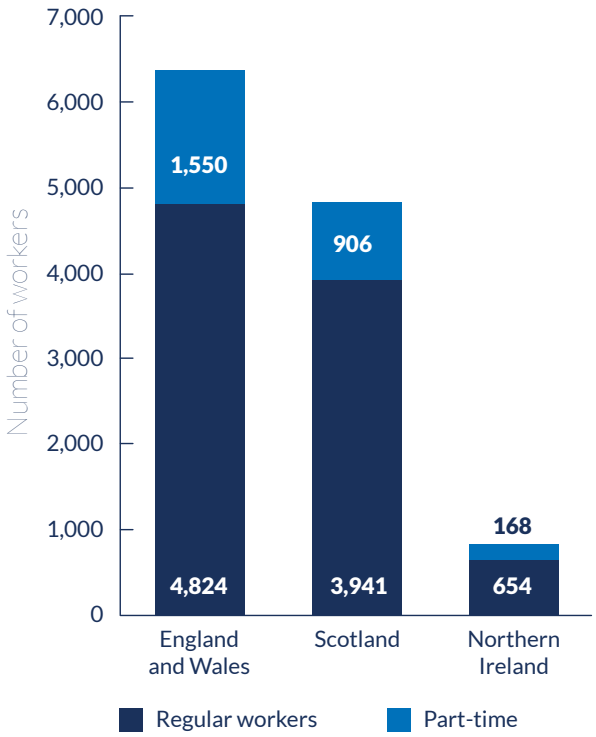


Figure 14: Breakdown of catching sector employment by devolved nation in 2019

The GDP for fishing in 2019 was £747 million, down 7% from 2018 and representing 5.5% of the total for agriculture, forestry and fishing combined[19]. Estimates of the UK fleet, based on samples of fishing costs and earnings, indicate a turnover of £1 billion, with an operating profit of £240 million[28]. Marine fisheries produced gross value added (GVA) of £483 million in 2018, or about 0.04% of the UK's non-financial sector GVA[32]. The majority of GVA is associated with the over 24 m length fleet segment based in Scotland, contributing 67% of the more than £300 million created in 2019. In 2019, net profit margins ranged from -22% to +33% across fleet segments, with an average of 10% across the UK fleet[28]. Masked within these figures are the social contribution of fisheries, particularly of the 10 m and under fleet to remote coastal communities. There is a paucity of social studies focused on how fisheries contribute to, for example, remote coastal communities.

Factors affecting economic performance vary between fleet segments, ranging from biological (e.g. local changes in stock abundance/availability), environmental (e.g. weather conditions), competition (more or fewer competing vessels and gear in the same area, and competition with other maritime industries for space and access), market prices, regulatory (e.g. quota or effort access, gear requirements), changes to operating costs (e.g. harbour dues, vessel and gear repairs, fuel prices). These factors combine to influence overall profit and economic performance. Catches (affected by multiple ecological and anthropogenic factors), market prices and fuel costs are key drivers.

In terms of employment, the UK Government records 12,043 fishers employed in the UK in 2019[19], split among the four devolved nations as shown in Figure 14. Seafish provide alternative employment statistics based on the number of Full Time Equivalent (FTE) jobs aboard UK vessels, using MMO employment data combined with data obtained from the fishing industry.

The distribution of jobs as measured in FTE differs slightly from UK Government statistics and the FTE estimate is 8,012 in 2020[28]. The majority of FTE jobs are aboard Scottish vessels (3,829), followed by English vessels (3,230), Northern Irish vessels (705) and Welsh vessels (140). Seafish also provide gender-disaggregated data for employment in the catching sector. There is, however, a lack of gender consideration for the post-harvest value chain, where women are significant contributors to the processing sector.

In terms of imports and exports, the UK has been noted to 'import what is eaten and export what is caught'[33]. The UK is a net importer of seafood due to the faster growth of the import market over time in comparison with the export market[32]. In 2019, 721,000 t of seafood valued at £3.5 billion was imported, and 452,100 t of seafood was exported, valued at £1.8 billion[19].

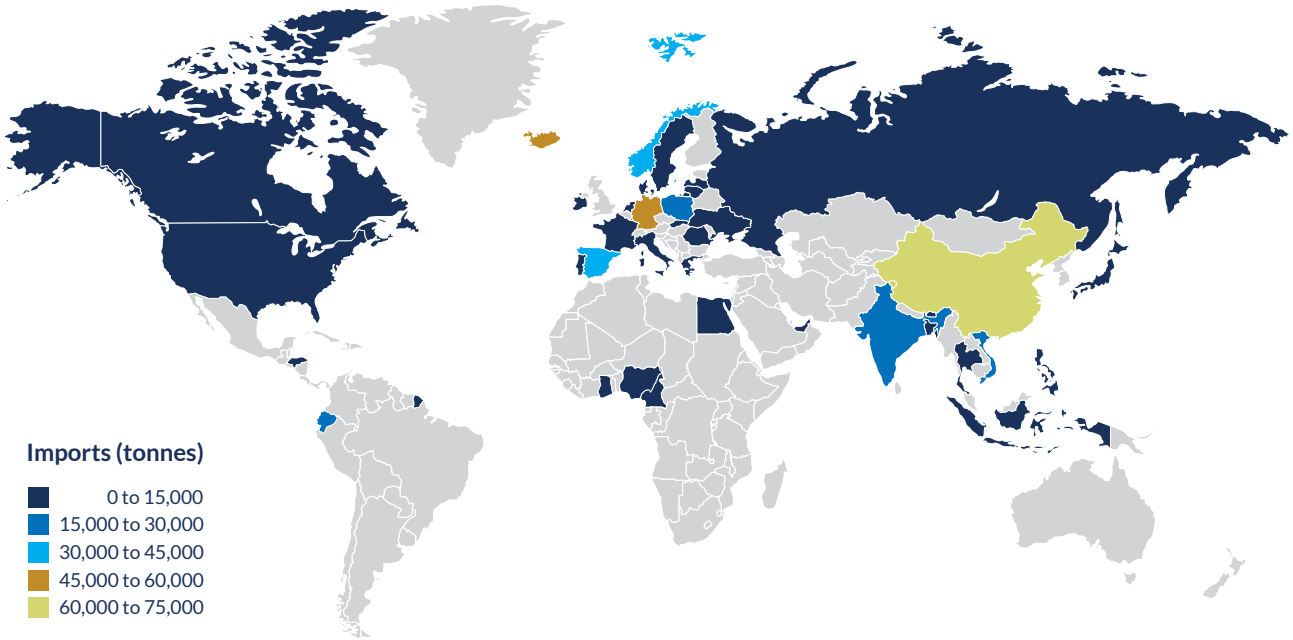


Figure 15: Global distribution of UK seafood imports in 2019

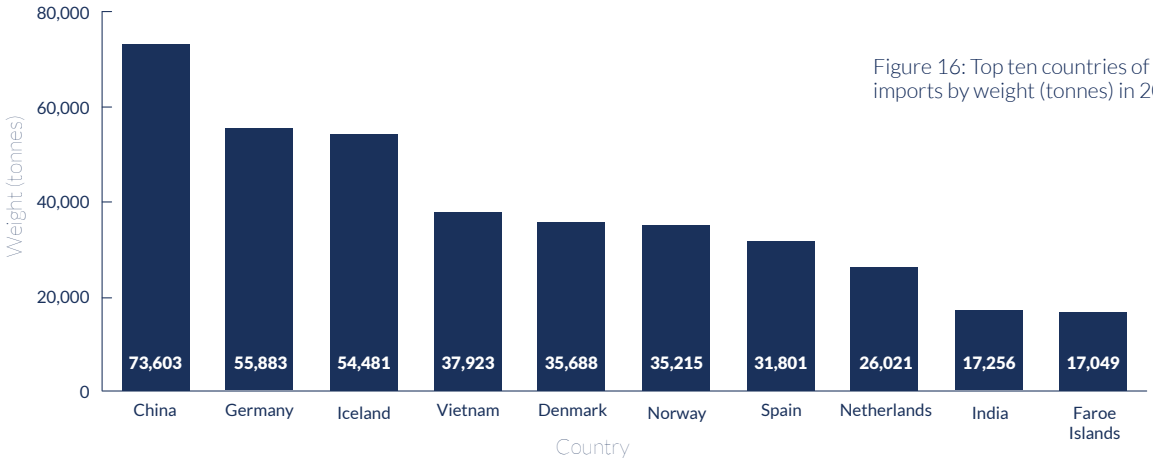


Figure 16: Top ten countries of UK seafood imports by weight (tonnes) in 2019

Disentangling the import/export figures is problematic; greater detail would be beneficial, for example about where product has been caught, whether the exporting country is the catching nation or a processor, and whether product is derived from aquaculture or capture fisheries. Nevertheless, plotting the available data provides a clear picture of the range and extent of imports and exports, and the global nature of the seafood sector (Figures 15 - 20)[19].

EU Member States are important sources of seafood consumed in the UK and are critical markets for fish and seafood caught by UK vessels. Asia is also an important source of seafood, although currently less important in terms of volume as an export market. However, the blunt volume figures should not diminish the importance of, for example, the Korean market for shellfish that is otherwise of relatively low value. The relevant EFTA States (Iceland and Norway) are important sources of imported seafood but are minor export destinations.

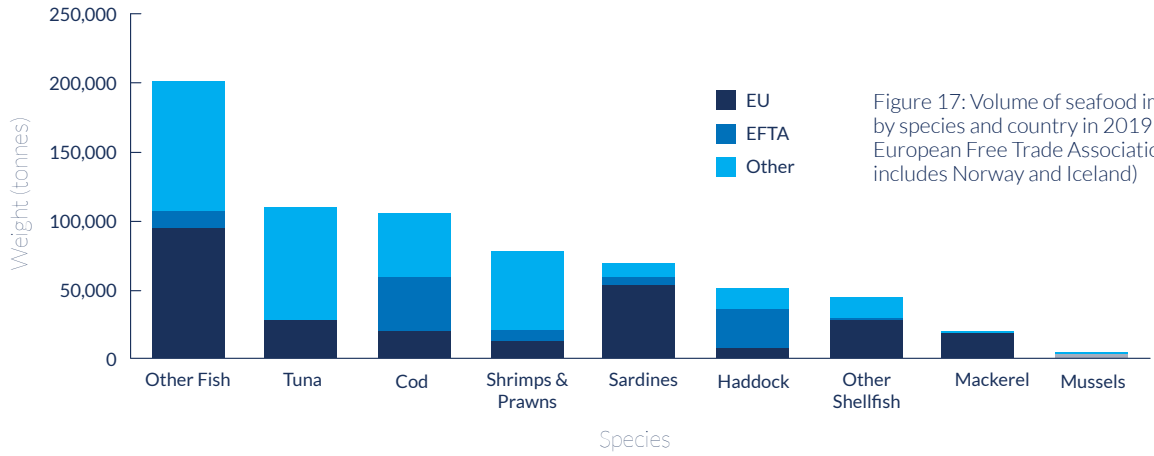


Figure 17: Volume of seafood imports by species and country in 2019 (EFTA = European Free Trade Association states, includes Norway and Iceland)

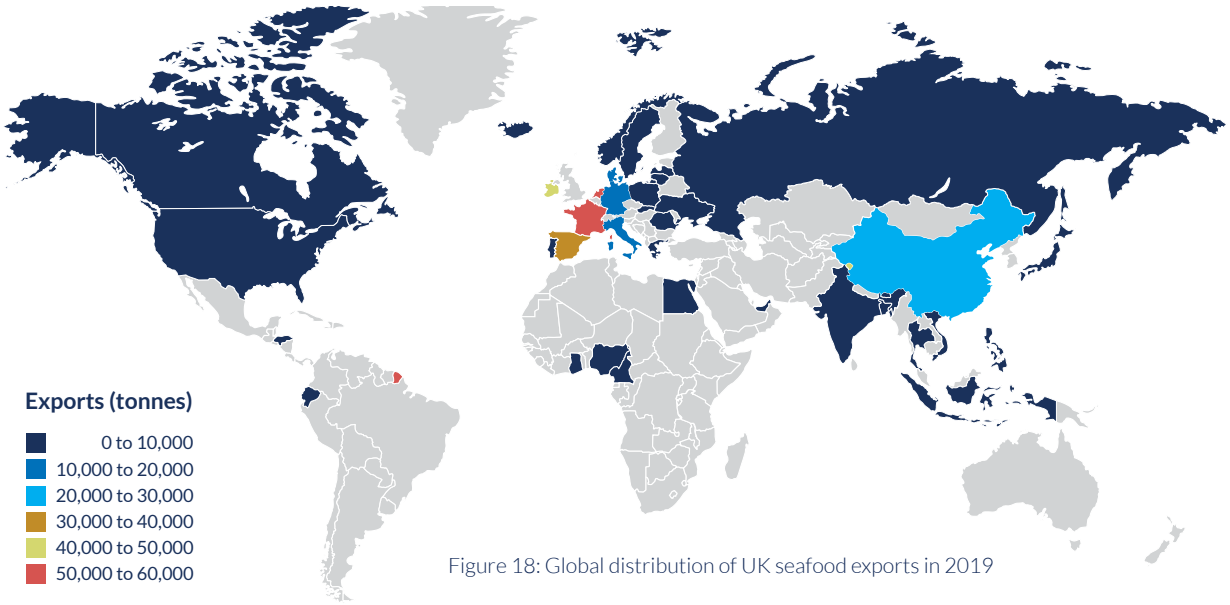


Figure 18: Global distribution of UK seafood exports in 2019

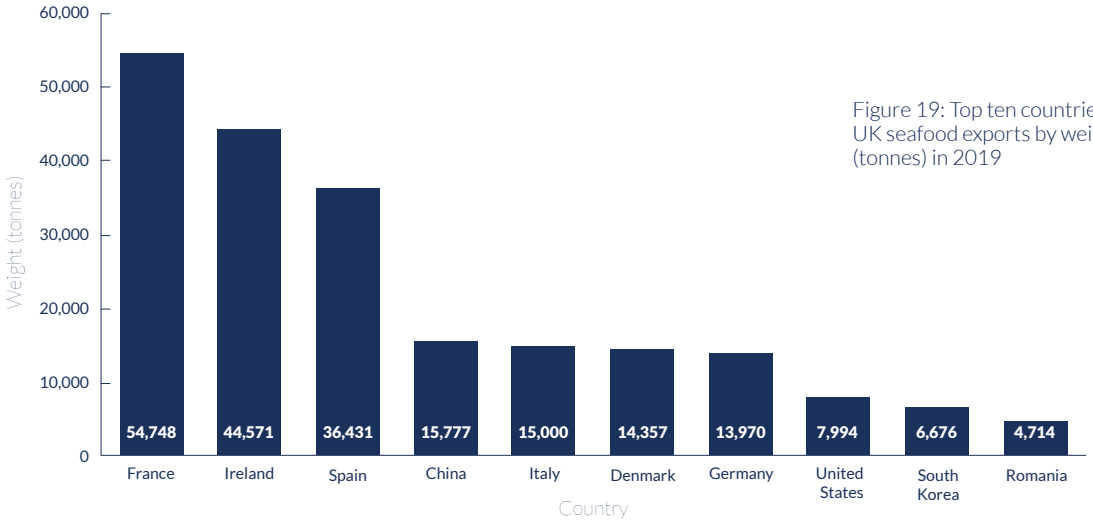


Figure 19: Top ten countries of UK seafood exports by weight (tonnes) in 2019

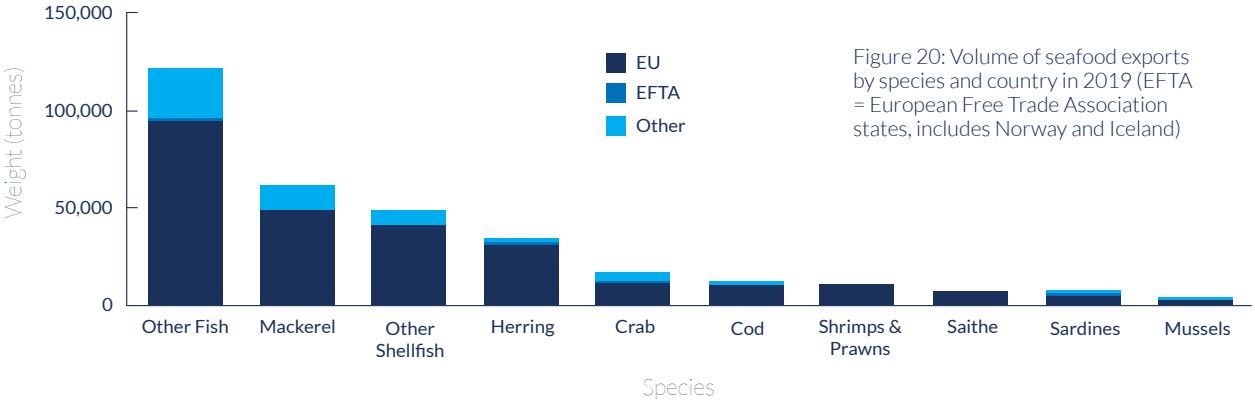


Figure 20: Volume of seafood exports by species and country in 2019 (EFTA = European Free Trade Association states, includes Norway and Iceland)

4. Focus stocks

This section investigates in greater depth the current biological and management status of a subset of the UK's fish stocks, selected according to their economic status (the 'top 10') or their performance: the 5 most sustainably and 5 most unsustainably fished[t], with the latter including three cod stocks. Separately, a more detailed examination of the recent exploitation and management history of all the cod stocks included in this report is provided, given ongoing concerns over the status of this iconic fish species. In doing so, the implications of any management actions or policy decisions by the UK government following Brexit can be considered against the more detailed benchmarks for these stocks.

4.1 Key observations

- **Six of the 'top ten' stocks identified as economically most important to UK fisheries are overfished or their stock biomass is at a critical level. This includes two stocks which are overexploited and their biomass is below MSY biological reference points. Only 3 are healthy and sustainably exploited.**
- **80% of the 'top ten' stocks are shared with other third parties, mainly with the EU, and subject to TACs. The remaining two are high value shellfish fisheries (scallops and edible crab).**
- **The prescribed TAC still exceeded the scientifically advised TAC for 4 of the relevant (eight) 'top ten' stocks in 2019 and 3 in 2020.**

[t] Sustainably fished or exploited' refers to the stocks' biomass and fishing mortality rate relative to MSY reference points, and is not a judgement on other criteria typically associated with sustainable fishing, such as environmental impacts resulting from catching method, gear type, etc.

- **UK quota uptake exceeds UK catch allocations for many of the applicable 'top ten', for which the UK receives between 20% and 98% of the EU TAC.**
- **About 70-90% of the landings of the 'top ten' come from Scottish vessels.**
- **'Top ten' landings (both by volume and volume) are dominated by mackerel, although North Sea cod and West of Scotland Nephrops are also valuable resources for the UK fishing industry.**
- **With a few exceptions, the 'top ten' stocks are also targeted by non-UK vessels.**
- **The five best performing (sustainably exploited and healthy) stocks have TACs set at or below advised TACs, unlike the 'top ten'.**
- **The five best performing stocks are typically caught in relatively small quantities and are of relatively low value to the UK fishing industry, except for Western English Channel common sole which attracted the highest price per tonne of all the focus stocks.**
- **Zero catches have been advised for 3 of the five worst performing (overfished and stock size at critical status) stocks, which are key bycatch species for commercially important mixed fisheries in the Celtic Sea, Irish Sea and West of Scotland.**
- **North Sea cod, which features in the 'top 10' and five worst performers, is once again subject to recovery management measures, but the TAC has exceeded scientific advice for the last two years.**
- **A focus on all of the cod stocks, an iconic species for the UK, highlights the challenges of rebuilding depleted stocks.**

4.2 Methodology

The 'top 10' stocks (management units) for the UK fishing sector were selected primarily on 2019 landings statistics (volume and value) from the MMO, but with additional factors such as the UK's share of the TAC (greater relative stability share = higher score) and scientific data availability (ICES category 1 or 2 stocks = higher score) also taken into account for stocks with comparative landings rankings. The resulting list[u] was:

- **North Sea herring** *(Clupea harengus)* (HER/4AB)
- **North Sea cod** *(Gadus morhua)* (COD/2A3AX4)
- **North Sea anglerfish** (Lophiidae) (ANF/2AC4-C)
- **North Sea haddock** *(Melanogrammus aeglefinus)* (HAD/2AC4)
- **North Sea whiting** *(Merlangius merlangus)* (WHG/2AC4)
- **North East Atlantic blue whiting** *(Micromesistius poutassou)* (WHB/1X14)
- **West of Scotland Nephrops** *(Nephrops norvegicus)* (NEP/5BC6)
- **North East Atlantic mackerel** *(Scomber scombrus)* (MAC/2CX14)
- **Eastern English Channel scallops** *(Pecten maximus)* (non-quota)
- **Southern North Sea crab** *(Cancer pagurus)* (non-quota)

[u] Detailed as EU management unit common name, species and EU management unit code

Landings values for blue whiting presented in the report appear relatively low as they are based on UK catches in UK waters (UK EEZ). However, catches of blue whiting by the UK fleet from outside the UK EEZ are significant, hence its inclusion in the 'top 10'. For example, the UK fleet landed 60,000 t of blue whiting in 2019 but less than 10,000 t of that was caught in UK waters (Figure 7).

A similar review is undertaken for the five most sustainably fished stocks[t] ('best performers'), selected based on the indicators of their stock size status (categorised 'Healthy' for the 2020 ICES advice year) and exploitation status (categorised 'Sustainably exploited' for the previous year [2019]). In addition, there was high confidence in these assessments as they were all based on the ICES MSY or Management Plan approach (category 1 stocks; data sufficient):

- **Irish Sea herring** *(Clupea harengus)* (HER/07A/MM)
- **Irish Sea haddock** *(Melanogrammus aeglefinus)* (HAD/07A)
- **North Sea megrims** *(Lepidorhombus* spp.) (LEZ/2AC4-C)
- **North Sea plaice** *(Pleuronectes platessa)* (PLE/2A3AX4)
- **Western English Channel common sole** *(Solea solea)* (SOL/07E)

The five most unsustainably fished stocks ('worst performers') were also selected on the basis of high confidence in the most recent assessment of their stock size status (categorised as 'Critical') and exploitation status (categorised 'Overfished'). Those assessments were again derived from the 2020 ICES advice year, with the exception of Irish Sea whiting for which only 2019 advice was available. The resulting list was:

- **North Sea and Eastern English Channel cod** *(Gadus morhua)* (COD/2A3AX4, COD/07D)[v]
- **West of Scotland cod** *(Gadus morhua)* (COD/5BE6A)
- **Celtic Sea and Western English Channel cod** *(Gadus morhua)* (COD/7XAD34)
- **North East Atlantic horse mackerel**[w] *(Trachurus* spp.*)* (JAX/2A-14)
- **Irish Sea whiting** *(Merlangius merlangus)* (WHG/07A)

Finally, the focus is turned to the cod stocks as a case study that brings into focus the factors that contribute to stock decline and which complicate recovery. A brief history of the ups and downs in cod population statuses, exploitation and management history is presented covering the following stocks:

- **North Sea cod** *(Gadus morhua)* (and Eastern English Channel) (COD/2A3AX4, COD/07D)[x]
- **West of Scotland cod** *(Gadus morhua)* (COD/5BE6A)

[v] Considered jointly in alignment with the ICES stock advice (cod.27.47d20)

[w] EU waters of 2a, 4a; 6, 7a-c,7e-k, 8abde; EU and international waters of 5b; intern. waters of 12 and 14

[x] Considered jointly in alignment with the ICES stock advice (cod.27.47d20)

- **Irish Sea cod** *(Gadus morhua)* (COD/07A)
- **Celtic Sea cod** *(Gadus morhua)* (and Western English Channel) (COD/7XAD34)

A detailed description of the methodology used to develop the stock-specific analysis of (where applicable) advised versus agreed TACs, landings (volume and value), quota uptake, unsustainable catches and national quota allocation is provided in Appendix 3.

