WORKING GROUP ON MIXED FISHERIES METHODOLOGY (WGMIXFISH-METHODS; outputs from 2020 meeting)

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Contents

i Executive summary

The ICES Working Group on Mixed Fisheries Methodology (WGMIXFISH-METHODS) meet to progress work on the improvement and development of the mixed fisheries advice. In this report the group provides a summary of the work completed in 2020.

Work continued on the full documentation of the mixed fisheries advice production process, including workflows, code repositories, stock annexes and associated documentation for all advice regions. A review was completed of the new data call and associated quality control procedures to identify possible areas of improvements.

Working group participants responded to the outcomes and issues encountered during WGMIXFISH-Advice 2019 for Celtic Sea, Iberian Waters, and North Sea. A full list of issues and solutions were collated and discussed during the meeting. Additionally, work continued on the development of mixed fisheries advice for three new advice regions: Bay of Biscay, Irish Sea, and Kattegat.

The working group responded to the outcomes of the Mixed Fisheries Scoping Meeting (WKMIXFISH), identifying timelines and requirements to meet the growing needs for mixed fisheries advice. To support these growing needs the group members presented and discussed new techniques in the field of mixed fisheries.

ii Expert group information

Expert group name	Working Group on Mixed Fisheries Methodology (WGMIXFISH-METHODS)
Expert group cycle	Annual
Year cycle started	2020
Reporting year in cycle	1/1
Chair	Claire Moore, Ireland
Meeting venue and dates	22-26 June 2020, by correspondence (30 participants)

1 Introduction

The Working Group on Mixed Fisheries Methodology (WGMIXFISH-METHODS) was formed in response to the need to further develop how ICES provides mixed fisheries advice and to progress application of methods, independent of the annual advisory meeting (ICES, 2014). Annually this meeting focuses on the development and improvement of mixed fisheries analysis.

Terms of Reference

WGMIXFISH-METHODS - Working Group on Mixed Fisheries Advice Methodology

2019/2/FRSG16The **Working Group on Mixed Fisheries Advice Methodology** (WGMIXFISH-METHODS), chaired by Claire Moore, Ireland, will meet in Nantes, France, on 22–26 June 2020 to:

a. Continue improvement of WGMIXFISH-ADVICE workflow, updating associated documentation and increasing transparency;
b. Respond to the outcomes of the Mixed Fisheries Scoping Meeting;
c. Respond to the outcomes and issues encountered during WGMIXFISH-Advice;
d. Review of updated data call, identifying possible areas of improvements;
e. Assess the fleet/métier definition in Bay of Biscay;
f. Development of Irish Sea FCube;
g. Continued development of the combined implementation of FCube and FLBEIA in conjugation with STECF/WGECON economists.

WGMIXFISH-METHODS will report by 3 August 2020 for the attention of ACOM.

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert's country can attend this Expert Group.

Supporting Information

Priority:	The work is essential to ICES to progress in the development of its capacity to provide advice on multispecies fisheries. Such advice is necessary to fulfil the requirements stipulated in the MoUs between ICES and its client commissions.
Scientific justification and relation to action plan:	The issue of providing advice for mixed fisheries remains an important one for ICES. The Aframe project, which started on 1 April 2007 and finished on 31 march 2009 developed further methodologies for mixed fisheries forecasts. The work under this project included the development and testing of the FCube approach to modelling and forecasts. In 2008, SGMIXMAN produced an outline of a possible advisory format that included mixed fisheries forecasts. Subsequently, WKMIXFISH

	was tasked with investigating the application of this to North Sea advice for 2010. AGMIXNS further developed the approach when it met in November 2009 and produced a draft template for mixed fisheries advice. WGMIXFISH has continued this work since 2010.
Resource requirements:	No specific resource requirements, beyond the need for members to prepare for and participate in the meeting.
Participants:	Experts with qualifications regarding mixed fisheries aspects, fisheries management and modelling based on limited and uncertain data.
Secretariat facilities:	Meeting facilities, production of report.
Financial:	None
Linkages to advisory committee:	ACOM
Linkages to other committees or groups:	SCICOM through the WGMG. Strong link to STECF.
Linkages to other organizations:	This work serves as a mechanism in fulfilment of the MoU with EC and fisheries commissions. It is also linked with STECF work on mixed fisheries.