4.3 Results

4.3.1 The UK's Top 10

Status overview

The 'top 10' stocks (management units) for the UK fishing sector were selected based primarily on landings, along with consideration of the UK's TAC share and data availability. **Only three of the 'top 10' were categorised as having a healthy stock status and being sustainably exploited in 2020 - North East Atlantic mackerel, North Sea haddock and West of Scotland Nephrops**[y] (Figure 21).

Six of the 'top 10' were categorised as either overfished or critical according to the exploitation or stock status. North Sea whiting and North East Atlantic blue whiting had a healthy stock status but were classed as being overfished. North Sea herring however was categorised as being in a critical condition but was considered to be sustainably exploited in the most recent assessment suggesting there may be cause for optimism.

Of greatest concern were the **two stocks for which both indicators of stock size and exploitation rate did not meet MSY reference points - Southern North Sea crab and North Sea cod.** Lack of data to support assessments against reference points for Eastern English Channel scallops (stock size) and North Sea anglerfish (more commonly referred to as monkfish), of which nearly 7,500 t was landed by the UK fleet in 2019, also highlights a priority for sustainable management.

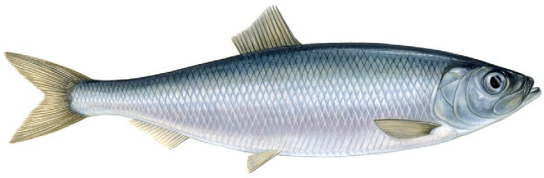
[y] For West of Scotland Nephrops, assessments are available separately for 3 functional units (stocks). The indicator status applies to all 3 of these functional units.

Stock health and exploitation status of the 'top 10' (Figure 21)

- Healthy / Sustainably exploited
- Critical / Overfished
- Data limited

North East Atlantic mackerel
(Scomber scombrus)

Exploitation status
Stock status



North Sea herring
(Clupea harengus)

Exploitation status
Stock status

North East Atlantic blue whiting
(Micromesistius poutassou)

Exploitation status
Stock status

North Sea haddock
(Melanogrammus aeglefinus)

Exploitation status
Stock status

West of Scotland Nephrops
(Nephrops norvegicus)

Exploitation status
Stock status

North Sea cod
(Gadus morhua)

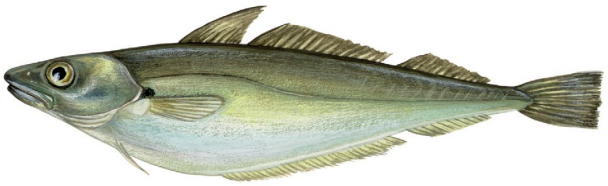
Exploitation status

Stock status

North Sea whiting
(Merlangius merlangus)

Exploitation status

Stock status



North Sea anglerfish
(Lophiidae)

Exploitation status

Stock status

Southern North Sea crab
(Cancer pagurus)

Exploitation status

Stock status

Eastern English Channel scallops
(Pecten maximus)

Exploitation status

Stock status

Advised versus prescribed TACs[z]

The implications of this analysis are considered as part of Case Study 1 (Section 5).

For **two of the stocks considered to be in good health and being exploited sustainably (haddock, Nephrops), the TAC has been set at or below the advised level for the last 4-5 years** (Figure 22). For North East Atlantic mackerel, the scientific advice has been applied for the last two years, having previously been significantly exceeded[aa].

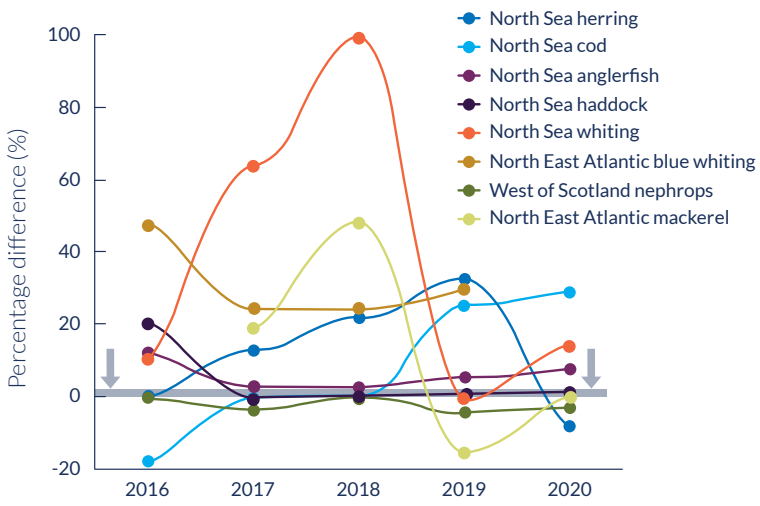


Figure 22: Difference between advised TAC and set TAC for the 'top 10' (2016-2020)

North Sea cod, which has been subject to a renewed period of recovery measures since 2019 (see Section 4.3.4), has had a TAC above scientific advice in the most recent years.

TACs for the stocks with a more mixed picture of their current status show variable trends. The TAC for North East Atlantic blue whiting[bb] was set at least 20% higher than scientific advice for the period 2016-2019, consistent with the current 'overexploited' status (Figure 21). However, the TAC for blue whiting[bb] is only partially influenced by the EU as Norway, Faroe Islands, Iceland and Russia also have significant interests in the fishery.

Discrepancy between the advised and agreed TAC for North Sea whiting was the most pronounced of all the focus stocks for the period 2016-2018.

Although there has been some improvement in recent years, the 2020 TAC was still 10% higher than that advised. Despite this, whilst the stock is being overexploited at present this is not reflected in the stock size indicator. **The increasing divergence between advised and set TAC for North Sea herring between 2016 and 2019 remains apparent in the 'critical' status of the stock size, despite the improvement in exploitation rate in 2020.**

Given the data poor status of North Sea anglerfish, it is concerning that for the majority of the time series there does not seem to have been a precautionary approach to TAC decision-making.

[z] Two of the 'top 10's stocks are non-quota, hence not included here

[aa] The % difference in 2016 could not be calculated as an overall TAC for the EU, Norway and the Faroes was not specified by the Council of Ministers.

[bb] The % difference is based on the advised total catches by ICES and the sum of the unilateral quotas. The % difference could not be calculated in 2020 because the sum of the unilateral quotas was not available.

UK TACs

The UK's relative stability share of the TACs for the focus stocks[z] ranged from 20% (North East Atlantic blue whiting) to 98% (West of Scotland Nephrops) (Figure 23). Additional insight into the relative reliance of the UK fishing industry on these stocks can be gained from the quota uptake figures e.g. how much of the UK's quota was fished by the UK fleet (Table 1). With the exception of North Sea anglerfish and West of Scotland Nephrops, almost all of the UK's initial (start of year) quota allocation, or more often in excess of that quota allocation, was caught by the UK fleet in 2019 (96-169% of starting TAC). These uptake figures are lower when compared to the end of year (final / adjusted) quota allocations because, with the exception of blue whiting and mackerel, the UK's quota increased during the fishing year[cc].

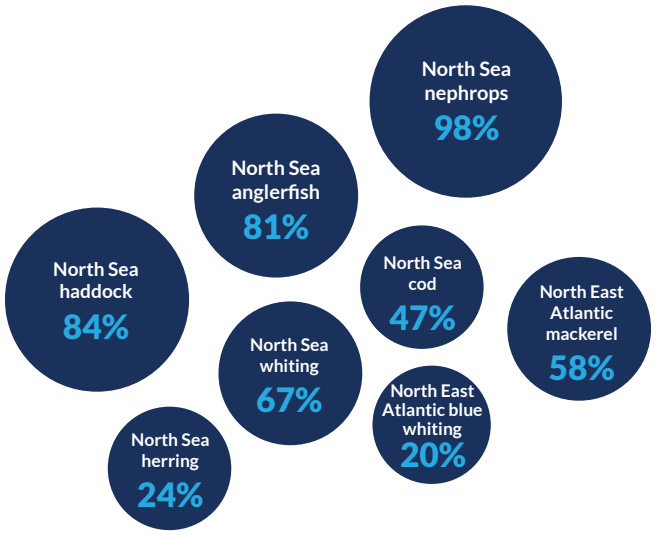


Figure 23: UK relative stability share for the 'top 10'

Looking forward, ICES advice on TACs for 2021 compared to 2020 suggest a mixed picture in terms of stock status and therefore fishing opportunities. For example, there is a significant (66%) increase in the advised North Sea haddock TAC for 2021 relative to 2020, whereas the advice for North Sea anglerfish is for a 20% decrease in permitted catches. Even between the three functional units which comprise the West of Scotland Nephrops management unit there is notable variation in the scientifically advised TAC for 2021 compared to 2020 (Table 1). The conversion of that scientific advice to the TAC is what matters and will be particularly critical for key stocks such as North Sea herring and cod where the stock is below sustainable biomass reference points.

[cc] For example, due to international swaps, quota flexibilities such as bank and borrowing, special conditions associated with TACs (e.g. transfer of quota between stocks / areas) and in-year TAC adjustments by the European AGRIFISH Council.

Table 1: Percentage uptake of UK quota in 2019 for the 'top 10' and change in the scientifically advised TAC

MANAGEMENT UNIT	% UPTAKE OF FINAL UK QUOTA IN 2019 (% OF INITIAL ALLOCATION)	% DIFFERENCE BETWEEN ADVISED TAC IN 2020 AND 2021
North Sea herring (HER/4AB)	101% (113%)	-15%
North Sea cod (COD/2A3AX4)	88% (143%)	+8%
North Sea anglerfish (ANF/2AC4-C)	48% (51%)	-20%
North Sea haddock (HAD/2AC4)	93% (116%)	+66%
North Sea whiting (WHG/2AC4)	91% (169%)	+19%
North East Atlantic blue whiting (WHB/1X14)	97% (96%)	-20%
West of Scotland Nephrops (NEP/5BC6)	57% (61%)	-17% to +18% [dd]
North East Atlantic mackerel (MAC/2CX14)	106% (101%)	-8%

Landings in 2019

Mackerel dominates UK vessel landings in UK waters, followed by North Sea herring, with the majority caught by the Scottish fleet (~81% and 75%, respectively) (Figure 24). Indeed, with the exception of Southern North Sea crab and North East Atlantic blue whiting, **Scottish registered vessels landed approximately 70-90% of the 'top 10' stocks.**

Landings by Northern Irish vessels are generally small in comparison to Scotland and to a lesser extent England. North Sea herring, West of Scotland Nephrops and in particular North East Atlantic Mackerel represent important stocks for Northern Irish vessels. Landings of these stocks by vessels administered in Wales are very low and hence do not appear on Figure 24[ee].

Approximate estimates of unsustainable catches in 2019, defined as catches (tonnes) in excess of the scientifically advised TAC, converted to a UK value based on the overall TAC share, are provided in Table 2 for the three stocks categorised as overexploited.

[dd] For the three stocks (functional units 11, 12, 13) associated with the management (TAC) unit

[ee] Indeed, Welsh registered vessels landed 1-2% of all landings by UK vessels in UK waters and abroad between 2015 and 2019, compared to 27-29% for English vessels, 62-65% for Scottish vessels and 4-7% for vessels administered in Northern Ireland. See: *https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2019*

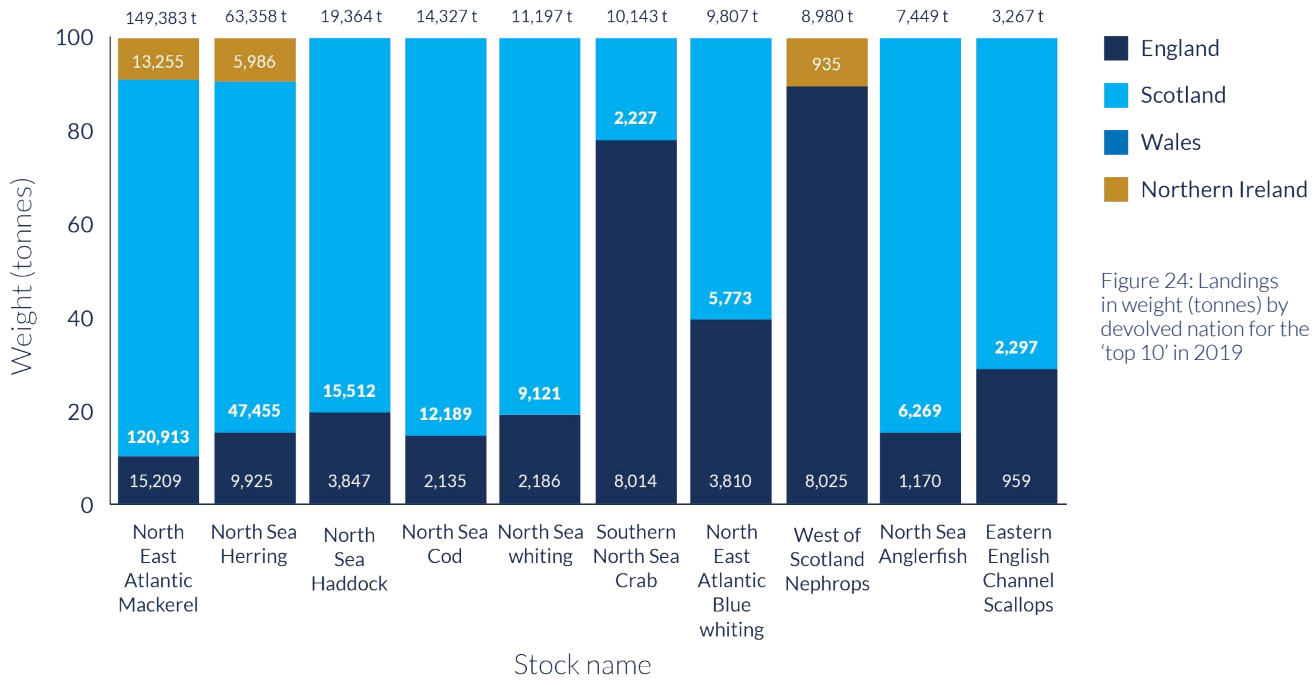


Figure 24: Landings in weight (tonnes) by devolved nation for the 'top 10' in 2019

Table 2: Approximate estimates of unsustainable landings in 2019

MANAGEMENT UNIT	ESTIMATED TOTAL WEIGHT (TONNES) OF UNSUSTAINABLE CATCHES IN 2019	ESTIMATED WEIGHT (TONNES) OF UNSUSTAINABLE LANDINGS BY THE UK FLEET IN 2019 (AS % OF TOTAL UK LANDINGS)
North Sea cod (COD/2A3AX4) [ff]	328	102 (<1%)
North Sea whiting (WHG/2AC4)	8,434	5,651 (48%)
North East Atlantic blue whiting (WHB/1X14) [gg]	339,579	13,583 (22%)

Foreign vessels targeting the 'top 10' stocks and catches outside the UK EEZ add a significant volume of catch onto those already caught by UK vessels in the UK EEZ (Figure 25). For example, on average between 2012-2016[hh] nearly 441,000 t of mackerel[ii] were landed from catches in the North East Atlantic, 72% of which was caught within the UK EEZ by foreign and UK vessels. UK vessels caught

[ff] Advised TAC in 2019 was 28204 t, TAC set at 35357 t (total of TACs for North Sea, Skagerrak and Eastern English Channel management units, in alignment with ICES stock area). ICES landings + discards for three TAC areas estimated at 35685 t. UK % share of unsustainable landings based on overall % quota share of three TAC areas (31%). Total landings for 2019 15645 t for UK vessels fishing in ICES Divisions 4a, 4b, 4c, 7d

[gg] Advised TAC in 2019 was 1,143,629 t for all fishing nations (EU, Norway, Faeroes, Iceland). ICES catch estimate 1,478,358 t. UK received 4% share of overall (sum of unilateral) TAC (rather than relative stability share of EU TAC). Total blue whiting landings in 2019 for UK vessels 60,791

[hh] Data on non-UK catches in the UK EEZ are only available from MMO statistics *(https://www.gov.uk/government/statistics/uk-commercial-sea-fisheries-landings-by-exclusive-economic-zone-of-capture-report-2019)* as an average for the period 2012-2016 and only in an aggregated form.

[ii] Also includes catches associated with the North Sea mackerel stock (MAC/2A34)

on average ~181,000 t of mackerel per year for the same period, although this is unsurprising as the UK is only allocated just over half of the TAC for this stock. **The majority (92%) of North Sea herring landings originate from UK waters, but are largely caught by EU vessels.** North Sea haddock, anglerfish and whiting landings are dominated by UK registered vessels and catches within the UK EEZ (on average, UK vessels caught around 24,000 t of haddock, 6700 t of anglerfish and 9500 t of whiting per year in UK waters between 2012 and 2016).

The Eastern English Channel scallop stock area includes the northern half of ICES subdivision 7d, where the main fishery covers a large bed which stretches across the mid-eastern part of the Channel, straddling the border between UK and France. In 2015 and 2016, landings by French vessels from this area were estimated to be approximately twice that of UK vessels[34].

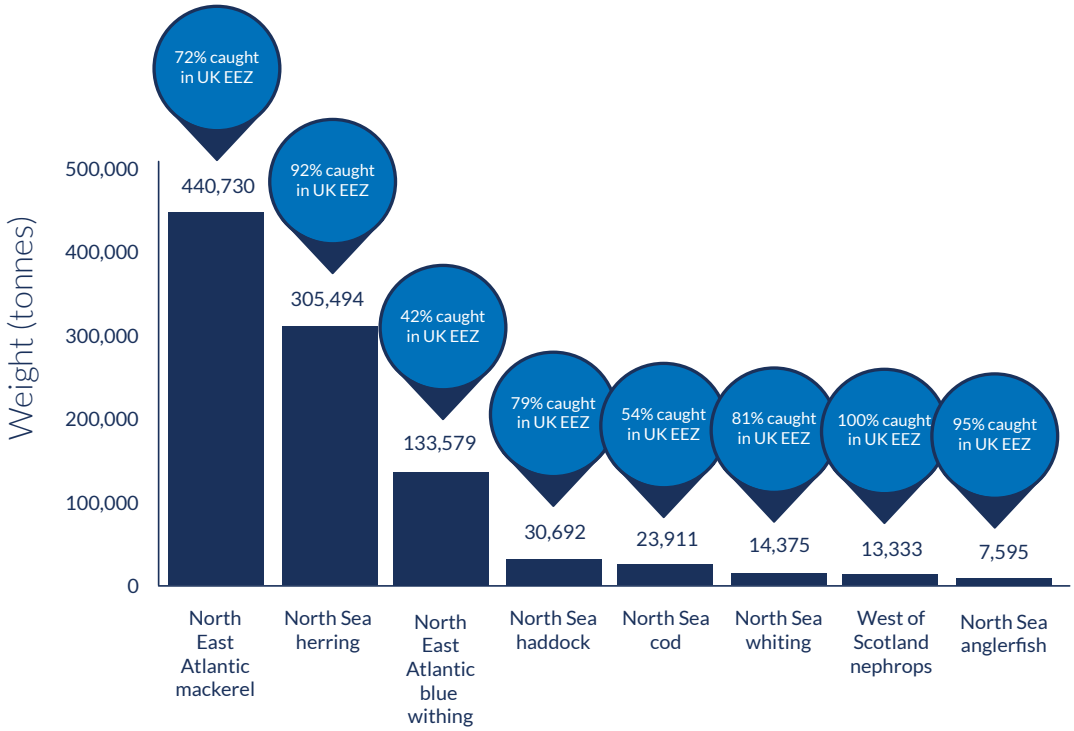


Figure 25: Landings of UK and foreign vessels of the 'top 10' in weight (tonnes) in 2019

Value of landings

In line with the volume of landings, the **annual value of mackerel caught by UK vessels in UK waters in 2019 was more than four times greater than any other species (£179 million)** (Figure 26). However, this dominance does not hold for price per tonne (Figure 27). This trend is common as pelagic species are typically caught in high volume but receive lower prices.

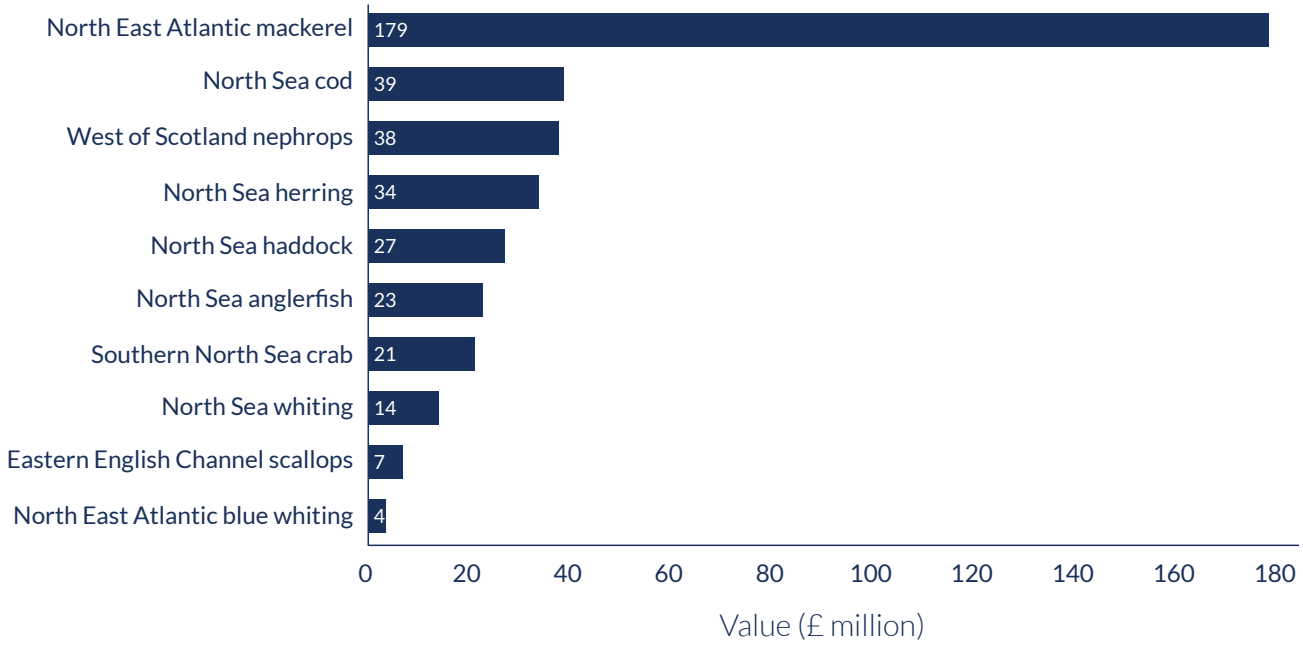


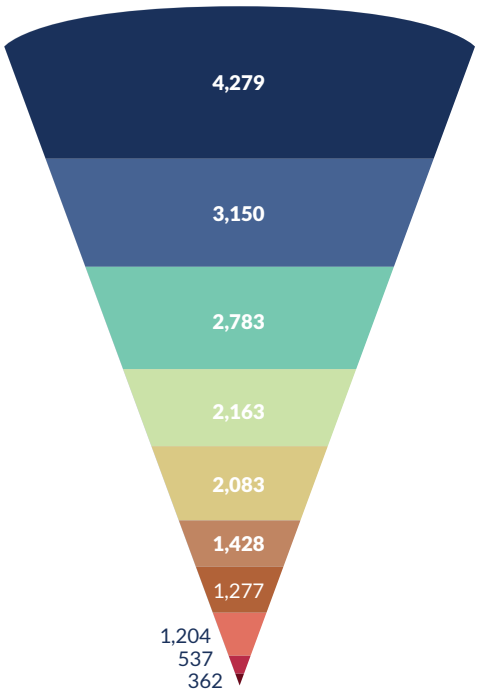
Figure 26: Annual value (£ million) of the 'top 10' by UK vessels in 2019

North Sea cod, West of Scotland Nephrops and North Sea herring had a similar overall value in 2019 (£34-£39 million) (Figure 26), **yet West of Scotland Nephrops achieved the highest price per tonne by far (£4,279).** As an iconic species, and one of the most important in UK commercial fisheries, cod also places relatively high when assessing price per tonne (Figure 27).

Anglerfish (monkfish) has a relatively low overall annual value in line with the relatively low volume of landings, although ranks second for the price per tonne (£3,150), reflecting its status as a popular, high value fish – and that the marketed product is primarily just the tail. Meanwhile, blue whiting ranks the lowest both in terms of overall value and by price per tonne, perhaps unsurprisingly as this species is generally used for fish meal and exported as a lower priced source of food. However, this is also a reflection of the relatively low catches of blue whiting by the UK fleet in UK waters compared to wider EU and international waters.

The value of non-quota shellfish stocks to the UK fishing industry is illustrated by the contribution of just two management units of scallops and edible crab to the 'top 10', despite their relatively limited geographical distribution.

For the **majority of the North Sea 'top 10' stocks,** namely mackerel, haddock, cod, herring, blue whiting and whiting, **Peterhead is the main port of landing,** followed by Lerwick and Fraserburgh, all situated on the North East coast of Scotland. Therefore, these fisheries are of high socio-economic importance to those areas in terms of employment and income



4,279 West of Scotland nephrops
3,150 North Sea anglerfish
2,783 North Sea cod
2,163 Southern North Sea crab
2,083 Eastern English Channel scallops
1,428 North Sea haddock
1,277 North Sea whiting
1,204 North East Atlantic mackerel
537 North Sea herring
362 North East Atlantic blue whiting

Figure 27: Price (£) per tonne for the 'top 10' in 2019

from the entire supply chain, e.g. catching sector through to the processing and distribution sectors. Port landings for West of Scotland Nephrops are spread over a larger geographic area, with key ports including Campbeltown, Mallaig, Stornoway and Troon. These shellfish fisheries are likely to add value to areas with limited additional industry. Key ports for Southern North Sea crab are likely to be Bridlington and Grimsby. It is more difficult to attribute scallop landings to a specific stock area because the fishery is in part comprised of large (≥15m) nomadic vessels[34]

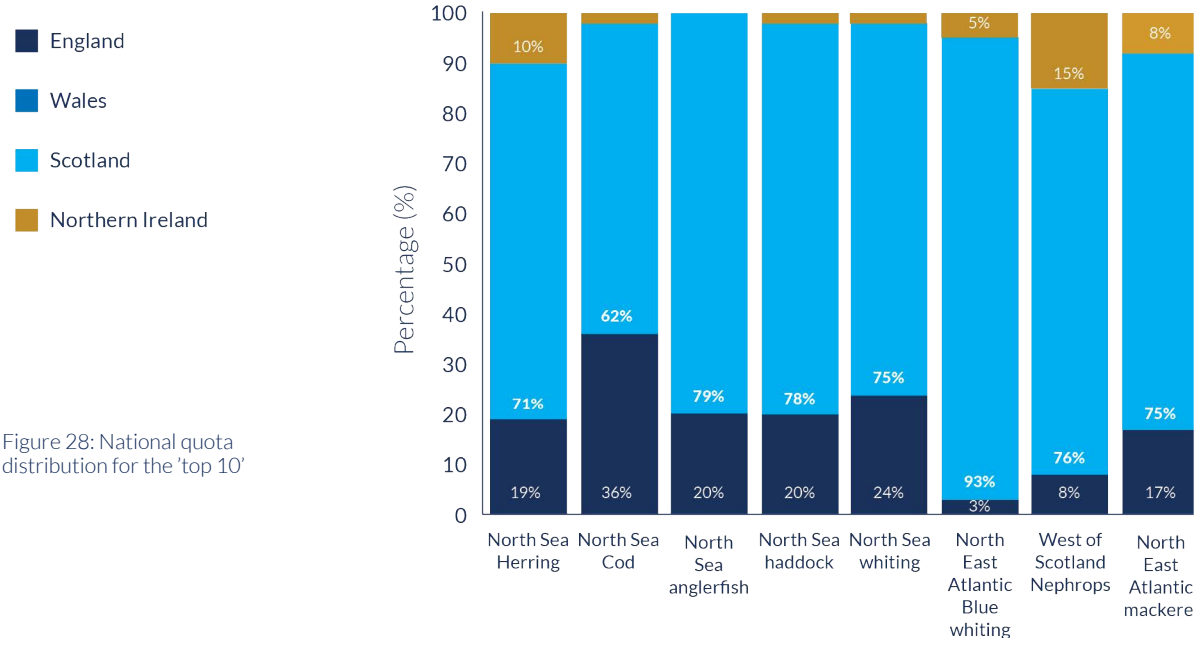


Figure 28: National quota distribution for the 'top 10'

National quota distribution

In alignment with the national distribution of landings, **Scotland** receives the **largest proportion of quota** between the four fisheries administrations (Figure 28)[jj] . The largest proportion appointed is for **North East Atlantic blue whiting (93%),** although Scottish landings represent approximately 60% by weight (Figure 24), suggesting for example a notable amount of domestic and/or international swapping of quota for this stock. England receives the second largest proportion of quota, however still considerably less than Scotland with the largest share being 36% for North Sea cod. Again, the landings values indicate a different end of year distribution of fishing effort compared to the starting allocations. Northern Ireland receives between 1% and 15% for each stock with the largest share assigned to West of Scotland Nephrops, whereas Wales is allocated a tiny fraction (0-0.2%).

4.3.2 Best performers

All five top performing stocks (Irish Sea herring and haddock, North Sea megrim and plaice, Western English Channel sole) currently have healthy stock sizes, are sustainably exploited[t] and have been for the past three years. In addition, there was high confidence in these indicator assessments as they are ICES 'data sufficient' stocks with defined MSY reference points. All five stocks are shared with the EU fleet[kk].

Advised versus prescribed TACs

The implications of this analysis are considered as part of Case Study 1 (Section 5).

All top performing stocks, with the exception of North Sea megrim since 2018 and Irish Sea haddock in 2016, had their TACs set at levels advised by ICES or below. A notable improvement in decision-making was evident for Irish Sea haddock between 2016 and 2017, which has since been maintained (Figure 29). The current trend in TAC setting for North Sea megrim needs to be monitored, including impacts on the stock.

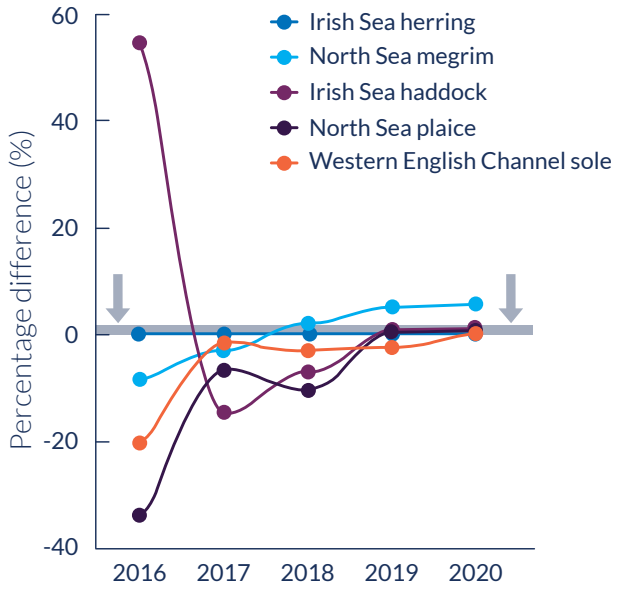


Figure 29: Difference between advised TAC and set TAC for the top performing stocks (2016-2020)

[jj] King scallops and crabs are non-quota species, hence are not included in the analysis

[kk] North Sea plaice is also shared with Norway

National quota distribution

The UK's quota for the two Irish sea stocks is largely allocated to the Northern Ireland fleet, whereas for the two North Sea stocks it is split in contrasting proportions between the English and Scottish fisheries administrations. Almost all the UK's quota for Western English Channel sole is initially allocated to the English fleet. Once again, Wales hardly features in the quota allocation for these stocks (Figure 30).

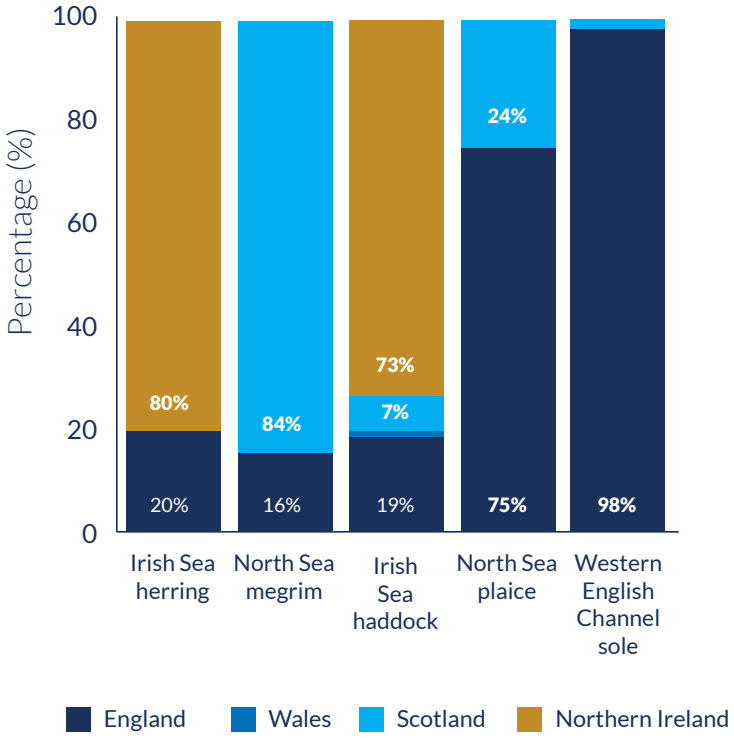


Figure 30: National quota distribution of the top performing stocks

Landings in 2019

In comparison with the majority of the 'top 10' stocks, UK landings (in UK waters) are considerably less for the five top performing stocks (Figure 31). The highest landings in 2019 were for Irish Sea herring (4,479 t) which, if compared to the 'top 10' stocks, would fall second to last.

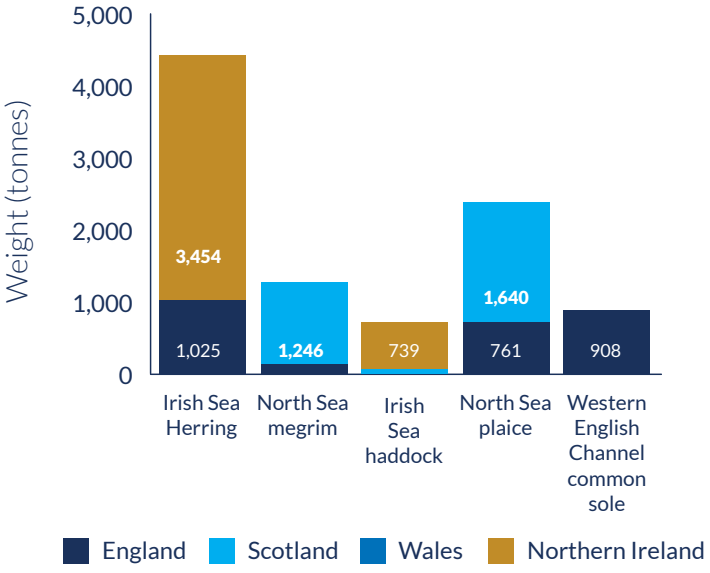


Figure 31: Landings (tonnes) of UK vessels in UK waters of the top performing stocks in 2019

Landings of Irish Sea haddock in 2019 were only around 740 t for the UK fleet, however this is significantly more than 2013-2016 during which time landings increased from 100 to 480 t. There are indications that it is becoming an important fishery for the East coast of Ireland. Landings by the Republic of Ireland fleet have similarly increased in recent years and are considered a reflection of the stock's recovery, which has been attributed to significant reductions in discarding of juvenile haddock by the Nephrops fishery following the introduction of more selective gear[35].

Similarly to the 10 focus stocks, the initial distribution of UK quota across the four fisheries administrations (Figure 30) did not necessarily translate to the total landings (Figure 31). This was most obviously the case for North Sea plaice. For example, whereas England received 75% of the plaice quota, English registered vessels landed 32% of the total landings compared to Scotland's 68% after an initial allocation of 24% of the UK quota.

Value of landings

Western English Channel common sole yielded the highest annual value and price per tonne of all the focus stocks by a significant margin in 2019 (£12 million value; £13,366 per tonne) (Figure 32 and 33). This is likely down to the very strong market demand, particularly from mainland Europe. Brixham, Newlyn and Plymouth are the key ports at which this stock is landed, all of which are well placed for exporting.

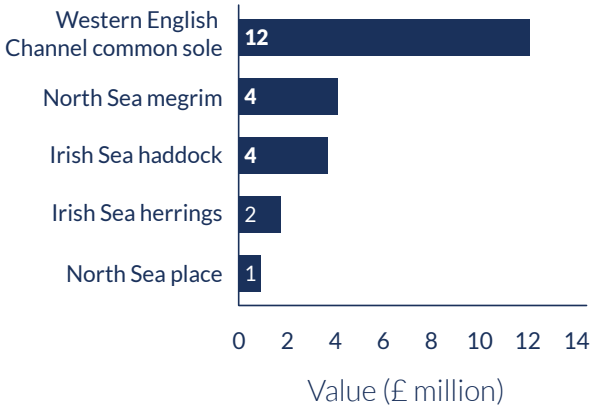


Figure 32: Annual landings value (£ million) for the best performers in 2019

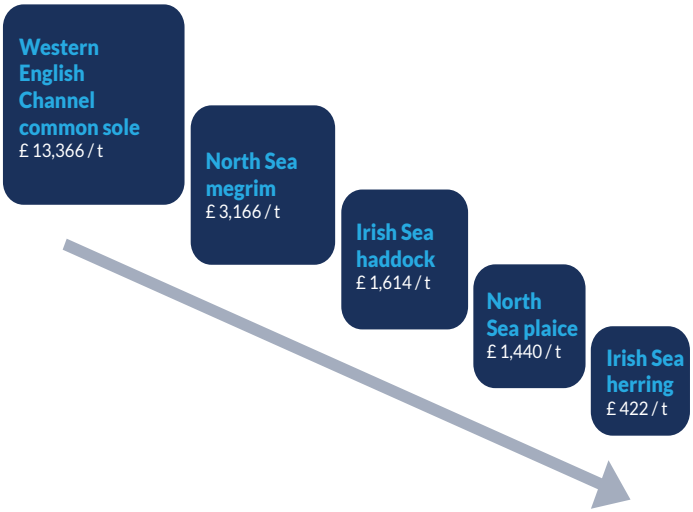


Figure 33: Price (£) per tonne for the best performing stocks in 2019

North Sea megrim and Irish Sea haddock both had an annual value of around £4 million in 2019, yet the price per tonne for megrim was considerably higher than haddock and was comparable to many stocks in the 'top 10'. Herring (similarly to blue whiting) is a cheaper source of food protein, most of which is exported to Norway or the Netherlands, receiving the lowest price of £422 per tonne in 2019.

Similarly to the 'top 10' stocks, North Sea megrim and North Sea plaice are predominantly landed at Peterhead and Lerwick. Irish Sea Haddock and Irish Sea herring have differing key ports, the former being Kilkeel, and the latter being Belfast and Ardglass.

4.3.3 Worst performers

All five worst performing stocks (all shared with the EU fleet[II]: North Sea and Eastern English Channel cod, West of Scotland cod, Celtic Sea cod, North East Atlantic horse mackerel, Irish Sea whiting) currently have critical stock sizes, are unsustainably exploited and have been for the past three years. In addition, there was high confidence in these indicator assessments as they are ICES 'data sufficient' stocks with defined MSY reference points.

Advised versus prescribed TACs

The overall picture for the five worst performing stocks is one of the advised TACs being exceeded, particularly for Celtic Sea cod and North East Atlantic horse mackerel early in the time series and North Sea cod more recently (Figure 34). North Sea cod has been subject to a renewed period of recovery measures since 2019. Whilst not plotted, the recurrent scientific advice for zero catches of Irish Sea whiting and West of Scotland cod, as well as Celtic Sea cod in 2019 and 2020, have also been exceeded through the setting of bycatch TACs (see Section 4.3.4 and Case Study 1 in Section 5 for further discussion).

National quota distribution

The majority of the UK's quota for the worst performing stocks is held by Scotland and England, with the exception of Irish Sea whiting which is allocated to Northern Ireland. Again, Wales has at most a tiny share of the fishing opportunities for these select quota stocks (Figure 35).

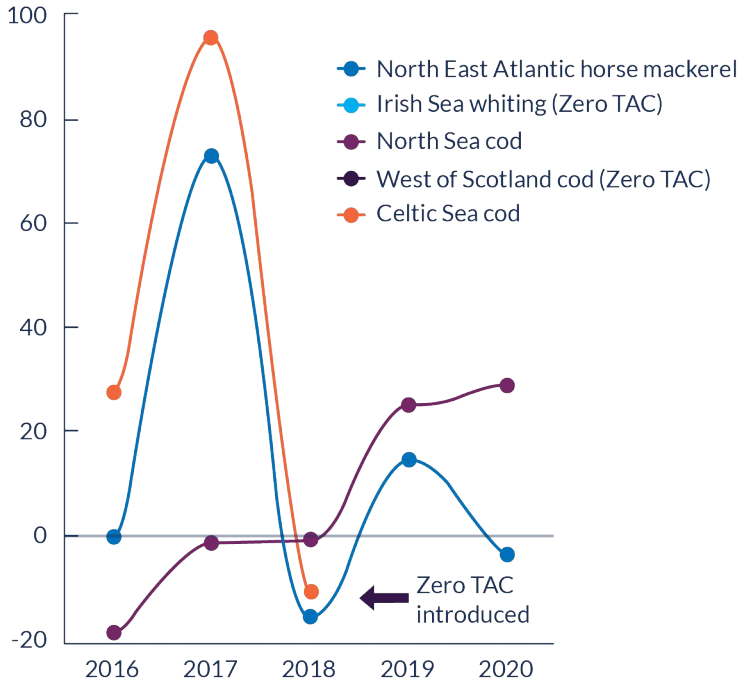


Figure 34: Difference between advised TAC and set TAC for the worst performing stocks (2016-2020)

[II] The TAC for North Sea cod is also shared with Norway and the TAC for North East Atlantic horse mackerel is also shared with the Faroe Islands

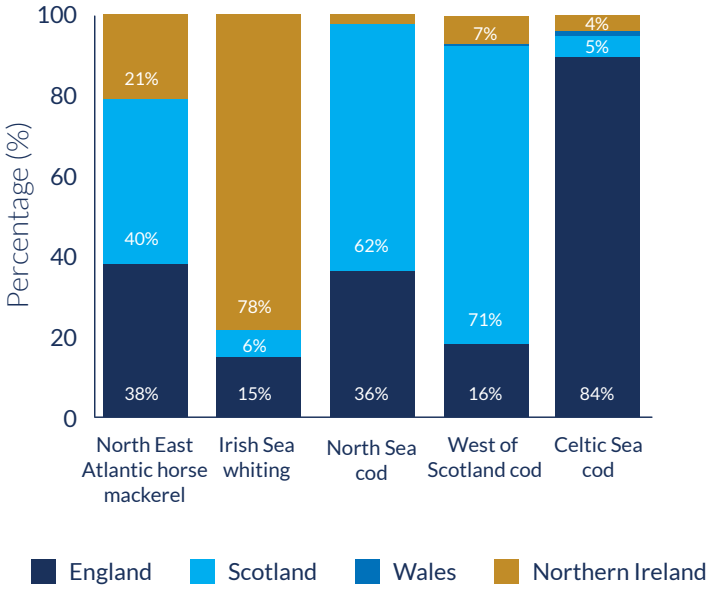


Figure 35: National quota distribution of the worst performing stocks

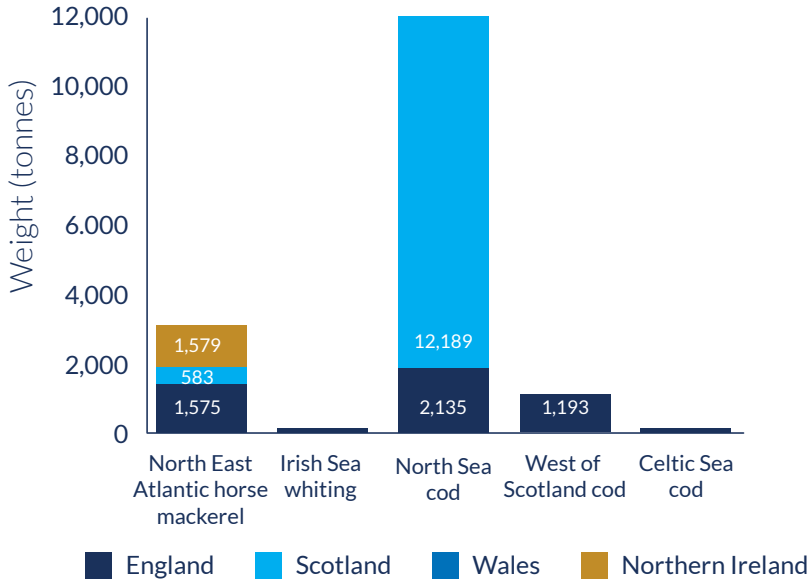


Figure 36: Landings (tonnes) of UK vessels in UK waters of the worst performing stocks in 2019

Landings in 2019

With the exception of North Sea cod, UK landings of the worst performing stocks are relatively low (Figure 36). For Celtic Sea cod, West of Scotland cod and Irish Sea whiting, the TAC is only permitted to cover bycatches of these depleted stocks, which are mainly associated with the Celtic Sea mixed otter trawl fishery targeting haddock and whiting, the West of Scotland mixed demersal trawl fisheries targeting haddock, saithe and anglerfish and the West of Scotland Nephrops fishery, and the Irish Sea Nephrops trawl fishery,

respectively (see Case Study 2 in Section 5). The UK held a 47% relative stability share in North Sea cod which amounted in 14,327 t being landed in 2019. This was a decrease from the ~19,500 t landed in 2018, reflective of the recent decline in stock biomass and the associated recovery measures. The UK also held a relatively large share of the EU TAC for Irish Sea whiting and West of Scotland cod (45% and 60%, respectively), but for Celtic Sea cod and North East Atlantic horse mackerel the UK's share of the TAC was minor (7% and 9% respectively).