2 ToR A - Continue improvement of WGMIXFISH-ADVICE workflow, updating associated documentation and increasing transparency

2.1 Overview

During WGMIXFISH-METHODS 2019 work commenced on the documentation of the complete mixed fisheries advice production process, from data submission to the final advice products (ICES 2019a). This process is driven by ICES move towards a quality assurance framework (QAF), but has the added benefit of:

1 - Providing WGMIXFISH members with a formalized framework, which clearly identifies procedures and responsibilities for the production of a consistently high quality advice product in an effective and efficient manner;

2 - Allowing WGMIXFISH members to identify knowledge gaps and possible areas for improvement;

3 - Increasing the group's transparency, making the work of WGMIXFISH more accessible, therefore allowing other ICES groups to effectively engage and collaborate with the group. While also providing a transparent guide for non-group members (ADG, stakeholders).

In 2020 a number of further advances were made in this area: assessment stock lists, stock annexes, fully reproducible code repositories and advice production plans for each of the advice regions. With all these key components documented it was possible to have a fully document advice production year, which allowed the group to better deal with the challenges presented by working remotely during Covid. Additionally, subgroup chairs were designated per advice region. These individuals provided meaningful leadership to new members, ensuring they were fully supported and able to engage in group work. A summary of the outcomes of this work can be found below

2.2 Bay of Biscay

Stock list (2020)	ank.27.78abd, bss.27.8ab, hke.27.3a46-8abd, hom.27.2a4a5b6a7a-ce-k8, mac.27.nea, meg.27.7b-k8abd, mon.27.78abd, nep.fu.2324, rjc.27.8, rjn.27.678abd, rju.27.8ab, sdv.27.nea, sol.27.8ab, and whg.27.89a
Assessment Code (TAF)	https://github.com/ices-taf/2020_BoB_MixedFisheriesAdvice
Stock Annex	https://www.ices.dk/sites/pub/Publication%20Reports/Stock%20Annexes/2021/mix.BoB_SA.pdf
Advice Plan	MS-Teams SharePoint (accessible by group members only)
Advice Experts	Dorleta García, dgarcia@azti.es Michel Bertignac, michel.bertignac@ifremer.fr Youen Vermard, youen.vermard@ifremer.fr

2.3 Celtic Sea

Stock list (2020)	cod.27.7e–k, had.27.7b–k, whg.27.7b–ce–k, nep.fu.11–17, 19, 20–21, 22 and outside FUs, sol.27.7fg, mon.27.78abd and meg.27.7b–k8abd
Assessment Code (TAF)	https://github.com/ices-taf/2020_CS_MixedFisheriesAdvice
Stock Annex	https://www.ices.dk/sites/pub/Publication%20Reports/Stock%20Annexes/2021/mix.cs_SA.pdf
Advice Plan	MS-Teams SharePoint (accessible by group members only)
Advice Experts	Claire Moore claire.moore@marine.ie Lionel Pawlowski Lionel.Pawlowski@ifremer.fr Mikel Aristegui-Ezquibela Mikel.Aristegui@Marine.ie Paul Bouch Paul.Bouch@Marine.ie Paul Dolder paul.dolder@cefas.co.uk