Value of landings

The three cod stocks are associated with the highest annual prices of around £3,000 per tonne, whereas North East Atlantic horse mackerel fetched the lowest price at £645 per tonne (Figure 37). However, because landings of horse mackerel were notably higher than the bycatch only stocks (albeit still low relative to North Sea cod and the other 'top 10' stocks) (Figures 24 and 36), the relative ranking of the worst performing stocks in terms of annual value in 2019 (Figure 38) does not follow the trend in price per tonne (Figure 37). Whilst once primarily destined for fish oil/meal production, in recent years fisheries for horse mackerel are targeting the human consumption market.

Figure 37: Price (£) per tonne for the worst performing stocks in 2019

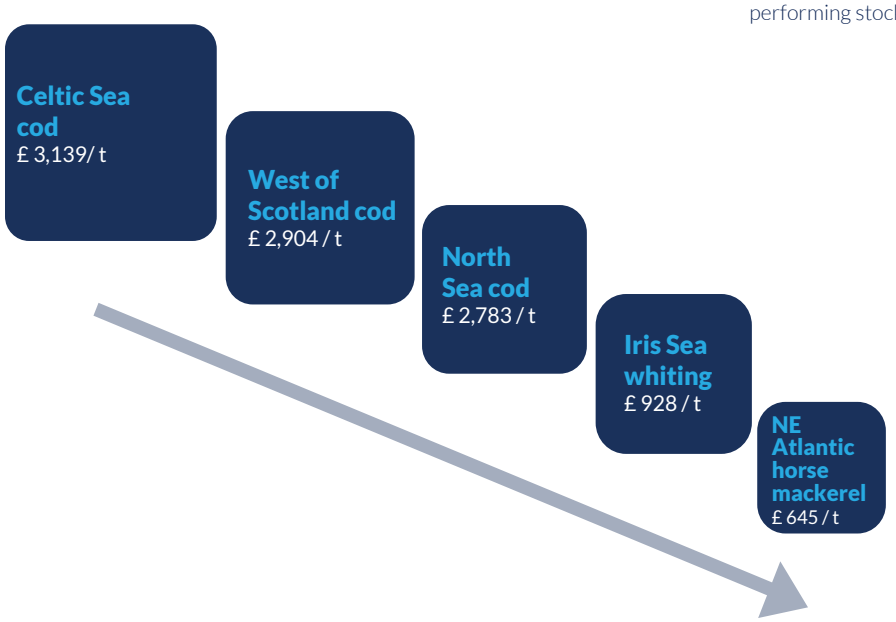
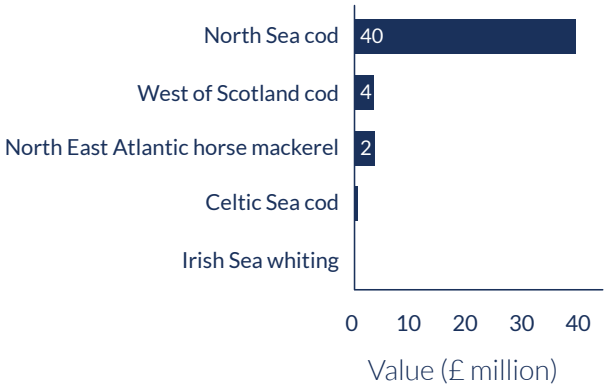


Figure 38: Annual landings value (£ million) for the worst performers in 2019



4.3.4 Concerned about cod?

Historically, cod has been one of the most important commercial fish stocks in the North Atlantic. A series of stock declines and collapses, linked primarily to unsustainable fishing pressure and more recently additive effects of unfavourable climatic conditions, have led to various management responses with variable - mainly unsuccessful - outcomes. The objective of this section of the report is to provide a brief history of the successes and failures for this symbolic fish species in European waters, the demise of which poses significant ecological and socio-economic consequences.

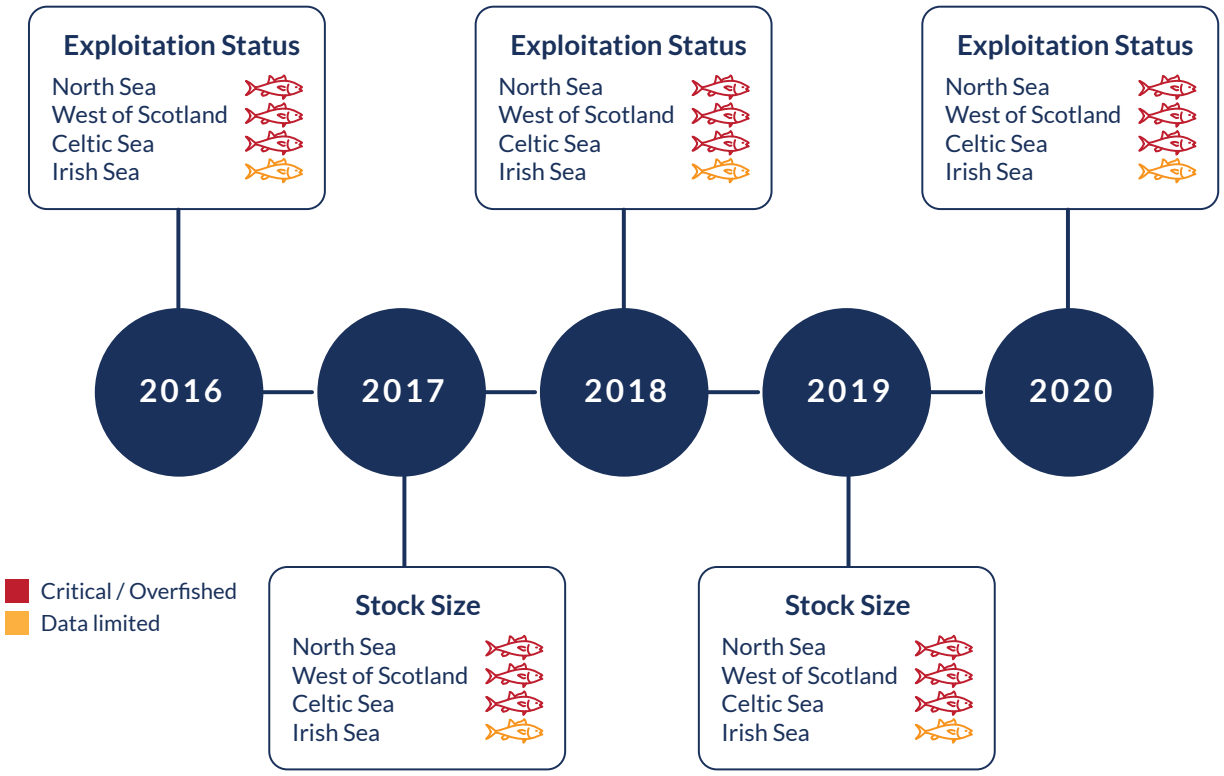


Figure 39: History of cod stock status and exploitation status (same categorisation for each stock each year) 2016 – 2020 (exploitation status only to 2019)

Cod stocks across European waters are in a critical state according to scientific advice. Indicators of stock status and exploitation are 'Critical' and 'Overfished' for three of the four stocks (five management units) considered here - Irish Sea cod, however, does not have defined reference points (Figure 39).

In 2018-2019, UK consumers purchased around 59,300 t of cod with a retail value of over £480 million, making it the 3rd most popular seafood resource sold in retail (after tuna and salmon). It also topped the list of imported marine species by value[36]. Those figures are not limited to Atlantic cod, however, the importance of this species[mm] overall is shown by the UK landings and imports data. In 2018, cod imports to the UK predominantly originated from Iceland[36], where Atlantic cod is sustainably managed, and imports from Norway and Iceland represented 38% of total cod imports by weight in 2019[19]. Domestically, cod ranked 8th by weight (~16,000 t) for UK vessel landings from the UK EEZ in 2019 and 6th by value (£44 million). Less than 2% of cod was caught by 10 m and under vessels (Figure 7) and most was caught by the Scottish fleet (Figure 40). In terms of UK seafood exports, cod plays a lesser role, representing around 3% of the overall value and volume in 2018 and 2019[19,36].

[mm] Atlantic cod (Gadus morhua) is one of several 'cod' species of imported into the UK

With climate change likely to be affecting cod's resilience to fishing mortality, effective recovery plans are needed more urgently than ever. However, because the majority of the cod stocks are now primarily caught as bycatch in valuable fisheries, as discussed in Case Study 2 (Section 5), such measures will require a shift in the balance from socio-economic priorities to ones that are actively fighting the corner of healthy ocean ecosystems, although if done successfully the longer-term benefits would be less selective.

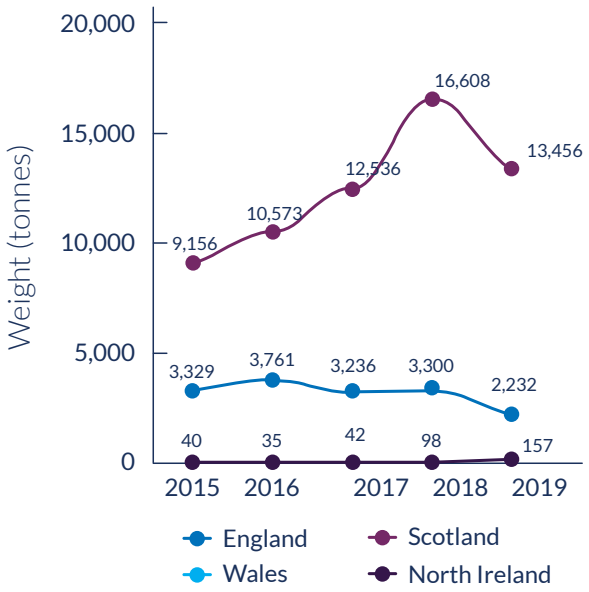


Figure 40: Total volume of cod landings by devolved nation (2016-2019)

Irish Sea cod (COD/07A)

There has been a continuous decline in the Spawning Stock Biomass (SSB) of Irish Sea cod (ICES Division 7a) since the early 1990s, which is currently close to its lowest level (Figure 41). The stock, which is the edge of Atlantic cod's southern limit, has been subject to increasingly restrictive advice on fishing mortality since the late 1980s, with zero catch advice since 2000, until 2018 and 2019 when there was a sudden jump up to 800-1000 t in response to apparently positive trends in biomass and fishing mortality in the preceding years. However, a subsequent change in assessment methodology, downgrading of the stock's data quality status and removal of the previously defined MSY reference points, coincided with advised catches in 2020 and 2021 falling to around 100 t[37].

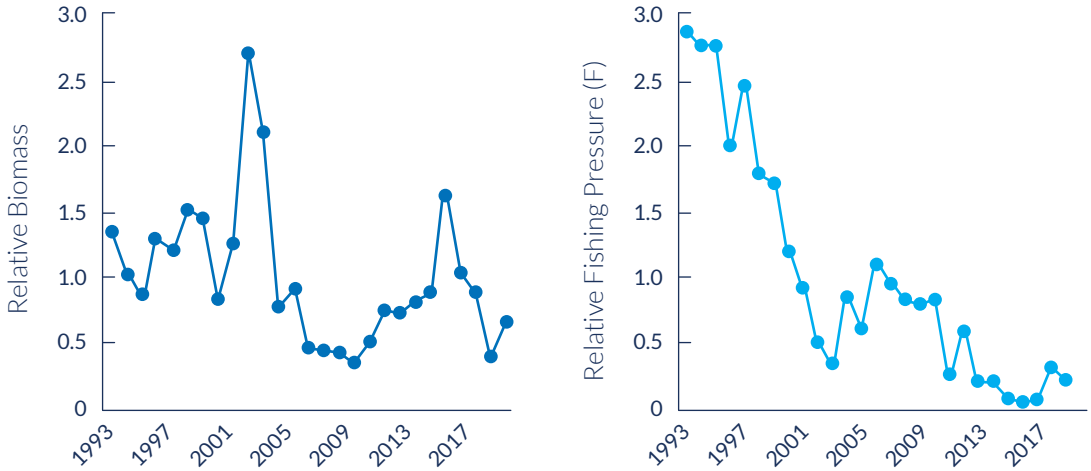


Figure 41: Timeseries of relative biomass and fishing pressure for Irish Sea cod (1993-2019)

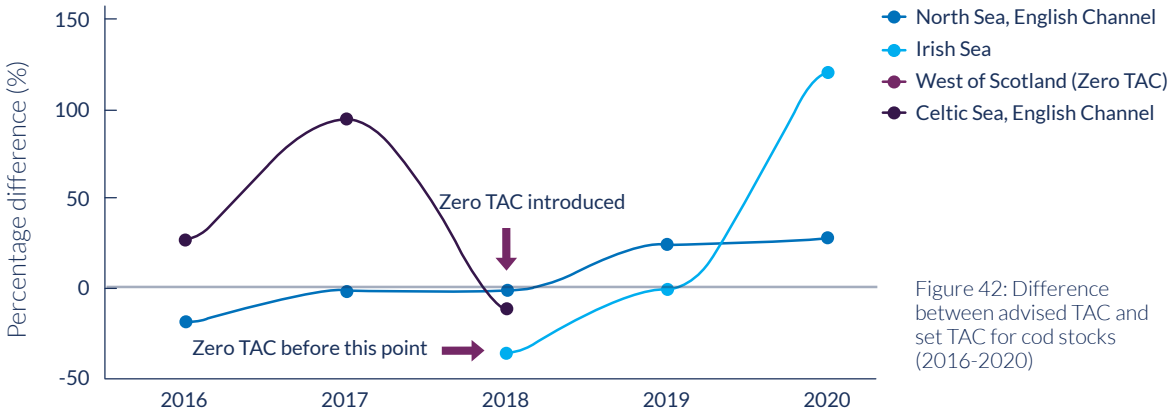


Figure 42: Difference between advised TAC and set TAC for cod stocks (2016-2020)

TACs are exclusively for bycatch; no targeted fisheries are allowed. In the years when ICES advised zero catches (e.g. 2016-17), small bycatch TACs (146 t) were set by the AGRIFISH Council. When advice changed in 2018, the TAC also increased notably but it remained below the assessment estimates. Since then it has crept up again to beyond that advised by scientists (Figure 42).

Catches of cod in the Irish sea are mainly associated with otter trawls fishing for demersal fish species and Nephrops, with Republic of Ireland and UK vessels largely responsible. The average discard rate is estimated to be around 30%, the majority of which are associated with the Nephrops fishery[38]. The majority (~68%) of the UK's share (29%) of the EU bycatch TAC went to the Northern Ireland fleet (Figure 43), for which reported landings ranged between 26 t in 2016 and 153 t in 2019.

Recovery measures were first introduced by the EU in 2000 in response to serious depletion of four cod stocks[nn] and have included seasonal and area-based closures to protect the spawning stock, technical gear (selectivity) measures and, until 2017, effort restriction, along with a harvest control rule with the unmet objective of restoring the stock biomass to a minimum precautionary level at the same time as restricting variability in TACs[39]. Attempts to manage fishing mortality through the cod recovery plan[oo], which came to an end in 2018[40], are now enacted through the Western Waters MAP[15] (since 2019) and other regulations such as the technical conservation 'tech con' regulation and North-Western Waters discard plan[42].

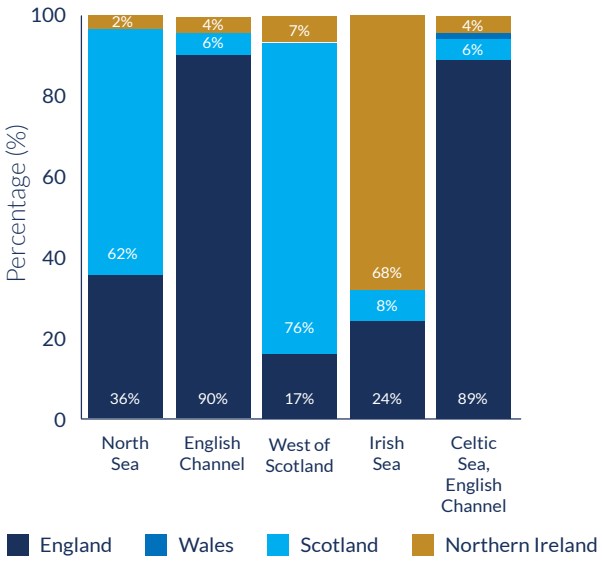


Figure 43: National distribution of UK cod stock quota

[nn] Irish Sea, West of Scotland, North Sea and Kattegat

[oo] Initially recovery plan Council Regulation (EC) No 423/2004 *(https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004R0423&from=EN)*, later replaced by long-term plan Council Regulation (EC) No 1342/2008 (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008R1342&from=EN)

West of Scotland cod (COD/5BE6A)

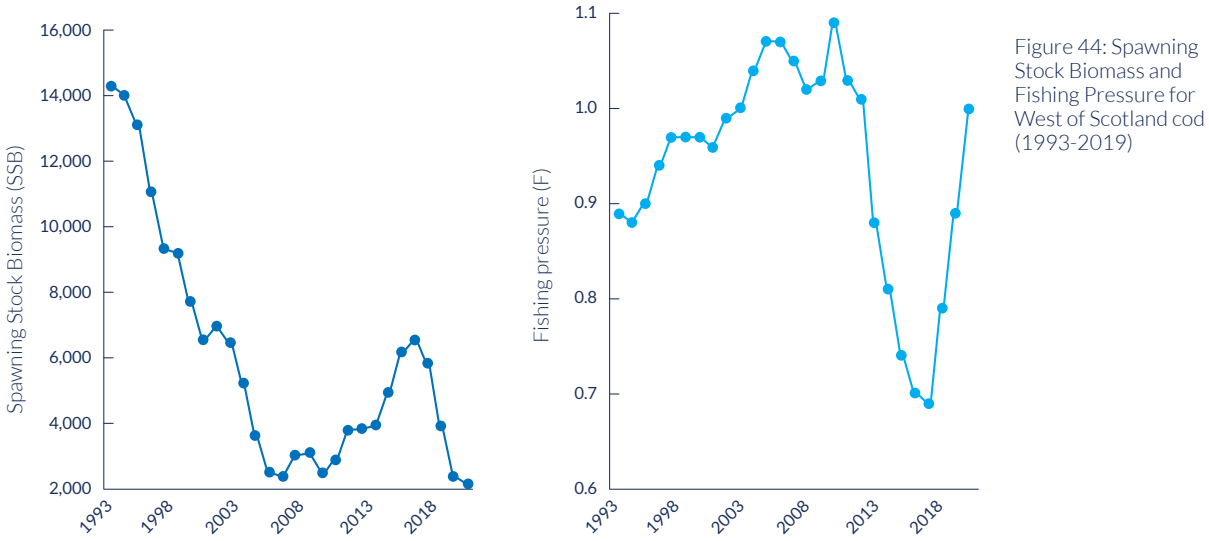


Figure 44: Spawning Stock Biomass and Fishing Pressure for West of Scotland cod (1993-2019)

The biomass of West of Scotland cod (ICES Division 6a) has also declined over (at least) the last four decades and the stock shows no sign of recovery (Figure 44), despite the measures under the EU's cod recovery plan and more recently the Western Waters MAP, etc (see Irish Sea cod). In response to very low recruitment since 2001 and SSB being below B_{lim} since 1993, ICES has advised zero target catches since 2003, following years of restrictions on fishing mortality[43].

Most cod landings are associated with the mixed demersal trawl fisheries targeting haddock, saithe and anglerfish, although cod only comprises around 1% of the total catches for this fishery. An estimated 45% of discards result from the Nephrops fleet, with the overall discard rate thought to be around 9%[44]. Area-misreported landings (catches taken in Division 6a but reported elsewhere) have been estimated to account for over 40% of the total landings in recent years. Unreported discarding of below minimum size cod, which under the Landing Obligation should have been landed since 2019, is also suspected[45]. ICES estimates total catches to have fluctuated between 2100 t and 4200 t since 2016, from a stock that is estimated to have had a SSB of between ~2500 and 6600 t for the same period (95% confidence interval range ~1500 to 8000 t)[43]. Landings by the UK fleet, predominantly Scottish vessels, have represented between 53-82% of official EU values in recent years, reflective of the UK's 60% relative stability share and application of Hague Preference (see Section 2), as well as the internal quota allocation between the fisheries administrations (Figure 43).

As discussed in Case Study 2 (Section 5), Member States of the North Western Waters Regional Group are required to develop and implement a bycatch reduction plan for West of Scotland cod, as a condition to the bycatch TACs set by the AGRIFISH Council[46]. Progress to date has been criticised[47], although the plan did include technical measures for the West of Scotland that have subsequently been incorporated into the discard plan[42]. The Scottish government and fishing industry are investigating further technical solutions, such as a bycatch avoidance tool[48] and gear selectivity measures, the outcomes of which are not yet clear[49].

Whilst the percentage difference between advised and agreed TACs cannot be calculated (due to zero catch advice), fishing pressure continues to be above MSY and precautionary reference points[43]. ICES advice on catch scenarios for zero TAC stocks estimates that if the advised TAC reductions in 2021 for West of Scotland haddock and particularly saithe (-1.5% and -21%, respectively) are implemented by the AGRIFISH Council, then a similar reduction in fishing mortality on cod will follow, and a 17-30% increase in SSB could be seen in 2022[44]. These predictions illustrate that continuation of setting TACs above scientifically advised levels will not only be detrimental to the stocks themselves (Case Study 1, Section 5), but also those other species that are inadvertently associated with the fisheries in question.

Celtic Sea cod (COD/7XAD34)

Unfortunately, the picture does not get any more positive for cod in the Celtic Sea (ICES Divisions 7b-c, e-k[pp]) (Figure 45). The SSB has been below B_{lim} since 2017, and fishing mortality has not fallen below F_{MSY} since the stock has been assessed, and has even been above F_{lim} in recent years. Even with zero catch, the scientific advice for 2019 - 2021, the stock was estimated to be well below B_{lim} in 2020 and is anticipated to stay that way in 2021[50]. Significant overshoots of the advised TAC occurred prior to the zero catch advice (2016, 2017), with bycatch only TACs set by the AGRIFISH Council in response to the recent advice (807 and 805 t in 2019 and 2020, respectively).

Celtic Sea cod are mainly caught as bycatch in the mixed otter trawl fishery targeting haddock and whiting. Cod are caught by Irish, French, UK and Belgian vessels with the UK receiving 7% of the TAC under relative stability. Total catches were estimated at around 4700 t in 2015 declining to 1550 t in 2018, with typically in the region of 90% of the catch landed. UK (mainly English, Figure 43) landings have ranged between around 259 t in 2016 and 62 t between in 2019.

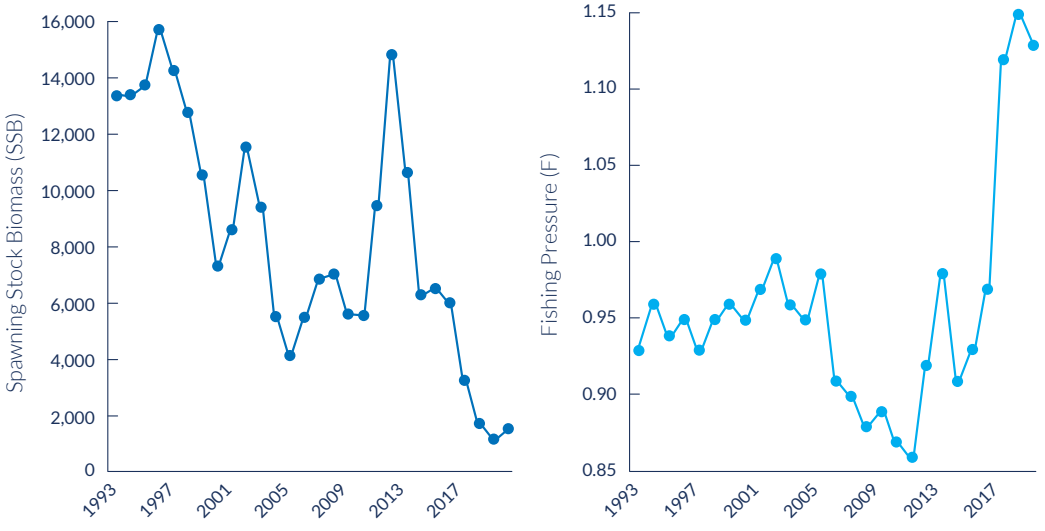


Figure 45: Spawning Stock Biomass and Fishing Pressure for Celtic Sea cod (1993-2019)

[pp] Division 7e also categorised as the Western English Channel.

Unlike the other cod stocks considered in this report, Celtic Sea cod were not part of the former EU cod long-term plan. The stock now falls under the Western Waters MAP and selective gear measures are specified for certain fisheries in the Celtic Sea Protection Zone[42, 51], although again little more has been achieved through the North Western Waters bycatch reduction plan. Seasonal closure of the Trevose Box, which includes the main cod spawning area in the eastern Celtic Sea, a fishing industry led initiative which has been implemented since 2005, is likely to have had positive effects. However, those have not been quantified[52,53], and collectively these measures are evidently insufficient to buffer the continued level of fishing mortality across the whole stock.

North Sea cod (COD/2A3AX4)

The North Sea has long been the most important source of cod catches for the EU, with the UK holding a 47% share in the annual Union TAC. Given its contribution to the UK's landings, North Sea cod features in the 'top 10' stocks but because of its status it is also one of the five worst performers (see Sections 4.3.1 and 4.3.3). The majority of the UK's quota is held by Scotland (Figure 43), which resulted in over 12,000 t of cod being landed by Scottish vessels in 2019 and an additional 2,100 t by English vessels (catches in UK waters only), with an approximate value of £40 million.

However, those figures represent a 27% decrease by weight and 13% by value compared to 2018, because of recent cuts in the North Sea cod TAC in response to

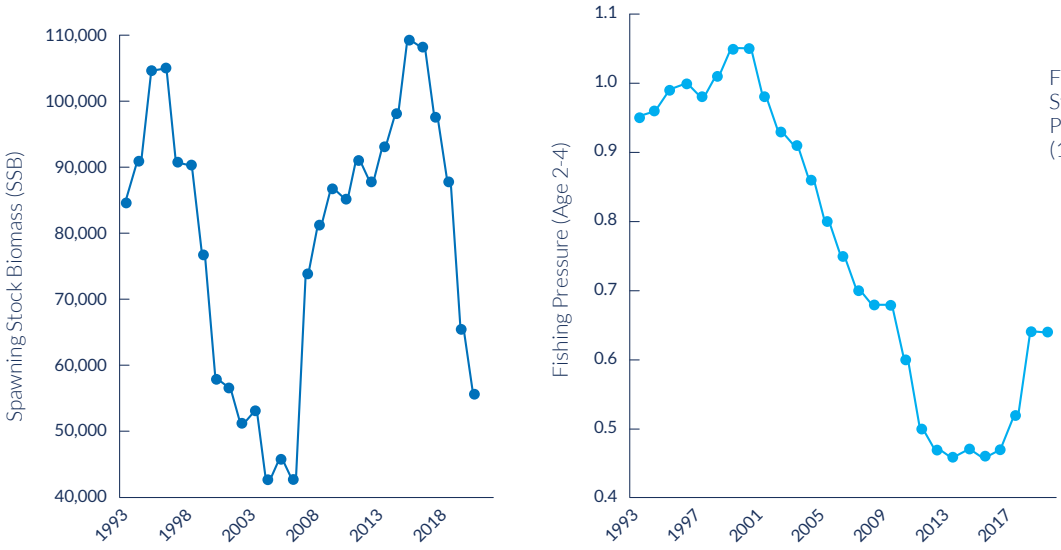


Figure 46: Spawning Stock Biomass and Fishing Pressure for North Sea cod (1993-2019)

a decline in the stock's status[qq]. But such comparison greatly masks North Sea cod's troubled past as whilst the SSB was estimated to be around 110,000 t in 2015/2016, it had been around 260,000 t in the early 1970s.

It is not the first time the stock has shown signs of overexploitation – the stock has been in the process of recovering since 2007, having reached a historical low in SSB (reaching ~43,000 t in 2006). The current stock depletion has not quite reached those levels but given the rapid downward trend that has been observed since 2017, it is still possible (Figure 46). Regardless, the SSB of North Sea cod has likely been below MSY $B_{trigger}$ since the early 1980s and below B_{lim} since the late '80s, except for 2015 and 2016, with consistently low recruitment since the mid '90s[54].

[qq] The TAC decreased by 32% between 2018 and 2019 and then by 50% between 2019 and 2020 (although the EU had sought a reduction of 61% to which Norway did not agree: *https://ec.europa.eu/fisheries/press/eu-and-norway-reach-agreement-fisheries-arrangements-2020_en).*

Management measures in the 2000s under the cod recovery plan, which included restricted TACs, technical measures (e.g. more selective mesh sizes and area closures) and complementary effort management regulations, were hailed a success and in 2017 it was certified by the Marine Stewardship Council (MSC)[55,rr]. However, the EU's long term management plan (which essentially replaced the original cod recovery plan in 2008)[oo] had been criticised because fishing mortality objectives were not met, largely due to inadvertent incentives created by landings quotas to continue overfishing and discard over-quota catch[ss] and insufficiently restrictive effort limitations[56,57].

The 2019 MAP for the North Sea establishes a mixed species management plan for the North Sea, with objectives that include reaching and maintaining MSY for target stocks, implementation of the landing obligation and an ecosystem-based approach to fisheries management[14]. Management measures, beyond the TAC reduction[qq], are being developed and negotiated between the affected Member States, Norway and European Commission in response to the recent stock decline. There are encouraging signs of positive institutional-industry collaborations to find solutions[58], including commitment by the Scottish fishing industry to a Fishery Improvement Project[55], which hopefully will draw on the lessons learnt from the previous management plans in order to set the stock on a speedy path to recovery.

In doing so, there are many complex factors that will need to be taken into consideration through the application of best available scientific evidence. These range from, for example, effective implementation of the discard ban in order that total mortality on the stock can be monitored and controlled, accounting for sub-population structure in order to avoid further loss of diversity and consideration of the role of climate change versus fishing pressure on cod distribution and recovery potential[54,59,60].

[rr] MSC certification for North Sea cod was however suspended in 2019

[ss] North Sea cod are caught as part of a mixed fishery. Therefore, quotas based on landings rather than catches result in discarding of the more quota restricted species, whilst quota is still available for others caught in the mixed fishery. There is also no incentive for more selective catches under such a system.

5. Environmental impact case studies

The purpose of this section is to consider five issues associated with UK fisheries and their management which have negative implications for the environment and sustainable fishing. In doing so, potential opportunities for improvements following Brexit, as well as further risks, are highlighted.

5.1 Case study: Advised versus prescribed TACs

A key legally binding commitment of the CFP is to end overfishing by 2020 by ensuring stocks are fished at a level that is MSY compatible. Whilst progress has been made, that objective has not be met in full because TACs have continued to be set above levels advised by the scientific community. The UK will have contributed to that failure as a member of the EU. However, the UK government promised to set 'a gold standard for sustainable fishing around the world' in the wake of Brexit. This can only be delivered by ensuring catches of shared stocks are fully aligned with scientific advice.

The key management method for fish stocks exploited by the EU fleet is output control through catch quotas – TACs. For most stocks shared by the UK, those TACs are set by the AGRIFISH Council during the annual December meeting, the result of the combined influence of the underlying scientific advice from ICES, the European Commission's proposal and Member State's contributions to the political negotiations. Previous reports have provided detailed analyses of the differences in advised versus agreed TACs.

Based on their analysis of 2015-2020, ClientEarth[10] found the percentage of set TACs that exceeded the scientific advice was 48% in 2020, although that 'overshoot' had dropped steadily from 73% in 2016. The magnitude of that overshoot (how much greater the agreed TAC was than the advised catch) had declined from ca. 13% in 2015 to 6% in 2020, although prior to 2020 the overshoot was consistently multiple times higher than the % 'undershoot' (where TACs followed the scientific advice). A closer look at the figures revealed that for those stocks where advice is based on the ICES precautionary approach or its approach to data limited stocks, higher TACs were agreed than had been advised for 82-87% of stocks between 2015 and 2019 and 71% in 2020, whereas where the advice was based on MSY reference points this figure was 25% in 2020. Also, in 2020, the proportion of stocks where the advised TAC was exceeded continued to be considerably higher for economically less important bycatch stocks compared to target stocks, indicating lower ambitions for sustainability[10]. Further, zero catches and/or no targeted fisheries were advised for 15 depleted stocks in 2020. In all cases, that advice was exceeded[61]. An earlier study[62] with wider geographical scope similarly found that 55%

of agreed TACs were set above ICES advice in 2017 and that 30% of 2017 TACs were more than double the scientific advice. Therefore, whilst progress has been made in recent years, far more is still needed to ensure that TACs are aligned with scientific advice, despite the agreed – and missed – 2020 deadline to end overfishing[10,61].

Whilst a detailed addition to these comprehensive reviews was beyond the scope of this report, we have investigated advised versus agreed TACs for the focus stocks (see Section 4)[tt]. Those analyses have shown that for the UK's 'top 10' and five worst performing stocks, the majority of TACs for the period 2016-2020 were above levels advised by ICES, with percentage differences varying from small (<5%) to significant (100%) depending on the stock and year. Whilst there was a mixed picture in terms of change over time overall, there appears to have been an improvement in 2019/2020, particularly for those stocks which had previously shown the most dramatic divergence from the advised levels. Worryingly, the notable exception to this trend was North Sea cod for which the TAC was 25-30% higher than the advised TAC (reduction) in recent years, following political negotiations between the EU and Norway (see Section 4.3.4).

Whilst the Irish Sea cod TAC is for bycatch only, it significantly exceeded the scientific advice in 2020, despite the worrying stock status. Similarly, although the percentage difference is not calculated as the advice was for a zero TAC, the permitted bycatch TACs for Irish Sea whiting, West of Scotland and Celtic Sea cod are clearly inconsistent with that scientific advice. As discussed in Case Study 2 below, this is an illustration of the trade-offs in mixed fisheries.

All top performing stocks, except for North Sea megrim since 2018 (5-6% above advised TAC) and Irish Sea haddock in 2016, had their TACs set at levels advised by ICES or, commonly, below (3-34% below advised TAC) during the period 2016-2020.

Therefore, an important observation from these analyses was that there appeared to be a general relationship between current stock status and differences between advised versus prescribed TAC, with those stocks considered to be in better state and exploited sustainably having been subject to TACs that were largely set at or below the scientifically advised levels.

Quantification of the influence of different Member States on the decision-making process for unsustainable TACs has been attempted, but is difficult due to lack of transparency[10]. Whilst a few other Member States were ranked higher, the UK was identified as one of the more vocal countries in pushing for higher TACs. Further, comparison of the Member States with the highest percentage of their TAC in excess of scientific advice ranked the UK as 7th in 2020, with that placing increasing to 3rd by total excess tonnage (2.1%, amounting to 12,207 t). Whilst these figures vary between years, the UK has frequently featured in the 'league table' since 2001[63].

Going forward, the UK will be negotiating quota with the EU in a very different capacity. Both parties

[tt] Excluding the non-quota Southern North Sea crab and Eastern English Channel scallops

will negotiate annually to agree the TACs for shared stocks. Under this scenario, the UK voice has the scope to have a very different tone. Concerns[64] are rapidly rising amongst the green community that the lack of firm environmental sustainable principles in the recent UK Fisheries Act1 (superscript), already absent in the original Fisheries Bill proposal[65], will enable the UK to seek - and set - unsustainable catch limits. Brexit still offers an opportunity for the UK government to actively demonstrate its 'commitment to sustainable fisheries for future generations' and to 'set a gold standard for sustainable fishing around the world[66]. The UK has a chance to put sustainability at the forefront of its independence and being a positive influence on catch limits is an obvious way to start.

5.2 Case study: Trade-offs in mixed fisheries

Fisheries that catch more than one fish species at a time are termed mixed fisheries. They can have advantages and disadvantages for both fisheries management and fishermen. Striking a balance between wanted and unwanted catch is inherently difficult in true mixed fisheries, particularly when the bycatch species should be subject to recovery measures. That is the dilemma facing decision-makers over the management of several mixed fisheries in the Celtic Sea, West of Scotland and Irish Sea where bycatch species are subject to zero TACs and bycatch reduction has been specified by the AGRIFISH Council of the EU.

Member State unwillingness to meet this requirement has been apparent, with political reluctance to prioritise the environment over socio-economics clearly the stumbling block. This trade-off is particularly evident in the Irish Sea where fishing pressure from the Nephrops fishery is preventing the recovery of whiting but further selectivity improvements, or other mortality reducing measures, would result in loss of revenue. The UK is now able to take its own independent decisions and if they are going to meet the vision for sustainability set out in the Fisheries White Paper, short-term losses may have to be shouldered by current fishermen for the sake of those who will come after them.

Few fisheries are truly 'single stock' operations or 'clean' in terms of their catches. For most, the catch hauled onto the vessel is typically a mixture of target and non-target species, the latter of which they may or may not be permitted to sell due to quota entitlements or minimum landing sizes, and/or may or may not want to sell due to market preferences and prices. Discarding of the unwanted portion of the catch has therefore always been a feature of these mixed fisheries. Bycatch and discarding pose a major threat to sustainable fisheries by negatively impacting

biodiversity, fish populations, ecosystems, and contributing to overfishing[67]. In addition, discarding is considered a waste of resources, unethical and a loss of scientific information[68,69,70]. As a result, the EU fully introduced the Landing Obligation (LO) under the CFP in 2019 following a phased introduction. Under the LO, discarding of species subject to catch limits is not permitted except under certain conditions, and instead all catches must be landed and counted against quota allocations (where applicable)[12].

Significant concerns over the ongoing lack of tangible implementation of the LO by all Member States, including the UK, have been raised[71]. This has shone a brighter light on a key problem associated with the mixed fisheries which characterise the EU fishing industry – bycatch of weak stocks. Under the LO, these depleted stocks pose the greatest 'choke risks' to the affected fleets – whereby application of the LO would mean vessels have to cease fishing prematurely due to insufficient quota to cover their non-target catches. In recent years, some of the weakest stocks (West of Scotland cod and whiting, Celtic Sea cod and plaice, Irish Sea whiting), caught as bycatch in some of the UK's most socio-economically important mixed fisheries, have received zero TAC advice from ICES and so have been subject to intense political discussions over mitigation measures for the resulting choke risks[72].

Such negotiations have in part focused on options for allocating the ensuing bycatch only TACs amongst the affected Member States. Those TACs are a key trade-off in mixed fisheries management as they are inherently linked to the potential catch of the more abundant (typically, but not always, target) species; the more limiting one must be, the more limited the other should be. However, scientific advice on mixed fisheries (rather than single stock assessments) to inform such decisions remains limited to a few stocks / fisheries[73,74]. These five zero catch advice stocks, mainly gadoids, are predominantly associated with the demersal trawl fisheries targeting haddock, saithe and anglerfish West of Scotland (cod, whiting) and anglerfish and megrim in the Celtic Sea (cod, also plaice[74,uu]), and the Irish Sea and West of Scotland Nephrops fisheries (whiting).

Essential to the TAC negotiations for these stocks was the requirement for Member States to jointly develop bycatch reduction plans through the North Western Waters Regional Group. The plans, which will need to include technical solutions[46], have been heavily criticised[47,75]. Therein lies another trade-off in mixed fisheries; where gear modifications could be introduced that reduce the unwanted catch, but at the same time result in losses of the target species which in the case of Nephrops may also include some fish catches[67,76,77,78,79]. The Irish Sea Nephrops fishery is a key example of this political dilemma.

Nephrops, also called Dublin Bay prawn, Norwegian lobster, langoustine and scampi, is a key commercial species for the EU fleet in the North East Atlantic.

[uu] Also caught as bycatch by bottom trawls targeting gadoids, beam trawl and seine net fisheries

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The UK fishing industry alone landed approximately 32,700 t in 2019, with a value of more than £109 million[26.] These fisheries are known for their bycatch issues and are therefore considered mixed fisheries; the North East Atlantic Nephrops trawl fishery was ranked as number eight among the top twenty fisheries with the highest recorded discard ratios and as number five based on gear type[80]. The scale of the bycatch issue may be greater in some areas when considering invertebrate bycatch. On one of the fishing grounds in the Clyde Sea area, Nephrops represented just 4% of the catch biomass on average, with fish discards representing 36% and invertebrates the remaining 60%[81]. A discard rate of 43%, with whiting representing 72% of the discards by weight, was reported for the Nephrops fishery off the North-East coast of England[82]. Regulations and innovation[83] are striving for higher selectivity in these fisheries, but there is some way to go, and in the meantime the recovery of bycatch stocks continues to be hindered[84.]

Whilst the smallest of the three management (TAC) units[vv], the Irish Sea (NEP/07) Nephrops fishery is an important fishery for Northern Ireland in particular[85], as well as the Republic of Ireland[67]. In 2019, 97% of the discards and 84% of the catch of Irish Sea whiting originated from the Nephrops-directed bottom-trawl fisheries, the majority of which was undersized (below the EU minimum conservation reference size). The whiting stock has remained well below B_{lim}[ww] since

[vv] EU waters of 2a and 4 (NEP/2AC4-C), 6; EU and int. waters of 5b (NEP/5BC6) and 7 (NEP/07)

[ww] The reference point Blim is the stock size below which there is a high risk of reduced recruitment

the mid-1990s[44]. Whilst the introduction of highly selective gear requirements in the Nephrops fishery[86] are thought to have reduced whiting catches in recent years, fishing pressure remains above the level which would enable the stock to rebuild[87].

Further gear selectivity improvements, to reduce unwanted catches of juvenile whiting, have been trialled with promising results[67]. However, such changes may well be at the cost of wanted catch. Implementing them also requires further investment by the fishing industry in what has always been an uncertain business. So should selective gear requirements be voluntary, perhaps incentivised by for example additional quota, or should they simply be universally mandatory? And should that only occur when there is good understanding of their economic impacts or sooner on a precautionary basis, for example given the fragile state of the whiting stock? Does it ultimately have to come down to decision makers making, hopefully informed, judgements over trade-offs between socio-economics and ecology?

These politically sensitive decisions are even more complex when multiple players, with different interests and objectives, are involved. The UK's independence offers an opportunity for the UK government to take tough decisions that tip the balance in the favour of the environment, because ultimately short-term pain for long-term gain is what will achieve 'sustainable fisheries for future generations[4].

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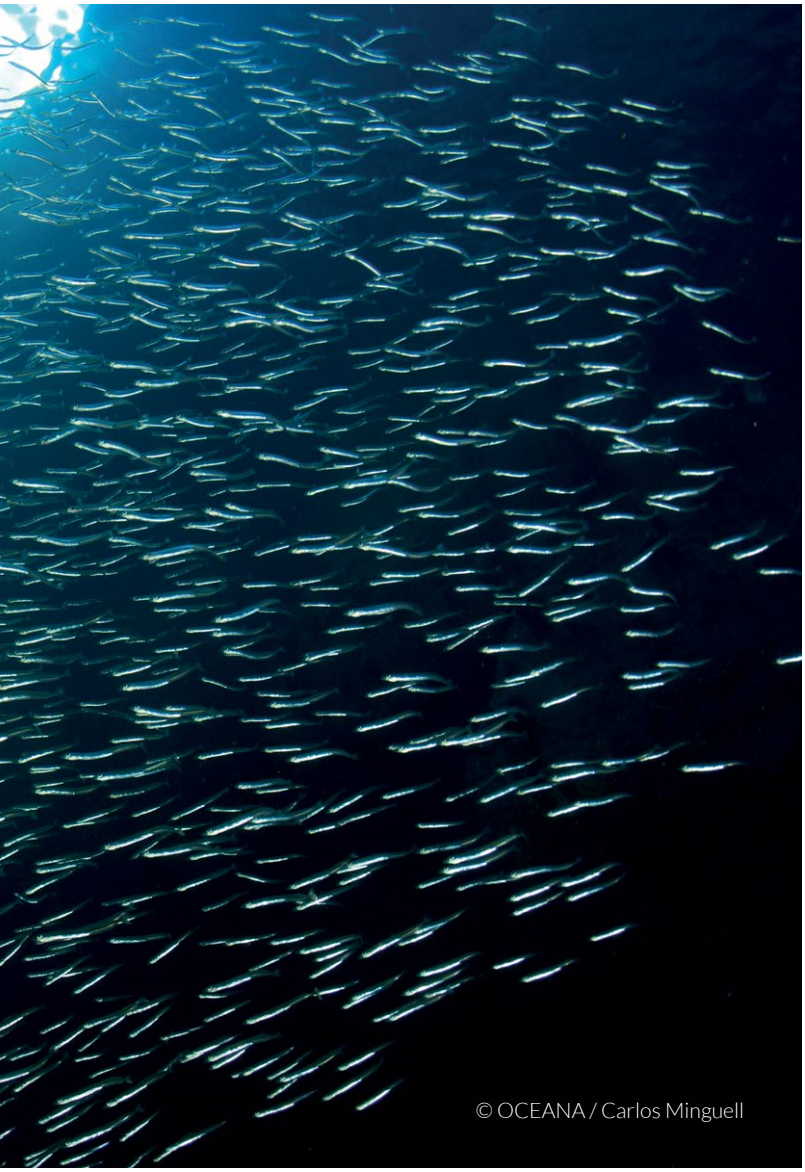
5.3 Case study: Competition between predators – sandeels in the North Sea

Sandeels are an essential component of the North Sea ecosystem, supporting populations of other fish, mammals and seabirds. Localised overfishing has led to depletion of subpopulations and climate change is likely to put further pressure on sandeel populations and their predators in the future. Scientific advice is that current management strategies are unsuitable. The implications of unsustainable fishing practices in UK and EU shared waters are significant for the UK's marine and coastal ecosystems. Brexit offers an opportunity for the UK to demonstrate better practice by accommodating the ecological importance of the species when implementing or influencing future management strategies.