2.4 North Sea

Stock list (2020)	cod.27.47d20, had.27.46a20, whg.27.47d, pok.27.3a46, ple.27.420 , ple.27.7d, sol.27.4, tur.27.4, wit.27.3a47d an nep.fu 5–10, 32, 33, 34, and 4 outFU
Assessment Code (TAF)	https://github.com/ices-taf/2020_NrS_MixedFisheriesAdvice
Stock Annex	https://www.ices.dk/sites/pub/Publication%20Reports/Stock%20Annexes/2021/mix.ns_SA.pdf
Advice Plan	MS-Teams SharePoint (accessible by group members only)
Advice Experts	Alessandro Orio alessandro.orio@slu.se Alexandros Kokkalis alko@aqua.dtu.dk Alfonso Pérez Rodriguez alfonso.perez-rodriguez@hi.no Andreas Sundelöf andreas.sundelof@slu.se Harriet Cole Harriet.Cole@gov.scot Klaas Sys klaas.sys@ilvo.vlaanderen.be Marc Taylor marc.taylor@thuenen.de Niall Fallon niall.fallon@gov.scot Sarah B.M. Kraak sarah.kraak@thuenen.de Thomas Brunel thomas.brunel@wur.nl Vanessa Trijoulet vtri@aqua.dtu.dk Youen Vermard youen.vermard@ifremer.fr

2.5 Iberian Waters

Stock list (2020)	ank.27.8c9a, hke.27.8c9a, lbd.27.8c9a, meg.27.8c9a, mon.27.8c9a
Assessment Code (TAF)	https://github.com/ices-taf/2020_IW_MixedFisheriesAdvice
Stock Annex	https://www.ices.dk/sites/pub/Publication%20Reports/Stock%20Annexes/2017/mix.bbi_SA.pdf
Advice Plan	MS-Teams SharePoint (accessible by group members only)
Advice Experts	Cristina Silva csilva@ipma.pt Hugo Mendes hmendes@ipma.pt Paz Sampedro paz.sampedro@ieo.es

2.6 Irish Sea

Stock list (2020)	In progress
Assessment Code (TAF)	https://github.com/ices-taf/2020_IrS_MixedFisheriesAdvice
Stock Annex	N/A
Advice Plan	MS-Teams SharePoint (accessible by group members only)
Advice Experts	Mathieu Lundy mathieu.lundy@afbini.gov.uk Ruth Kelly ruth.kelly@afbini.gov.uk

2.7 Kattegat

Stock list (2020)	In progress
Assessment Code (TAF)	N/A
Stock Annex	N/A
Advice Plan	MS-Teams SharePoint (accessible by group members only)
Advice Experts	Johan Lövgren johan.lovgren@slu.se Alessandro Orio alessandro.orio@slu.se Sofia Carlshamre sofia.carlshamre@slu.se

3 ToR B - Respond to the outcomes of the Mixed Fisheries Scoping Meeting

3.1 Summary of workshop

The WKMIXFISH workshop was held at ICES Headquarters on 3-5 March 2020 to review the current mixed fisheries advice and identify future direction given the changing needs of the advisory system. It provided a forum for researchers, managers and stakeholders to jointly identify the key challenges and drivers for advice on mixed fisheries, review how current methods and approaches meet their needs and identity future priority areas.

The workshop had 28 participants from 10 Countries, from a wide range of backgrounds. The workshop discussed the types of approaches to advice that may be possible in the future given current available data, knowledge and models; identifying what was needed to develop advice to meet managers' and stakeholders' needs and setting out a road map to meet these goals. Communication and visualisation of often complex, multi-faceted advice provided on mixed fisheries was also discussed to identify how multi-layered information coming from mixed fishery analyses can be provided in a clear, robust and meaningful way so that trade-offs can be assessed among management options. The outputs from the workshop set direction for future mixed fisheries advice by prioritising research, developing, and – ultimately - increasing our capacity to support mixed fisheries management. WGMIXFISH-METHODS concluded that these outcomes could be broken into 8 main areas, each of which are essential to the development of mixed fisheries advice, with varying times lines. The priority for WGMIXFISH is now to ensure that the data processing and advice production is sufficiently automated and transparent to ensure that the group can adapt to the developing requirements of the fisheries. The outcomes of WKMIXFISH will be addressed annually by WGMIXFISH-METHODS.