Sandeels, like other forage fish, are a crucial component of the North Sea ecosystem, being key species that transfer energy from zooplankton to larger fish (such as haddock and horse mackerel), marine mammals (including minke whale and grey seals) and seabirds (for example puffins and sandwich terns)[88,89,90,91]. Sandeels, predominantly *Ammodytes marinus*, are targeted by fishing fleets from Denmark, Norway, Sweden, UK and Germany, with Denmark catching more than 70% of the annual total landings[92]. As a result of the EU relative stability key, where quota allocation among nations was determined based on past records, Denmark controls more than 90% of the quota for sandeels in UK waters. This is largely destined for processing into fishmeal.

The fishery for sandeels expanded significantly in the 1970s and was not constrained by TACs until 2006. Landings between 1994 and 2002 averaged 880,000 t, but fell to 300,000 t for the period 2003 to 2016[92]. Since the late 1980s, a growing evidence base has identified a link between the success or failure of seabird breeding and the availability and quality of sandeels[93]. As a result, areas rich in sandeels within about 100km of seabird colonies have been the focus of concern, as overfishing risks local depletion of reproductively isolated subpopulations[98].

Localised overfishing and reduced breeding success of seabirds led to the closure of an area of water east of Scotland to commercial fishing for sandeels in 2000[94]. Despite an initial bounce-back in the years immediately after the closure, a combination of factors (a population depleted by unsustainable fishing, consumption by predators, natural mortality and changing food availability) prevented this subpopulation from recovering[89,94]. With climate change forecast to further alter food availability for sandeels and therefore seabirds, there is a strong rationale to implement precautionary management measures that adequately account for dependent predators. Another issue is the sustainability of the fishmeal and activities which the sandeels supply in Denmark, most notably salmon, mink and pig farms. All have sustainability issues, including the tonnage of fishmeal needed per ton of salmon[95,96,97].

Shared management of the sandeel fishery on the Dogger Bank may become an increasingly contentious issue now the UK has left the EU. The Danish fleet extracts a substantial volume of sandeels from the area of the Dogger Bank within UK waters. Currently there is no precautionary management plan[98,99]

and under-reporting of catches has until recently been a problem[98]. The current approach to management is an escapement strategy where efforts are made to maintain the spawning stock biomass above the MSY $B_{trigger}$ after the year's fishing has happened[98]. ICES advise that this approach is not sustainable without a ceiling on fishing mortality, which currently does not exist[98].

The UK's status as a fully independent coastal state provides an opportunity to demonstrate better practice by accommodating the ecological importance of the species when implementing or influencing future management strategies[100]. Options discussed range from spatial closures close to seabird breeding colonies during the breeding season, allocation of 'quota' to sandeel predators to closing the fishery entirely. But this requires an explicit commitment to an ecosystem-based approach to sustainability and to following scientific advice when determining fishing opportunities.

5.4 Case study: Caught in the net - cetacean bycatch

Accidental catches of dolphins, porpoise and whales in fishing gear is a global problem, which the European fishing fleet make an indefensible contribution to. Bycatch and mortality estimates strongly indicate possible population level impacts in European waters, especially the NE Atlantic. Common dolphin mortality inferred from strandings on France's Western Channel coastline alone in 2018 was estimated to be between 3400 and 10,500 individuals, alongside an estimated annual bycatch in the Celtic Sea of around 720 individuals (range 278-1345) and 3973 (range 1998-6599) in the Bay of Biscay and Iberian Peninsula.

However, confidence in estimates is generally severely hindered by low levels of monitoring, despite legal requirements. The UK has gone to more effort than other EU countries to address the issue, but there is more required to ensure cetacean bycatch by the vessels fishing in UK waters is avoided where possible. That work could become a flagship achievement of the UK's new fisheries management framework, although it will not be possible without international collaboration.

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Each year, high numbers of dolphins, whales and harbour porpoise *(Phocoena phocoena)* die in fishing nets in European waters, resulting in a major conservation and welfare concern[101]. Tackling this bycatch issue is an essential component of achieving sustainable and responsible fisheries. In the Celtic Sea, where most net fishing effort is undertaken by the UK [xx,103], the bycatch mortality rate of harbour porpoise is likely to exceed the precautionary threshold (1% of population abundance[104]). Common dolphin *(Delphinus delphis)* mortality in the same ecoregion, primarily due to bottom otter trawls and gillnets, is considered to be impacting at the population level too[105].

The UK's Cetacean Strandings Investigation Programme[106] recorded 503 stranded harbour porpoise and 186 common dolphins in 2018, with bycatch as the identified cause of death accounting for between 0-40% and 24-33% of those strandings[yy], respectively, depending on the location[105,107]. The current best estimate[zz] of porpoise bycatch in all UK

[xx] In the UK, static net fisheries (set gillnets, drift gillnets, trammel nets and tangle nets) are recognised as having the highest rates of marine mammal bycatch, though some very specific and local issues have been identified in other types of UK fisheries. Overall, it is clear that the majority of marine mammal bycatch in UK fisheries occur in gillnet fisheries.

[yy] Strandings schemes provide useful supplementary evidence of bycatch, however it is not always possible to attribute the cause of death

[zz] These estimates are however associated with notable limitations due to necessary assumptions to enable extrapolation of the available data to the fleet level, which may introduce bias to the estimates, therefore affecting confidence in these estimates *http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2018/WGBYC/wgbyc_2018.pdf*

gillnet fisheries is 1250 (range 606–3114) animals if all over 12 m boats used pingers in relevant areas (higher if they do not). Bycatch estimates for common dolphins in the Celtic Seas alone are 720 individuals (95% confidence interval range 278-1345) per year for the period 2016-2018 and 3973 (95% CI 1998-6599) in the Bay of Biscay and Iberian Peninsula ecoregion. Common dolphin mortality inferred from strandings on France's Bay Western Channel coastline in 2018 was estimated to be between 3400 and 10,500 individuals[108].

Despite various legal requirements developed over the past few decades including the Habitats Directive[109] and Marine Strategy Framework Directive[110], there has been limited implementation to deliver effective monitoring or mitigation by EU Member States[101]. Estimating the total number of individuals caught across entire fishing fleets is challenging due to low observer coverage and the scarcity of detailed data on the distribution of fishing effort[111]. This means that fleets which pose the greatest risk of bycatch are generally under-sampled and so bycatch is underestimated. Even in 2018, the quality and scope of Member States' reports on the implementation of the EU's cetacean bycatch regulations[aaa] remained varied, with most countries lacking dedicated observer programmes[bbb,105]. Whilst bycatch estimates remain uncertain and patchy, the case for mitigation remains weak and cetaceans and other protected species will continue to be inadvertently killed by fishing activities.

On a more positive note, the UK is leading the way in terms of commitments to the current legislative requirements. It was considered to be the only EU country to be fully compliant with the pinger requirements[aaa] and to have a long-running, dedicated observer programme for protected species bycatch monitoring[105,107], although observer coverage across the UK fleet is still very low (<1%). In 2004, the UK banned the use of pair trawls (typically used to fish for seabass) within 12 miles of the south-west coast of England, due to high levels of common dolphin bycatch[112]. However, despite the UK's efforts, further improvements are required in ICES Division 7e (western English Channel), particularly for gill nets, due to the relatively high fishing effort and bycatch risk[105]. Accurate information on net fishing effort is needed to inform Bycatch Risk Assessments, for all vessel sizes[107]. Increased sampling of smaller

[aaa] EU Regulation 812/2004, at that time. The Regulation had two components, one specifying the use of Acoustic Deterrent Devices (ADDs or 'pingers') on vessels of 12 m or over in certain métiers; the other setting out on board observer monitoring requirements for vessels of 15 m or over [for specified fisheries and under certain conditions]. Member States were also obliged to establish Pilot or Scientific Studies on some smaller vessels, and to report annually to the European Commission on their implementation of the regulation. In June 2019, this regulation was repealed by the new Technical Conservation Measures Regulation (EU 2019/1241). The former requirements were largely carried over to the new regulation, which has the objective to minimise, or where possible eliminate, incidental catches of sensitive marine species such that they do not pose a threat to the species' conservation status. Additional monitoring and mitigation obligations to reduce protected species bycatch are set out within the EU Habitats Directive (although the implementation of this regulation has been formally challenged by eNGOs: *https://uk.whales.org/2019/07/10/wdc-leads-call-for-eu-commission-to-take-legal-action-against-15-governments-over-dolphin-deaths/)* and revised Commission Decision 2017/8483 relating to the implementation of the MSFD, and specifically the assessment of Good Environmental Status.

[bbb] Most commonly, observer data on cetacean bycatch originate from more general fisheries observer programmes under the EU Data Collection Framework Regulation 2017/1004 *(https://datacollection.jrc.ec.europa.eu/legislation/current/obligations)* as part of the Multiannual Plan *https://datacollection.jrc.ec.europa.eu/dc/fleet/eum*

[ccc] Although the use of pingers is mandatory for EU fishing vessels over 12m, such vessels only represented 2% by number of those UK vessels deploying static nets in 2017 *(https://research-repository.st-andrews.ac.uk/handle/10023/6855).* This is despite vessels both under and over 12m fishing where harbour porpoises are known to be present *(https://doi.org/10.1017/S002531541100155X).*

vessels (< 12 m) should also be a priority as they likely account for a significant proportion of bycatch[ccc], as is the use of pingers in high risk areas to reduce bycatch of harbour porpoise[113], despite the lack of EU legislative requirements for such activities on the smaller inshore fleet[aaa]. For other species, management strategies need to consider other mitigation measures, including effort reductions, time/area closures, bycatch reduction devices and use of alternative or modified gears[114], all of which are dependent on commitments to long-term, reliable monitoring programmes linked to mitigation strategies.

In order to tackle cetacean bycatch in UK waters, the UK Government has said they are developing a coherent and coordinated, stakeholder-led approach to minimise cetacean bycatch[115] and in 2017 committed to development of a cetacean bycatch strategy[116]. It is imperative that the UK's efforts continue beyond EU membership, but moreover are demonstrably effective at tackling the issue of marine mammal bycatch in UK waters within agreed timeframes. To do so, those activities need to recognise that political boundaries are irrelevant to the animals affected, and need to treat the EU requirements as minimum standards to be exceeded as evidence of the UK's ambition to become "a world leader in managing our resources while protecting the marine environment"[117,118].

5.5 Case study: Ploughing the seafloor for scallops

The ecological impacts of scallop dredging on vulnerable habitats are well documented, ultimately leading to reduced biodiversity. The effects on seemingly more resilient areas of the seabed are less well understood but where bans are in place, biodiversity recovery has been observed including on areas of the seabed between sensitive reef habitats.

Given the economic importance of scallop fisheries to the UK and EU fishing industries, there remains a tug-o-war between environmental and political decision making. The UK's departure from the EU poses the risk of expansion of this fishing activity without sufficient consideration of the longer-term impacts on the marine ecosystem.

An estimated 20,371 t of Great Atlantic, or King, scallops *(Pecten maximus)* worth over £47 million were harvested by UK vessels[ddd] in UK waters in 2019, making it the fourth most valuable fishery, with 38% of those landings arising from the English Channel and just 3% recorded as collected by commercial hand diving[26]. The scallop stocks are internationally exploited, primarily by the UK and France, with additional activity from Ireland, the Netherlands and Belgium, so the total removals are significantly higher than these figures. Management of these fisheries is largely under the control of the Member States, except for EU set minimum sizes and an effort cap for vessels ≥15 m in ICES subarea 7[119]. UK management measures[eee] also involve effort restrictions through licence numbers for over 10m vessels plus gear restrictions and some inshore (<6nm) spatial restrictions, often related to Marine Protected Areas[fff].

Concerns over the environmental impacts from scallop dredging are largely related to the wider ecosystem effects, rather than on the scallops themselves[120]. That said, there was no routine assessment or monitoring of stocks prior to 2017 and recent assessments indicate that of the 7 identified stocks in English waters, 1 is overfished, 3 are data limited and the remaining are sustainably exploited from a population perspective.

It is the methods used to extract the scallops from their typically semi-buried position in the seabed that is of concern[120] (Figure 51). Relatively heavy bottom towed gear, trawls and in particular dredges, required to dislodge the scallops so they can be collected in the attached net or cage, physically disturb the seabed and have significant adverse impacts on the other associated species and seafloor habitats. Such effects occur both directly by physical damage or increased availability to

[ddd] Including Isle of Man and Guernsey

[eee] Scallop Orders (Scotland): *https://www.legislation.gov.uk/ssi/2017/127/made, (England): https://www.legislation.gov.uk/uksi/2012/2283/contents, (Wales): https://www.legislation.gov.uk/wsi/2010/269/made, (Northern Ireland): https://www.legislation.gov.uk/nisr/2008/430/made*

[fff] In England, such spatial restrictions are often regulated through Inshore Fisheries and Conservation Authority (IFCA) byelaws, and may be accompanied by other local effort-based and technical measures, such as: *https://www.cornwall-ifca.gov.uk/scalloping and http://www.ne-ifca.gov.uk/news/scallop-dredging/*

predators, and indirectly through reduction in habitat complexity and re-suspension of soft sediments, nutrients, eggs, etc. Suspended sediment can bury or smother surrounding marine life such as filter-feeding mussels. Long-lived, slow-growing, upright epifaunal species (such as maerl, pink sea fans, sponges, mussels and sabellaria) often have fragile body structures that can be destroyed by encounters with fishing gear, taking longer to recover, whereas smaller organisms with shorter lifespans (such as polychaete worms and encrusting bryozoans) tend to be more resilient. Maerl beds[ggg] are a particularly special and sensitive biogenic habitat found in UK (and wider) waters; supporting high levels of biodiversity, they are protected under national and international legislation and agreements[hhh], and are extremely vulnerable to physical damage by scallop dredging as well as smothering[121]. Mobile megafauna, for example crabs, urchins, starfish and fish species such as monkfish, are also subject to the unintended consequences of this fishing activity, either caught as bycatch or damaged or killed on the seafloor. Scallop dredging can therefore lead to changes in community composition and ultimately reduced biodiversity, whereby communities are comprised of fewer, more resistant species[120.]

The UK has made some progress in protecting some of the more obviously vulnerable habitats, such as seagrass, maerl, horse mussel *(Modiolus modiolus)* beds and reefs, from the impacts of scallop dredging as part of the Marine Protected Area (MPA) network [122]. However, concerns remain that due to limited understanding of what levels of dredging are sustainable for more resilient habitats[120] and their associated infauna and epifauna, including those also protected under environmental legislation, tailored management is still lacking in the majority of UK waters including MPAs for which effective management is still largely lacking[123,124,125]. In Wales

[ggg] *https://www.marlin.ac.uk/habitats/detail/255/maerl_beds*

[hhh] Including the UK's Marine and Coastal Access Act *(https://www.legislation.gov.uk/ukpga/2009/23/contents)* through designation as a protected feature of Marine Conservation Zones *(https://www.gov.uk/government/collections/marine-conservation-zone-designations-in-england), EU Habitats Directive (https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm)* and OSPAR Habitats Convention for the Protection of the Marine Environment of the North-East Atlantic *(https://www.ospar.org/convention)*

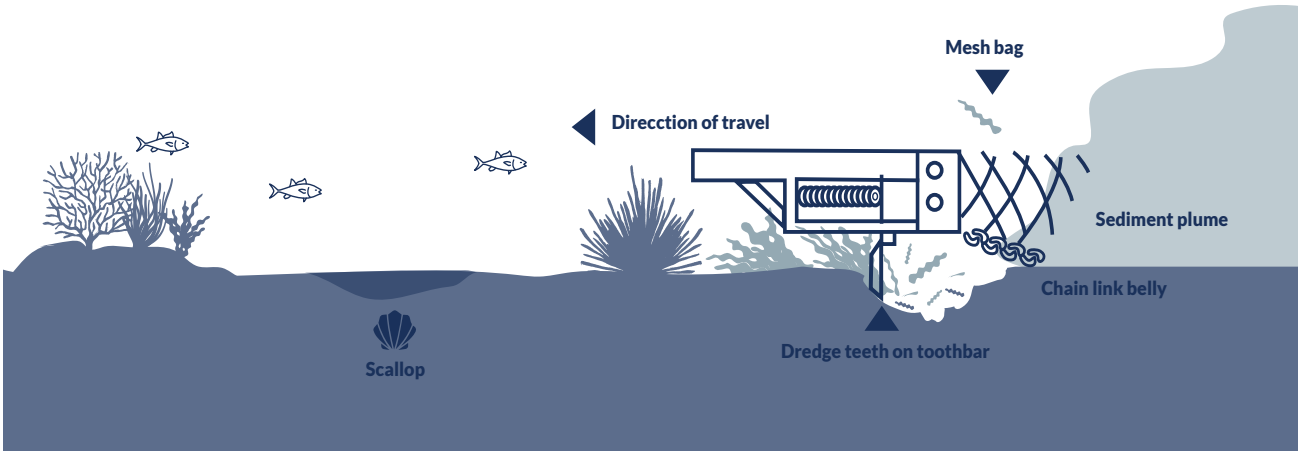

Figure 51: Illustration of the interaction of a scallop dredge with the seafloor (source: Colin Munro)

for example, there is ongoing conflict over a pending Welsh Government decision to allow scallop dredging in a larger area of Cardigan Bay Special Area of Conservation[iii], including the potential impacts on Bottlenose dolphins as a protected feature of the MPA[126].

What could the UK's exit from the EU mean for the marine environment in relation to scallop dredging? The risks arise from factors such as potential weakening of environmental legislation[127], socio-economic pressures to prioritise this valuable fishery under any restructuring of the UK's fisheries management framework and displacement of activity from quota fisheries if negotiated quota and access arrangements are unfavourable for some UK fleets[128]. The UK's status as an independent coastal state could however offer opportunities for joint marine conservation and sustainable fishing initiatives. For example, the reefs of Lyme Bay in Dorset[jjj] have been protected from bottom towed gear since 2008 with numerous studies reporting subsequent improvements in ecological indicators. These for example include anticipated recovery in species richness and species abundance[129,] as well as the less predictable spread of reef associated species from the recognised areas of reef to the infilling sedimentary habitat, indicating that protection of the whole area from the damaging effects of bottom towed gear such as scallop dredging has had wider, unexpected benefits for the habitat's recovery[130.] However, the benefits have also extended to ecosystem services and human wellbeing, in part due to the increased monthly landings and value of hand-dived scallops under the 'Reserve Seafood' branding[kkk,131].

Ultimately if scallop dredging is to become less impactful, it needs to be spatially managed with fishing grounds allocated outside of MPAs and other vulnerable or protected habitats. Defra are presently developing a Scallop fisheries management plan which will need to address these issues and should engage NGOs and other scientists as well as the industry in the process.

[iii] For example, see: *https://gov.wales/written-statement-new-scallop-fishing-cardigan-bay-new-management-measures; https://www.clientearth.org/scallop-dredging-cardigan-bay-legal-issue-not-economic-one/; https://www.bbc.co.uk/news/uk-wales-51402245*

[jjj] *http://www.dorsetmpas.uk/lyme-bay-reefs/*

[kkk] *https://lymebayreserve.co.uk/reserve-seafood/*


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6. Audit conclusions

The objective of this report was to provide an evidence-based snapshot of the status of UK fish stocks and the UK fishing sector's recent exploitation history of those stocks, to provide a baseline for future evaluation of the UK's progress and/or setbacks in the sustainable management of fish stocks.

In 2019, fish stocks managed by the EU through catch quotas caught in UK waters contributed around 387,000 tonnes and £572 million to the UK fishing industry's annual production, or more than half of the total UK fisheries turnover of about £1 billion. The majority of fish were caught by over 24 m vessels operating from Scotland, with pelagic species such as mackerel and herring dominating UK catches by volume, and in the case of mackerel also by value, along with other key resources such as Nephrops and cod. To put this in national context, the GDP for fishing in 2019 was £747 million, representing 5.5% of the total for agriculture, forestry and fishing combined, whilst in terms of GVA marine fisheries represented about 0.04% of the UK's non-financial sector in 2018. Heterogeneity, for example in geographical catch distribution, fleet composition, species diversity and devolved interests, is a key feature of the UK fishery sector.

The majority (>80%) of UK fisheries landings from the North East Atlantic in 2019 came from UK waters. The second most important source of fish for the UK fleet were EU waters, and the Irish EEZ in particular, accounting for an additional 15% of landings (8% by value). On average, around 27% of EU catches in the North East Atlantic were also taken from UK waters between 2012 and 2016. In fact, EU vessels landed more fish from UK waters than the UK fleet, although the UK fleet's landings had higher value.

The UK is however a net importer of seafood. In 2019, 721,000 t of seafood valued at £3.5 billion was imported, and 452,100 t of seafood was exported, valued at £1.8 billion. EU Member States are important sources of seafood consumed in the UK and are critical markets for UK fishery exports. Asia, Iceland and Norway are also chief sources of seafood for the UK but are less important export destinations.

When the UK was part of the EU, TACs for stocks under exclusive and non-exclusive EU competence were set or negotiated by the EU Agriculture and Fisheries Council (AGRIFISH), which included the UK's Fisheries Minister. The allocation of the agreed TACs among EU member states was subject to a fixed percentage known as the relative stability key. For 82 quota stocks fished by the UK and EU fleet (and other third parties in some cases, largely Norway and the Faroe Islands) and considered in this report, the UK received between a 2% and 98% relative stability share. For the shared stocks the UK will now directly negotiate bilateral and multilateral agreements over catch quotas and other management measures.

Despite the CFP commitment for fish stocks to be fished at levels compatible with MSY by 2020, 15.9% (n=13) of the 82 shared stocks were below MSY biomass reference points in recent assessments and

25.6% (n=21) were being fished at levels which will not meet that objective. Data limitations mean there is lower confidence in the scientific assessment of stock and exploitation status for 14.3% and 19.6% (n=7 and 11), respectively, of those stocks. More worryingly, no stock status reference points have been defined for 36.6% (n=30) of quota stocks (n=23 or 28% have no fishing mortality reference points), including high value fisheries such as Nephrops and anglerfish (monkfish), leaving them at greater risk of unsuitable management decisions. TACs for three quota stocks were not based on any scientific advice.

Non-quota stocks, predominantly shellfish, typically managed through national effort and technical restrictions (input control measures), are very important resources for the UK fishing industry, particularly the 10 m and under coastal fleet. Shellfish comprise around 20% of landings by larger (over 10 m) vessels but >80% of 10 m and under vessel landings by value and volume, the result of the fleet's limited (<2%) access to UK quota, despite their domination by number (74% of the UK fleet in 2019). The UK government do not intend to change the existing national quota allocation methodology following Brexit, which is based on Fixed Quota Allocation units, differentially associated with the three key groups – sector (vessels of any size that are part of a Producer Organisation), non-sector (over 10 m vessels only) and 10 m and under (majority of smaller vessels fall into this category). However, eNGOs are advocating that low-impact fishers are given preference when it comes to allocation of any additional negotiated UK quota. One key requirement for such an approach would be the definition of low impact fishing, a categorisation that is subject to ongoing debate.

Whilst assessment of some of these non-quota species and stocks by UK scientific advisors and management bodies has improved in recent years, there remain significant gaps in understanding and monitoring of sustainable levels of fishing; addressing these deficiencies should be a priority for the UK in the near term. Landings of lobsters, edible crabs and king scallops collectively contributed around 51,500 tonnes and £159 million to the UK fishing industry in 2019. Of the 17 stocks (or fishery units) of these three species included in the audit, 1 crab stock was considered to have a healthy stock size, although it was also categorised as overfished, and 3 scallop stocks were thought to be sustainably exploited, although their biological status could not be assessed. In contrast, 7 crab and lobster units were in a critical state due to overexploitation, plus 1 additional stock was classed as overfished. All assessments were based on proxy reference points, but for 5 stocks even these were not available.

Focusing on the 10 stocks which are economically most important to UK fisheries, 8 of which are shared with third parties - mainly the EU - and managed through quotas, 6 are overfished or their stock biomass is at a critical level: North Sea herring, North East Atlantic blue whiting, North Sea whiting, Eastern English Channel scallops, North Sea cod, Southern North Sea crab (the latter two are both overexploited and their biomass is below MSY reference points). Further, there is insufficient data to define reference points for North Sea anglerfish. Therefore, only 3 of the top 10 stocks upon which the UK fishing industry relies are considered to be healthy and sustainably exploited: North East Atlantic mackerel, North Sea haddock and West of Scotland Nephrops.

The other cod stocks in European waters are also in a critical state according to scientific advice. Historically, cod has been one of the most important commercial fish stocks in the North Atlantic. A series of stock declines and collapses, linked primarily to

unsustainable fishing pressure and more recently additive effects of unfavourable climatic conditions, have led to various management responses with variable - mainly unsuccessful – outcomes. Measures to once again rebuild cod in the North Sea are now being developed and implemented, but the results will take some time to emerge. The UK must continue its commitment to supporting the recovery of this iconic stock, which should in parallel demonstrate its progress towards meeting domestic duties within the new Fisheries Act to develop Fisheries Management Plans which maintain stocks at or below MSY or restore them to levels capable of producing MSY.

Alongside implementation of successful recovery plans, lagging full policy implementation and political decisions to set TACs above advised catch levels are still pending issues of fisheries management. There is evidence from this report that stocks where TACs are set according to scientific advice are in better health than those where TACs are repeatedly set above the advised catch. For many of the stocks in the most worrying state, predominantly gadoids (cod and whiting) in the Celtic Sea ecoregion, resolving this issue of misalignment between advised and agreed TACs is highly politically sensitive due to their status as bycatch species in economically important mixed fisheries.

Whilst the majority of the report refers to the sustainability of fishing activities in the context of stock and exploitation status in relation to MSY reference points, sustainable fisheries management has far wider-ranging considerations. The UK has an opportunity to fully integrate an ecosystem-based approach to sustainability into its new domestic fishing regime by explicitly accounting for the environmental impacts of fishing activities in management decisions and regulation. Key examples of where this is urgently required have been provided in this report, namely accommodating the ecological importance of sandeels to the wider marine ecosystem when implementing or influencing future management strategies, ensuring cetacean bycatch by vessels fishing in UK waters is reduced to an unavoidable minimum level, and introducing careful spatial management of scallop dredging to significantly reduce its impact on the UK's marine environment, particularly within MPAs.

This audit indicates there are still rough seas ahead for sustainable management of fishery resources in European waters. Sub-optimal levels of scientific evidence, numerous examples of stocks not recovering from over-exploitation when fishing pressure is reduced, and climate change, mean application of the precautionary principle is as important as ever. But so is effective collaboration across borders, whether they are national or international. The UK's approaching status as an independent coastal state with significant interests in these shared resources offers ecological and socio-economic opportunities, as well as risks. Ultimately, the UK Government must ensure transparent decision-making that aligns with scientific advice is at the heart of the new fisheries management framework and that the long-term vision of setting 'a gold standard for sustainable fishing around the world' is achieved. This will undoubtedly require a shift in the balance from socio-economic priorities to ones that are actively fighting the corner of healthy ocean ecosystems, although if done successfully the longer-term benefits would be less selective.

7. Oceana's Policy Recommendations

The UK's decision to leave the EU, and therefore also the CFP, has enormous consequences for the management of North East Atlantic fish stocks. So, the fisheries governance system for these stocks and the balance of power in the decision-making process has been altered. This new management framework should be settled, and its results, for which the UK has a great responsibility, will be evident in the years to come.

Within the last decade, thanks to a collaborative effort based on the ambitious EU fisheries policy, the overfishing rate in the North East Atlantic has dropped from 66% to 38%[6]. This progress, while insufficient, is a positive trend that must continue and accelerate so that overfishing finally becomes a thing of the past, and so that marine ecosystems are given the chance to rebound and build resilience to large-scale threats such as climate change[132].

The UK government has repeatedly stated its ambition to become a world leader with "gold standard fisheries management" following its departure from the EU[4]. The UK should maintain the ambition of achieving sustainable fishing and not backtrack on jointly established high standards on sustainable fisheries and the environment. To safeguard public, natural, and renewable fish resources for ours and future generations, the UK must take the lead in North East Atlantic fisheries management and act with credibility, consistency, and transparency.

Overfishing has been a major driver of marine biodiversity loss in the last 40 years[133] and it also critically undermines fish populations' resilience to the impacts and threats. UK fisheries must be managed in the wider context of the climate and ecological emergency and should be guided by international commitments: the Paris Agreement[134] the Convention on Biodiversity (CBD), the United Nations Sustainable Development Goals[136,III] (SDGs) and the United Nations Convention on the Law of the Sea[137] (UNCLOS).

[III] Specifically, SDG Goal 14: Conserve and sustainably use the oceans, seas and marine resources, with all its targets. Target 14.4 explicitly requires: "By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics."

7.1 Management of UK domestic fisheries

The UK championed environmental changes in the last CFP reform in 2013, like the (missed) ambitious objective of ending overfishing by 2020, the international requirement of the MSY exploitation target for all stocks, and the prohibition of wasteful discards. Now that EU regulations no longer apply to the UK, it is time to build and implement a national management framework.

For the time being, the UK has adopted the Fisheries Act 2020[1], the first major domestic fisheries legislation in nearly four decades and which sets the basic legal framework for the management of UK fisheries. Despite securing some positive elements, the UK Fisheries Act fell short of Oceana aspirations for an ambitious legislation by failing, for example, to include a firm duty, not just objective, for all stocks to be fished at sustainable levels (MSY) in line with scientific advice.

The UK Government and Devolved Administrations continue developing further fisheries rules to provide a complete management framework, notably the fisheries statements and the fisheries management plans. The next months are critical for adding the needed legal requirements to ensure responsible fishing activity. The consequence of taking back control of UK waters should also mean assuming full responsibility and accountability for sustainable management of fisheries.

A transition to fully sustainable fisheries must encompass setting fishing opportunities in line with the scientific advice, stopping illegal fishing through a comprehensive fisheries control and sanction system, banning the use of non-selective and destructive fishing practices particularly in Marine Protected Areas (MPAs), and protecting Essential Fish Habitats[mmm] by spatial and temporal fishing restrictions. In doing so, it will facilitate not only healthy fish stocks and marine ecosystems, but also will contribute to the cultural and economic prosperity of coastal communities by making sure the fishing industry can continue to thrive for years to come.

The UK should take urgent action to continue efforts to end overfishing of its stocks and ensure that the UK fishing activity is sustainable. Specific actions required to achieve this include:

- **Fully implement the following Fisheries Act fisheries objectives: the sustainability, precautionary, ecosystem, scientific evidence, bycatch, and climate change objectives.**
- **Include the binding commitment to recover and/or maintain all exploited stocks above biomass levels capable of producing MSY (in line with international commitments), with a timeframe to achieve it, when adopting the Joint Fisheries Statement and the Secretary of State Fisheries Statement.**

[mmm] Habitat identified as crucial to the ecological and biological requirements for the critical life cycle of exploited fish species, like spawning or nursery grounds, and which may require special protection to improve stock status and long term sustainability crucial habitats in the life cycle of

- Set fishing opportunities, catch limits and effort restrictions, which do not exceed the best available scientific advice. Ensure that fishing opportunities for mixed fisheries are consistent with the sustainable exploitation of the worst-preserved stocks, and that by-catch TACs for depleted stocks are not granted until rebuilding plans are implemented.
- Develop Fisheries Management Plans for fish stocks, starting with those in the worst state of conservation and those which are data deficient, containing clear management objectives and targets with a timeframe to achieve them.
- Improve the data collection, scientific assessment methods, and management of data deficient fisheries.
- Reform the allocation of fishing opportunities using environmental criteria that favour low-impact fishing. Provide incentives to implement fishing practices with reduced environmental impacts whilst avoiding harmful subsidies.
- Improve fishing gear selectivity to minimize the bycatch of non-target species. Implement by-catch reduction plans for sensitive and vulnerable species/stocks.
- Phase out non-selective and destructive fishing practices (e.g. bottom contacted gears, like bottom trawling or dredges) starting in all the "paper park" MPAs where no fishing activity restrictions have been implemented.
- Establish a network of Essential Fish Habitats (spawning, nursery and feeding grounds) in UK waters to contribute to the rebuilding and sustainable exploitation of fish resources.
- Prevent illegal, unreported, and unregulated (IUU) fishing by ensuring adequate control and enforcement of fisheries in UK waters, of the UK fleet in international waters, and imports of fisheries products.

7.2 Management of stocks shared with third countries

Many important UK fish resources are shared stocks with third countries. So, joint agreement on management measures with those countries is crucial to ensure the sustainable exploitation of the stocks, which is impossible to achieve through unilateral action alone.

To facilitate the adoption of joint management measures for the shared stocks, the UK has become a NEAFC contracting party[138], and established bilateral agreements and memorandums of understanding with the main North East Atlantic coastal fishing states, including Norway[3], the Faroe Islands[139], Greenland[140] and Iceland[141], plus the EU[2]. While such arrangements provide the management and negotiation frameworks, relevant annual management measures to be agreed, like the setting of fishing opportunities, still depend on the results of the annual negotiations between the UK and the third countries.

The status of most North East Atlantic fish stocks, and hence the socio-economic performance of the European fleet, depends to a large extent on the collaboration and international agreements, for instance the UK shares over 100 fish stocks with the EU. Unfortunately, international agreements for North East Atlantic shared stocks do not always deliver the optimum utilisation of the fishery resources, such as the frequent lack of agreement on stock shares that lead to the setting of unilateral quotas which in turn exceed the agreed TAC and the scientific advice, leading to overfishing.

The UK and the third countries with which it shares fish resources must become constructive partners in the fight against overfishing, biodiversity loss and climate change. Only international cooperation with common objectives, transparency and accountability will address those transboundary challenges.

To facilitate the sustainable exploitation of shared fish stocks Oceana endorses the following recommendations:

- **Condition the reciprocal access to waters and resources on sustainability, transparency and legality of the fisheries concerned. Science-based management must underpin all the international fisheries agreements and management decisions.**
- **Establish long-term political agreements on allocation keys for the respective quota shares to ensure that total catches do not exceed the agreed catch limits and to provide stability to the fishing sector.**
- **Manage shared stocks jointly according to the best available scientific advice and a common methodology of an independent, non-biased and widely acknowledged organisation such as ICES (of which the UK and North Atlantic coastal countries are members[142]). All parties should collaborate in the collection and sharing of data to elaborate the stock assessment.**


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- **Set fishing opportunities for shared stocks in line with the best available scientific advice and long-term management strategies that include precautionary harvest control rules. For fully assessed stocks, fishing opportunities must not exceed the F_{MSY}. For data-limited and vulnerable stocks, the precautionary approach should be followed[nnn] .**
- **The management of shared stocks should be consistent with the obligations and rights under the (Aarhus) Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters[143]. Management proposals and negotiation process should be made transparently, with access guaranteed for all stakeholders.**

Oceana hopes that this UK Fisheries Audit report and above recommendations will contribute to UK policy-making and support UK progress on ending overfishing, international commitments, and switching to fully sustainable fisheries.

[nnn] Agreements on shared stocks must implement a genuine precautionary approach as defined by the United Nations Fish Stock Agreement (UNFSA, 1995; https://www.un.org/Depts/los/convention_agreements/texts/fish_stocks_agreement/CONF164_37.htm). When the available data and information are uncertain, unreliable, or inadequate, decision makers should engage in more cautious management, and a lack of scientific certainty cannot preclude management action.

Appendices

Appendix 1 – List of stocks and corresponding management units included in the UK fisheries audit

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
Greater silver smelt (*Argentina silus*) in divisions 5.b and 6.a (Faroes grounds and west of Scotland)	aru.27.5b6a	West of Scotland	EU and int. waters of 5, 6 and 7	ARU/567	Celtic Sea, West of Scotland, Irish Sea	Greater silver smelt	*Argentina silus*
Greater silver smelt (*Argentina silus*) in subareas 7–10 and 12, and in Division 6.b (other areas)	aru.27.6b7	Celtic Sea, West of Scotland, Irish Sea					
Tusk (*Brosme brosme*) in subareas 4 and 7–9, and in divisions 3.a, 5.b, 6.a, and 12.b (Northeast Atlantic)	usk.27.3a45b6a7-912b	Celtic Sea, West of Scotland, Irish Sea, North Sea	EU waters of 4	USK/04-C	North Sea	Tusk	*Brosme brosme*
			EU and int. waters of 5, 6 and 7	USK/567EI	Celtic Sea, West of Scotland, Irish Sea		
Boarfish (*Capros aper*) in sub-areas 6–8 (Celtic Seas, English Channel, and Bay of Biscay)	boc.27.6-8	Celtic Sea, English Channel	EU and int. waters of 6, 7 and 8	BOR/678	Celtic Sea, English Channel	Boarfish	*Capros aper*
Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawn-ers (North Sea, Skagerrak and Kattegat, eastern English Channel)	her.27.3a47d	North Sea, English Channel	EU and Norwe-gian waters of 4 north of 53° 30′ N	HER/4AB	North Sea	Herring	*Clupea harengus*
			4c, 7d	HER/4CXB7D	North Sea, English Channel		
			4, 7d and Union waters of 2a	HER/2A47DX	North Sea, English Channel		
no ICES advice	no ICES advice		EU and int. waters of 5b, 6b and 6aN	HER/5B6ANB	West of Scotland		
Herring (*Clupea harengus*) in Division 7.a North of 52°30′N (Irish Sea)	her.27.nirs	Irish Sea	7a	HER/07A/MM	Irish Sea		
no ICES advice	no ICES advice		7e and 7f	HER/7EF	English Channel, Celtic Sea		
Cod (*Gadus morhua*) in Subarea 4, Division 7.d, and Subdivision 20 (North Sea, eastern English Chan-nel, Skagerrak)	cod.27.47d20	North Sea, English Channel	; EU waters of 2a; that part of 3a not covered by the Skagerrak and Kattegat	COD/2A3AX4	North Sea	Cod	*Gadus morhua*
			7d	COD/07D	English Channel		

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
Cod *(Gadus morhua)* in Division 6.a (West of Scotland)	cod.27.6a	West of Scotland	6a; EU and int. waters of 5b east of 12° 00' W (by-catches)	COD/5BE6A	West of Scotland		
Cod *(Gadus morhua)* in Division 7.a (Irish Sea)	cod.27.7a	Irish Sea	7a	COD/07A	Irish Sea		
Cod *(Gadus morhua)* in divisions 7.e–k (western English Channel and southern Celtic Seas)	cod.27.e-k	Celtic Sea, English Channel	7b, 7c, 7e-k, 8, 9 and 10; Union waters of CECAF 34.1.1	COD/7XAD34	Celtic Sea, English Channel		
Megrim *(Lepidorhombus* spp.*)* in divisions 4.a and 6.a (northern North Sea, West of Scotland)	lez.27.4a6a	North Sea, West of Scotland	EU waters of 2a and 4	LEZ/2AC4-C	North Sea	Megrims	*Lepidorhombus* spp.
			EU and int. waters of 5b; 6	LEZ/56-14	West of Scotland		
Megrim *(Lepidorhombus whiffiagonis)* in divisions 7.b–k, 8.a–b, and 8.d (west and southwest of Ireland, Bay of Biscay)	meg.27.7b-k8abd	Celtic Sea, English Channel	7	LEZ/07	Celtic Sea, English Channel, Irish Sea		
Anglerfish *(Lophius budegassa, Lophius piscatorius)* in subareas 4 and 6 and in Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)	anf.27.3a46	North Sea, West of Scotland	EU waters of 2a and 4	ANF/2AC4-C	North Sea	Anglerfish	Lophiidae
			6; EU and int. waters of 5b; int. waters of 12 and 14	ANF/56-14	West of Scotland		
White anglerfish *(Lophius piscatorius)* in Subarea 7 and in divisions 8.a–b and 8.d (southern Celtic Seas, Bay of Biscay)	mon.27.78abd	Celtic Sea, English Channel	7	ANF/07	Celtic Sea, English Channel, Irish Sea		
Black-bellied anglerfish *(Lophius budegassa)* in Subarea 7 and divisions 8.a–b and 8.d (Celtic Seas, Bay of Biscay)	ank.27.78abd	Celtic Sea, English Channel					
Haddock *(Melanogrammus aeglefinus)* in Subarea 4, Division 6.a, and Subdivision 20 (North Sea, West of Scotland, Skagerrak)	had.27.46a20	North Sea, West of Scotland	4; EU waters of 2a	HAD/2AC4	North Sea	Haddock	*Melanogrammus aeglefinus*
			5b,6a	HAD/5BC6A	West of Scotland		
Haddock *(Melanogrammus aeglefinus)* in Division 6.b (Rockall)	had.27.6b	West of Scotland	EU and int. waters of 6b, 12 and 14	HAD/6B1214	West of Scotland		
Haddock *(Melanogrammus aeglefinus)* in divisions 7.b–k (southern Celtic Seas and English Channel)	had.27.7b-k	Celtic Sea, English Channel	7b-k, 8, 9 and 10; EU waters of CECAF 34.1.1	HAD/7X7A34	Celtic Sea, English Channel		
Haddock *(Melanogrammus aeglefinus)* in Division 7.a (Irish Sea)	had.27.7a	Irish Sea	7a	HAD/07A	Irish Sea		
Whiting *(Merlangius merlangus)* in Subarea 4 and Division 7.d (North Sea and eastern English Channel)	whg.27.47d	North Sea, English Channel	4; EU waters of 2a	WHG/2AC4	North Sea	Whiting	*Merlangius merlangus*
Whiting *(Merlangius merlangus)* in Division 6.a (West of Scotland)	whg.27.6a	West of Scotland	6; EU and int. waters of 5b; int. waters of 12 and 14 (by-catches)	WHG/56-14	West of Scotland		

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
Whiting *(Merlangius merlangus)* in Division 7.a (Irish Sea)	whg.27.7a	Irish Sea	7a	WHG/07A	Irish Sea		
Whiting *(Merlangius merlangus)* in divisions 7.b–c and 7.e–k (southern Celtic Seas and western English Channel)	whg.27.7b-ce-k	Celtic Sea, English Channel	7b-h, 7j, 7k	WHG/7X7A-C	Celtic Sea, English Channel		
Hake *(Merluccius merluccius)* in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay)	hke.27.3a46-8abd	North Sea, Celtic Sea, West of Scotland	2a and 4	HKE/2AC4-C	North Sea	Hake	*Merliccius merluccius*
			5b, 6, 7, 12 and 14	HKE/571214	Celtic Sea, West of Scotland, Irish Sea		
Blue whiting *(Micromesistius poutassou)* in subareas 1–9, 12, and 14 (Northeast Atlantic and adjacent waters)	whb.27.1-91214	Celtic Sea, West of Scotland, Irish Sea, North Sea	1 to 7, 8abde, 12, 14 (EC and Int. waters)	WHB/1X14	Celtic Sea, West of Scotland, Irish Sea, North Sea	Blue whiting	*Micromesistius poutassou*
Lemon sole *(Microstomus kitt)* in Subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	lem.27.3a47d	North Sea, English Channel	2a(EC), and 4(North Sea) (EC)	L/W/2AC4-C	North Sea	Lemon sole	*Microstomus kitt*
Witch *(Glyptocephalus cynoglossus)* in Subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	wit.27.3a47d	North Sea, English Channel				Witch	*Glyptocephalus cynoglossus*
Blue ling *(Molva dypterygia)* in subareas 6–7 and Division 5.b (Celtic Seas and Faroes grounds)	bli.27.5b67	Celtic Sea, West of Scotland, Irish Sea	EC and int. waters of 5b, 6, 7	BLI/5B67	Celtic Sea, West of Scotland, Irish Sea	Blue ling	*Molva dypterygia*
Blue ling *(Molva dypterygia)* in subareas 1, 2, 8, 9, and 12, and in divisions 3.a and 4.a (Northeast Atlantic)	bli.27.nea	North Sea	EU and int. waters of 2 and 4 (by- catches)	BLI/24	North Sea		
Ling *(Molva molva)* in subareas 6–9, 12, and 14, and in divisions 3.a and 4.a (Northeast Atlantic and Arctic Ocean)	lin.27 .3a4a6-91213	Celtic Sea, West of Scotland, Irish Sea	Union waters of 4	LIN/04-C	North Sea	Ling	*Molva molva*
			EU and intl. waters of 6, 7, 8, 9, 10,12, 14	LIN/6X14	Celtic Sea, West of Scotland, Irish Sea		
Norway lobster *(Nephrops norvegicus)* in Division 4.a, Functional Unit 10 (northern North Sea, Noup)	nep.fu.10	North Sea	EU waters of 2a and 4	NEP/2AC4-C	North Sea		
Norway lobster *(Nephrops norvegicus)* in Division 4.a, Functional Unit 7 (northern North Sea, Fladen Ground)	nep.fu.7	North Sea					
Norway lobster *(Nephrops norvegicus)* in Division 4.b, Functional Unit 33 (central North Sea, Horn's Reef)	nep.fu.33	North Sea					
Norway lobster *(Nephrops norvegicus)* in Division 4.b, Functional Unit 34 (central North Sea, Devil's Hole)	nep.fu.34	North Sea					