Scenario / rough timeline to advice	1-2 years	3-5 years	5 years +
Data streamlining: Develop workflows that can require minimum intervention so that advisory meetings can focus on discussing scenarios and how this translates to advice. We still spend too much time addressing data issues (this might be extended to code curation too).	X		
Scenarios: Mixed-fishery considerations will continue to be scenario-based, but can we give more consideration to the types of scenarios given the policy context. E.g. replacing the max. scenario with those based on bycatch TACs for zero advice species. Should there be fleet-specific rules? Do we know better than "everyone fishes their entire Saithe TAC"? Can we simplify (declutter) the advice sheets, to communicate the advice better?	X		
Descriptive advice: What are the key spatial interactions, species correlations and other dynamics that tell the story of the fisheries? How to incorporate in fisheries overviews and elsewhere (e.g. in an app type interface). We can link up with ICES SFD here (Roi Martinez chair of the Working Group on Spatial Fisheries Data (CEFAS) has been approached).		X	

Scenario / rough timeline to advice	1-2 years	3-5 years	5 years +
Stocks in advice: General recognition of importance of *right* stocks rather than every stock. Analysis by area on key stocks driving interactions? What can we say for other species without explicitly including all species, e.g. "based on catch correlations in the fisheries and increase in effort required for A and B, we can expect higher mortality on X, Y and Z" ?	X		
Spatial adaptation: Recognised that fishers will adapt and we see changes in catchability in the historical data. This has a direct effect on our forecasts, how to factor into the advice? We're unlikely in the short-medium term to be predicting behavioural response, but could such considerations inform scenarios (e.g. max adaptation within min scenario, or using catchability in previous years to bound)?		X	
Economics: Could this take the form of an impact assessment approach to mixed fishery scenarios? Complementary work to be undertaken by WGECON based on existing mixed-fishery models. To work up an "economic impact of scenarios" section?		X	
Selectivity: Managers are keen to understand potential impact of selectivity changes, but a big evidence gap. How might we move to scenarios that include selectivity changes? What would be needed?			X
MSEs: Again, a focus on incorporating scenarios including technical measures, potential behaviour adaptations and sensitivities to these assumptions. How can these be incorporated? Case study MSE applications at MIXFISH Methods?			X

3.2 Advancing methodology

In order to respond to the needs raised by WKMIXIFSH, and to continue horizon scanning for future developments in mixed fisheries methodology and advice, time was given at the working group to present and discuss advances in the field and ongoing work. The summary of these presentations and discussions are detailed below.

3.2.1 Beyond short-term forecasting: Ongoing applications in the North Sea

Marc Taylor

Summary: The presentation provides examples of medium- to long-term mixed fisheries scenarios being developed in several projects for the North Sea case study using the FLBEIA mode. Examples from the Probyfish project address the protection of bycatch stocks through advice measures, gear modifications, and metier effort reallocation. Examples from the Pandora project address the incorporation of additional factors affecting stock dynamics, such as the modelling of environmentally-mediated stock recruitment relationships and density-dependent natural mortality, which can improve realism in long-term scenarios.

Discussion: Topics included – 1. Whether scenarios of gear modifications would be able to reproduce known responses in shifts to demography (we believe that it would, although this would not capture changes to median population growth, as is predicted by length-based models). 2. Whether an FLBEIA could implemented an option within the "MaxProfit" fleet effort control that allowed for the optimization of yield (i.e. all prices equal 1.0). 3. Whether density-dependent changes to M are realistic given that

the linear functions used for prediction are based on single predator-prey interactions, and do not consider prey switching. This is likely relevant and may make the approach only applicable to short- to medium-term scenarios.

3.2.2 Providing Integrated Total Catch Advice for the Management of Mixed Fisheries with an Eco-viability Approach

Florence Briton and Claire Macher

Summary: This work progresses the accounting of technical interactions in mixed fisheries while explicitly addressing the human dimensions of sustainability in the TAC advice of these fisheries, hereby articulating research questions raised in both WGMIXFISH and WGEcon ICES working groups. It uses an eco-viability framework to reconcile multi-dimensional sustainability requirements and present its application to two multispecies fisheries: the Bay of Biscay French demersal fishery and the Australian Southern and Eastern Shark and Scalefish Fishery. This talk discusses the economic and social standards that could be compatible with ecological sustainability and provide guidelines to design harvest control rules in both contexts.