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
Norway lobster *(Nephrops norvegicus)* in Division 4.b, Functional Unit 6 (central North Sea, Farn Deeps)	nep.fu.6	North Sea				Norway lobster	*Nephrops norvegicus*
Norway lobster *(Nephrops norvegicus)* in Division 4.b, Functional Unit 8 (central North Sea, Firth of Forth)	nep.fu.8	North Sea					
Norway lobster *(Nephrops norvegicus)* in Division 4.a, Functional Unit 9 (central North Sea, Moray Firth)	nep.fu.9	North Sea					
Norway lobster *(Nephrops norvegicus)* in Division 6.a, Functional Unit 11 (West of Scotland, North Minch)	nep.fu.11	West of Scotland	6; EU and int. waters of 5b	NEP/5BC6	West of Scotland		
Norway lobster *(Nephrops norvegicus)* in Division 6.a, Functional Unit 12 (West of Scotland, South Minch)	nep.fu.12	West of Scotland					
Norway lobster *(Nephrops norvegicus)* in Division 6.a, Functional Unit 13 (West of Scotland, the Firth of Clyde, and the Sound of Jura)	nep.fu.13	West of Scotland					
Norway lobster *(Nephrops norvegicus)* in Division 7.a, Functional Unit 14 (Irish Sea, East)	nep.fu.14	Irish Sea	7	NEP/07	Celtic Sea, Irish Sea		
Norway lobster *(Nephrops norvegicus)* in Division 7.a, Functional Unit 15 (Irish Sea, West)	nep.fu.15	Irish Sea					
Norway lobster *(Nephrops norvegicus)* in Division 7.b, Functional Unit 17 (west of Ireland, Aran grounds)	nep.fu.17	Celtic Sea					
Norway lobster *(Nephrops norvegicus)* in divisions 7.a, 7.g, and 7.j, Functional Unit 19 (Irish Sea, Celtic Sea, eastern part of southwest of Ireland)	nep.fu.19	Celtic Sea, Irish Sea					
Norway lobster *(Nephrops norvegicus)* in divisions 7.b–c and 7.j–k, Functional Unit 16 (west and south-west of Ireland, Porcupine Bank)	nep.fu.16	Celtic Sea					
Norway lobster *(Nephrops norvegicus)* in divisions 7.g and 7.f, Functional Unit 22 (Celtic Sea, Bristol Channel)	nep.fu.22	Celtic Sea					
Norway lobster *(Nephrops norvegicus)* in divisions 7.g and 7.h, functional units 20 and 21 (Celtic Sea)	nep.fu.2021	Celtic Sea					
Plaice *(Pleuronectes platessa)* in Subarea 4 (North Sea) and Subdivision 20 (Skagerrak)	ple.27.420	North Sea	4; EU waters of 2a; that part of 3a not covered by the Skagerrak and the Kattegat	PLE/2A3AX4	North Sea		

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
no ICES advice	no ICES advice		EU waters of 5b, 6, 12, 14	PLE/56-14	West of Scotland	Plaice	*Pleuronectes platessa*
Plaice *(Pleuronectes platessa)* in Division 7.a (Irish Sea)	ple.27.7a	Irish Sea	7a	PLE/07A	Irish Sea		
Plaice *(Pleuronectes platessa)* in Division 7.d (eastern English Channel)	ple.27.7d	English Channel	7de	PLE/7DE	English Channel		
Plaice *(Pleuronectes platessa)* in Division 7.e (western English Channel)	ple.27.7e	English Channel					
Plaice *(Pleuronectes platessa)* in divisions 7.f and 7.g (Bristol Channel, Celtic Sea)	ple.27.7fg	Celtic Sea	7fg	PLE/7FG	Celtic Sea		
Plaice *(Pleuronectes platessa)* in divisions 7.h–k (Celtic Sea South, southwest of Ireland)	ple.27.7h-k	Celtic Sea	7hjk	PLE/7HJK	Celtic Sea		
Pollack *(Pollachius pollachius)* in subareas 6–7 (Celtic Seas and the English Channel)	pol.27.67	Celtic Sea, English Channel, Irish Sea	6; EU and int. waters of 5b; int. waters of 12 and 14	POL/56-14	West of Scotland	Pollack	*Pollachius pollachius*
			7	POL/07	eltic Sea, Irish Sea, English Channel		
Saithe *(Pollachius virens)* in subareas 4 and 6, and in Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)	pok.27.3a46	North Sea, West of Scotland	3a and 4; EU waters of 2a	POK/2C3A4	North Sea	Saithe	*Pollachius virens*
			6; EU and int. waters of 5b, 12 and 14	POK/56-14	West of Scotland		
no ICES advice	no ICES advice		7, 8, 9 and 10; EU waters of CECAF 34.1.1	POK/7/3411	Celtic Sea, Irish Sea		
Turbot *(Scophthalmus maximus)* in Subarea 4 (North Sea)	tur.27.4	North Sea	EU waters of 2a and 4	T/B/2AC4-C	North Sea	Turbot	*Psetta maxima*
Brill *(Scophthalmus rhombus)* in Subarea 4 and divisions 3.a and 7.d–e (North Sea, Skagerrak and Kattegat, English Channel)	bll.27.3a47de	North Sea, English Channel				Brill	*Scophthalmus rhombus*
Shagreen ray *(Leucoraja fullonica)* in subareas 6–7 (West of Scotland, southern Celtic Seas, English Channel)	rjf.27.67	West of Scotland,CelticSea, Irish Sea, Eastern English Channel	EU waters of 6a, 6b, 7a-c and 7e-k	SRX/67AKXD	West of Scotland, Celtic Sea, Irish Sea, Eastern English Channel	Skates and rays	*Leucoraja fullonica*
Thornback ray *(Raja clavata)* in Subarea 6 (West of Scotland)	rjc.27.6	West of Scotland					*Raja clavata*
Blonde ray *(Raja brachyura)* in Subarea 6 and Division 4.a (North Sea and West of Scotland)	rjh.27.4a6	West of Scotland, North Sea					*Raja brachyura*
Small-eyed ray *(Raja microocellata)* in divisions 7.f and 7.g (Bristol Channel, Celtic Sea North)	rje.27.7fg	Celtic Sea	EU waters of 7f 7g	RJE/7FG	Celtic Sea	Small eyed ray	*Raja microocellata*
Cuckoo ray *(Leucoraja naevus)* in Subarea 4 and Division 3.a (North Sea, Skagerrak, and Kattegat)	rjn.27.3a4	North Sea	EU waters of 2a and 4	SRX/2AC4-C	North Sea	Skates and rays	*Leucoraja naevus*

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
Blonde ray *(Raja brachyura)* in divisions 4.c and 7.d (southern North Sea and eastern English Channel)	rjh.27.4c7d	English Channel, North Sea	7d	SRX/07D	English Channel	Skates and rays	*Raja brachyura*
			EU waters of 2a and 4	SRX/2AC4-C	North Sea		*Raja clavata*
Thornback ray *(Raja clavata)* in Subarea 4 and in divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)	rjc.27.3a47d	English Channel, North Sea	7d	SRX/07D	English Channel		*Raja montagui*
			EU waters of 2a and 4	SRX/2AC4-C	North Sea		*Raja microocellata*
Spotted ray *(Raja montagui)* in Subarea 4 and in divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)	rjm.27.3a47d	English Channel, North Sea	7d	SRX/07D	English Channel		*Raja undulata*
			EU waters of 2a and 4	SRX/2AC4-C	North Sea		*Reinhardtius hippoglossoides*
Small-eyed ray *(Raja microocellata)* in divisions 7.d and 7.e (English Channel)	rje.27.7de	English Channel	7d	SRX/07D	English Channel		*Raja microocellata*
Undulate ray *(Raja undulata)* in divisions 7.d–e (English Channel)	rju.27.7de	English Channel	EU waters of 7d and 7e	RJU/7DE	English Channel	Undulate ray	*Raja undulata*
Greenland halibut *(Reinhardtius hippoglossoides)* in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North of Azores, East of Greenland)	ghl.27.561214	West of Scotland	EU waters of 2a and 4; EU and int. waters of 5b and 6	GHL/2A-C46	North Sea, West of Scotland	Greenland halibut	*Reinhardtius hippoglossoides*
Mackerel *(Scomber scombrus)* in subareas 1–8 and 14, and in Division 9.a (the Northeast Atlantic and adjacent waters)	mac.27.nea	Celtic Sea, West of Scotland, Irish Sea, English Channel	3a and 4; EU waters of 2a, 3b, 3c and Subdivisions 22-32	MAC/2A34	North Sea	Mackerel	*Scomber scombrus*
			6, 7, 8a, 8b, 8d and 8e; EU and int. waters of 5b; int. waters of 2a, 12 and 14	MAC/2CX14	Celtic Sea, West of Scotland, Irish Sea, English Channel		
Sole *(Solea solea)* in Division 7.a (Irish Sea)	sol.27.7a	Irish Sea	7a	SOL/07A	Irish Sea	Common sole	*Solea solea*
Sole *(Solea solea)* in Division 7.d (eastern English Channel)	sol.27.7d	English Channel	7d	SOL/07D	English Channel		
Sole *(Solea solea)* in Division 7.e (western English Channel)	sol.27.7e	English Channel	7e	SOL/07E	English Channel		
Sole *(Solea solea)* in divisions 7.f and 7.g (Bristol Channel, Celtic Sea)	sol.27.7fg	Celtic Sea	7fg	SOL/7FG	Celtic Sea		
Sole *(Solea solea)* in divisions 7.h–k (Celtic Sea South, southwest of Ireland)	sol.27.7h-k	Celtic Sea	7hjk	SOL/7HJK	Celtic Sea		
Sprat *(Sprattus sprattus)* in divisions 7.d and 7.e (English Channel)	spr.27.7de	English Channel	7de	SPR/7DE	English Channel	Sprat	*Sprattus sprattus*
Spurdog *(Squalus acanthias)* in the Northeast Atlantic	dgs.27.nea	Celtic Sea, West of Scotland, Irish Sea, English Channel	EU and intern. waters of 1, 5, 6, 7, 8, 12 and 14	DGS/15X14	Celtic Sea, West of Scotland, Irish Sea, English Channel	Spurdog	*Squalus acanthias*

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
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)	hom.27.3a4bc7d	North Sea, English Channel	EU waters of 4b, 4c and 7d	JAX/4BC7D	North Sea, English Channel	Horse mackerel	*Trachurus* spp.
Horse mackerel (*Trachurus trachurus*) in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k (the Northeast Atlantic)	hom.27 .2a4a5b6a7a-ce-k8	Celtic Sea, West of Scotland, Irish Sea, English Channel, North Sea	EU waters of 2a, 4a; 6, 7a-c,7e-k, 8abde; EU and intern. waters of 5b; intern. waters of 12 and 14	JAX/2A-14	Celtic Sea, West of Scotland, Irish Sea, English Channel, North Sea		
The Wash	no ICES advice	North Sea	The Wash	non-quota	North Sea	Cockles	*Cerastoderma edule*
Thames Estuary	no ICES advice	North Sea	Thames Estuary	non-quota	North Sea		
ICES Subdivision 27.7.e - Inshore Cornwall	no ICES advice	English Channel	ICES Subdivision 27.7.e - Inshore Cornwall	non-quota	Celtic Sea	King scallops	*Pecten maximus*
ICES Subdivision 27.7.e - Offshore Cornwall	no ICES advice	English Channel	ICES Subdivision 27.7.e - Offshore Cornwall	non-quota	Celtic Sea		
ICES Subdivision 27.7.e - Lyme Bay	no ICES advice	English Channel	ICES Subdivision 27.7.e - Lyme Bay	non-quota	English Channel		
ICES Subdivision 27.7.d - South	no ICES advice	English Channel	ICES Subdivision 27.7.d - South	non-quota	English Channel		
ICES Subdivision 27.7.f.l - Bristol Channel	no ICES advice	Celtic Sea	ICES Subdivision 27.7.f.l - Bristol Channel	non-quota	Celtic Sea		
ICES Subdivision 27.4.b - North Sea South	no ICES advice	North Sea	ICES Subdivision 27.4.b - North Sea South	non-quota	North Sea		
ICES Subdivision 27.4.b	no ICES advice	North Sea	Central North Sea	non-quota	North Sea	Edible crab	*Cancer pagurus*
ICES Subdivision 27.4.b,c	no ICES advice	North Sea	Southern North Sea	non-quota	North Sea		
ICES Subdivision 27.7.e,f,h	no ICES advice	English Channel, Celtic Sea	Western English Channel	non-quota	English Channel, Celtic Sea		
ICES Subdivision 27.7.f.g,a	no ICES advice	Celtic Sea, Irish Sea	Celtic Sea	non-quota	Celtic Sea, Irish Sea		
ICES Subdivision 27.7.d, 4.c	no ICES advice	English Channel, North Sea	Eastern English Channel	non-quota	English Channel, North Sea		

Advice stock area (ICES/ other)	Advice code (ICES)	Sea basin(s) - stock	Management area	Management unit code (EU)	Sea basin(s) - management unit	Species	
ICES Subdivision 27.4.b	no ICES advice	North Sea	Northumberland and Durham	non-quota	North Sea	Lobster	*Homarus gammarus*
ICES Subdivision 27.4.b	no ICES advice	North Sea	Yorkshire Humber	non-quota	North Sea		
ICES Subdivision 27.4.c	no ICES advice	North Sea	East Anglia	non-quota	North Sea		
ICES Subdivision 27.7.d,e	no ICES advice	English Channel	Southeast South Coast	non-quota	English Channel		
ICES Subdivision 27.7.e,f	no ICES advice	English Channel, Celtic Sea	Southwest	non-quota	English Channel, Celtic Sea		
Seabass (*Dicentrarchus labrax*) in divisions 4.b–c, 7.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea)	bss.27.4bc7ad-h	North Sea, Irish Sea, English Channel, Celtic Sea	4bc, 7	non-quota	North Sea, Irish Sea, English Channel, Celtic Sea	Seabass	*Dicentrarchus labrax*
EIFCA district	no ICES advice	North Sea	Eastern IFCA District	non-quota	North Sea	Whelks	*Buccinum undatum*
K&EIFCA district	no ICES advice	North Sea	Kent and Essex IFCA District	non-quota	North Sea		

Appendix 2 – Stock and Exploitation status indicator methodology

Indicators of stock size and stock exploitation status were derived from the most recent ICES advice or alternative ('other') stock assessments. These indicators are based on assessments of the stock size and fishing rates against MSY reference points, where available. The categorisation in Table 3 and Table 4 was applied to form the indicators.

ICES/Other[ooo] Stock size (SSB) indicator	Stock Size Indicator (UK Fisheries Audit)
SSB at or above $B_{trigger}$ or $B_{trigger\ proxy}$ or $B_{MSY\ target}$[ooo]	Healthy
SSB below $B_{trigger}$ or $B_{trigger\ proxy}$ or $B_{MSY\ target}$[ooo]	Critical
No reference point / exploitation status unknown	Data limited
Not assessed	Unknown

Table 3: Stock size status indicators

ICES/Other[ooo] Fishing pressure (F) indicator	Exploitation Indicator (UK Fisheries Audit)
F at or below F_{MSY} or $F_{MSY\ proxy}$ or $F_{MSY\ target}$[ooo]	Sustainably exploited
F above F_{MSY} or $F_{MSY\ proxy}$ or $F_{MSY\ target}$[ooo]	Overfished
No reference point / exploitation status unknown	Data limited
Not assessed	Unknown

Table 4: Exploitation status indicators

[ooo] Applies to non-quota stocks, such as crabs and lobsters, assessed by Cefas

For data sufficient[ppp] quota stocks, the exploitation status indicator evaluates the estimated level of recent fishing mortality relative to F_{MSY}, defined as the maximum fishing mortality that would enable the stock to reach or maintain B_{MSY} – the biomass reference point that enables a stock to deliver its MSY.

Stock size status is based on the ICES biomass reference point 'MSY $B_{trigger}$', defined as the parameter in the ICES advice framework which triggers a more cautious response, typically reduced fishing mortality (F) to allow the stock to rebuild to levels compatible with MSY ($F<F_{MSY}$)[9]. Whilst this reference point reflects the lower bound of stock size fluctuation around B_{MSY}, therefore with limited scope for an arguably more precautionary management response (e.g. management action is triggered when the stock is $<B_{MSY}$ rather than at or approaching it), it is widely established as an appropriate reference for MSY[62]. It is therefore used as the basis of the stock status indicator for ease of understanding, acceptance and repetition.

For stocks that are more data limited[qqq], ICES classify stock and exploitation status relative to MSY proxies (MSY $B_{trigger\ proxy}$ or F_{MSY} proxy) under the precautionary approach to advice provision. Assessment of the status of the non-quota stocks is also based on a proxy MSY level (European lobster[144]; Edible crab[145]) or MSY candidate harvest rate (King scallop[34]). The proportion of stocks for which the indicators are based on these proxy reference points is stated to show the relative distribution of lower and higher confidence assessments.

[ppp] ICES categories 1 or 2 stocks: *https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/Introduction_to_advice_2019.pdf*

[qqq] ICES category 3 or 4 stocks

Appendix 3 – Focus stock analysis methodology

In addition to the data sources and analyses described in Section 3.3, information was collated on the stock specific TACs advised by ICES and agreed TACs (by EU AGRIFISH Council) for the corresponding management units, for a five-year (2016-2020) period and the percentage difference calculated. These analyses also inform Case Study 1 (in Section 5). For some management units, this was not possible due to an advised zero TAC (see Case study 2) or incompatible ICES advice (stock) and management units.

Landings data for 2019 for each focus stock (management unit) for UK vessels in the UK EEZ by fisheries administration were sourced from the MMO[26]. Analyses based on vessel size category (10 m and under, over 10 m) required exclusion of records with no specified vessel length. Information on quota uptake in 2019[19] is provided to add additional context to the contribution of the focus stocks to the UK fishing industry. These uptake figures are based on EU landings data for each Member State in relation to the final or adjusted TAC for each country. That TAC may be higher or lower than the initial relative stability share, due to for example international quota swaps, banking or borrowing of quota, in-year TAC adjustments, etc, as described in brief in Section 2. For the purposes of the report, the percentage uptake is also calculated relative to the initial quota allocation for the UK, based on the UK landings figures for 2019 held by the EU[rrr].

To provide an estimate of the volume of unsustainable catches in 2019, for those focus stocks where the exploitation status was categorised as 'overfished', the total catch (based on ICES landings and discard figures in the advice sheets[sss]) in excess of the advised TAC was calculated. To determine an approximate value for the UK fleet, the UK's percentage quota share[ttt] was applied to the estimate of total unsustainable catch. In turn, the UK unsustainable catch estimate was provided as a percentage of the UK's 2019 landings (in all applicable areas, not just UK waters)[19]. These estimates are only indicative as there are various likely sources of inaccuracies in the calculation. These include errors in the catch data that cannot be quantified, for example arising from underestimation due to unreported discarding or from misalignment between advised TACs at the stock level and catches at the management unit level. Also, differences between the UK's (or any nation's) initial relative stability share and final share of the total catches are likely, due to quota movement processes described above.

Where applicable, the proportional allocation of the UK's quota between the devolved countries is presented (based on the MMO's allocations in 2020[146]).

[rrr] Table 2.12 of Section 2 Landings file; differences between Member State and EU landings records often exist due to time lags in reporting and/or discrepancies between data sources (see methodology): *https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2019*

[sss] Where the ICES stock unit aligns with >1 management unit (TAC area) the catches for all management units were used in the calculation.

[ttt] Relative stability share (North Sea whiting), average % share as the advised TAC applied to >1 TAC area (North Sea cod) or % share of overall TAC received by UK (NE Atlantic blue whiting)

Appendix 4 – Glossary

Stock unit refers to a part of a fish population usually with a particular migration pattern, specific spawning grounds, and subject to a distinct fishery. In theory, a stock unit comprises all the individuals of fish in an area, which are part of the same reproductive process. It is self-contained, with no emigration or immigration of individuals from or to the stock .

Management unit is the component of the stock unit that is considered a 'stock' for the purposes of fisheries management[uuu].

Total Allowable Catch (TAC) is a catch limit set for a particular fishery, typically for a fishing year or season. TACs set by the European Commission are typically for a given management unit.

Fixed Quota Allocation (FQA) is a system designed to allocate quota as a percentage of total available quota, to a certain fishing licence, based on historical average landings

ICES is the International Council for the Exploration of the Sea (www.ices.dk): 'an intergovernmental marine science organization, meeting societal needs for impartial evidence on the state and sustainable use of our seas and oceans'.

Landings mean the part of the total catch that is physically landed at a port. Landed fish may be whole, gutted and headed or filleted.

Catches mean all fish taken from the sea regardless of whether they are landed (also referred to as wanted catch) or discarded (known as unwanted catch) back into the sea.

Maximum Sustainable Yield (MSY) is a theoretical maximum yield (catch) that can be taken from a stock in the long term under constant environmental conditions when that stock is at the biomass reference point B_{MSY}

B_{lim} is the limit biomass reference point, below which the stock has reduced reproductive capacity and an increased risk of stock collapse.

B_{MSY} is a biomass reference point which in theory represents the stock size at maximum population growth rate and therefore the biomass of a stock at which it could deliver its MSY.

Fishing mortality (F) is a parameter used in fisheries population dynamics (which forms the basis of stock assessments) to account for the rate of loss of organisms from a population due to removals associated with fishing

[uuu] Taken from: *http://www.ices.dk/community/Documents/Advice/Acronyms_and_terminology.pdf*

F_{lim} is the fishing mortality which will result in an average stock size of Blim in the long term.

F_{MSY} is the fishing mortality rate that should, on average (all other things being equal) lead to a stock reaching B_{MSY}

$B_{trigger}$ is a biomass reference point defined as the parameter in the ICES advice framework which triggers a more cautious response, typically reduced fishing mortality, to allow the stock to rebuild to levels compatible with MSY ($F<F_{MSY}$)

Spawning Stock Biomass (SSB) is typically the metric used to indicate the status of a stock. SSB represents the reproductive capacity of the stock as it is an estimate of the combined weight of all (mature) individuals which are capable of reproducing.

Demersal refers to fish species living on or near the sea floor.

Pelagic refers to fish species found mainly in shoals in midwater or near the sea surface

Shellfish covers all crustaceans (such as crabs and lobsters) and molluscs (such as scallops and mussels)

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