Discussion: Implications of setting more precautionary thresholds for the ecological sustainability

3.2.3 Can we take account of technical interactions at haul level?

Sarah Kraak

Summary: This was not a presentation of work carried out but rather of a topic for discussion. Since technical interactions take place at haul level, looking at catchabilities at metier level and averaged over a few years misses some of the haul-level variability and assumes that the fishery cannot adapt. Proby-Fish Deliverable 3_1 demonstrates that variability in catch composition exists at metier level 7 within metier level 6. Moreover, it demonstrates that not all species catches within a métier correlate at the haul level. Two questions were posed: Can Fcube/FLBEIA be run at métier level 7? Can catchabilities in the models be modified based on the lack of correlations found between pairs of species' catches? Perhaps we could give advice on what effort reallocations to incentivise.

Discussion: Data availability is problematic for métier level 7. Some variability may be due to chance (not under control of the fishers for adaptation); we might look at historical catchabilities by year to find how catchabilities can vary. MSEs could take uncertainly of catchability into account based on haul catchabilities.

3.2.4 Projections and simulations featuring gear changes should account for the "Rosa Lee effect"

Sarah Kraak

Summary: Kraak *et al.* (2019) pointed out that in short-term forecasts, medium-term projections, and MSE simulations featuring selectivity changes, the "Rosa Lee phenomenon" should be accounted for, ideally by using length-based models. The Rosa Lee phenomenon arises when size-selective fishing removes faster-growing individuals at higher rates than slower-growing fish, whereby the surviving populations will become dominated by slower-growing individuals. When this effect is ignored, bias may occur in catch and stock projections. Kraak *et al.* (2019) explored the effects quantitatively in a length-and-age-based simulation model of a simplified fishery on a stock that resembles Western Baltic cod (R

scripts are available at https://github.com/sarahbmkraak/Rosa-Lee-paper). They found that, when only fishing rate was changed, the biases in predictions of SSB and catches were relatively small (<10%). When the selectivity parameters (L_{50} or selection range) of the gear were increased, the bias in the prediction of catches <MCRS was very substantial (120-160%). When these selectivity parameters were decreased, the biases in the predictions of SSB and all catches were substantial (25-50%). For simulated stocks with slower mean growth, the biases became more pronounced.

Most of the modelling for WGMIXFISH work is carried out with age-based rather than length-based or age-length-based models (the numbers of individuals in cohorts are tracked by age, not length). For scenarios of gear change, the new selection-at-age pattern is calculated using the mean length-at-age derived from age-length keys (ALK) or from growth parameters according to a growth model, e.g. the Von Bertalanffy growth model. Thus, length-at-age is assumed to be fixed and the Rosa Lee effect is ignored, causing biased projections when gear changes are simulated.

It will not be feasible, in the short-term at least, to modify all age-based modelling to age-length-based modelling. Therefore, it would be useful if quantitative proxies for the effects of the Rosa Lee phenomenon could be established. Unfortunately, the consequences of the Rosa Lee phenomenon are very dependent on stock- and fishery-specific parameters and cannot easily be extrapolated between stocks and fisheries. For example, Kraak *et al.* (2019) report that results are very different for faster and slower growing species (compare Figure 3.1 and Figure 3.2). They also report that simulations with different starting F resulted in very different bias patterns. Moreover, the effects are not very intuitive and straightforward, because the length changes differ by age group (panel d in figures 3.1 and 3.2): at young ages, the mean length may increase, while at older ages, the mean length may dip in the initial years after the gear change and then increase to above the initial level, while at even older ages, the mean length may dip and then increase, but stay below the initial level. This dip is also time-lagged depending on age (panel d in figures 3.1 and 3.2). Therefore, unfortunately, it cannot be anticipated how the bias will look like for other species and fisheries than the ones simulated by Kraak *et al.* (2019). Perhaps the R scripts of Kraak *et al.* (2019) can be used to explore the effects for other species (available at https://github.com/sarahbmkraak/Rosa-Lee-paper).

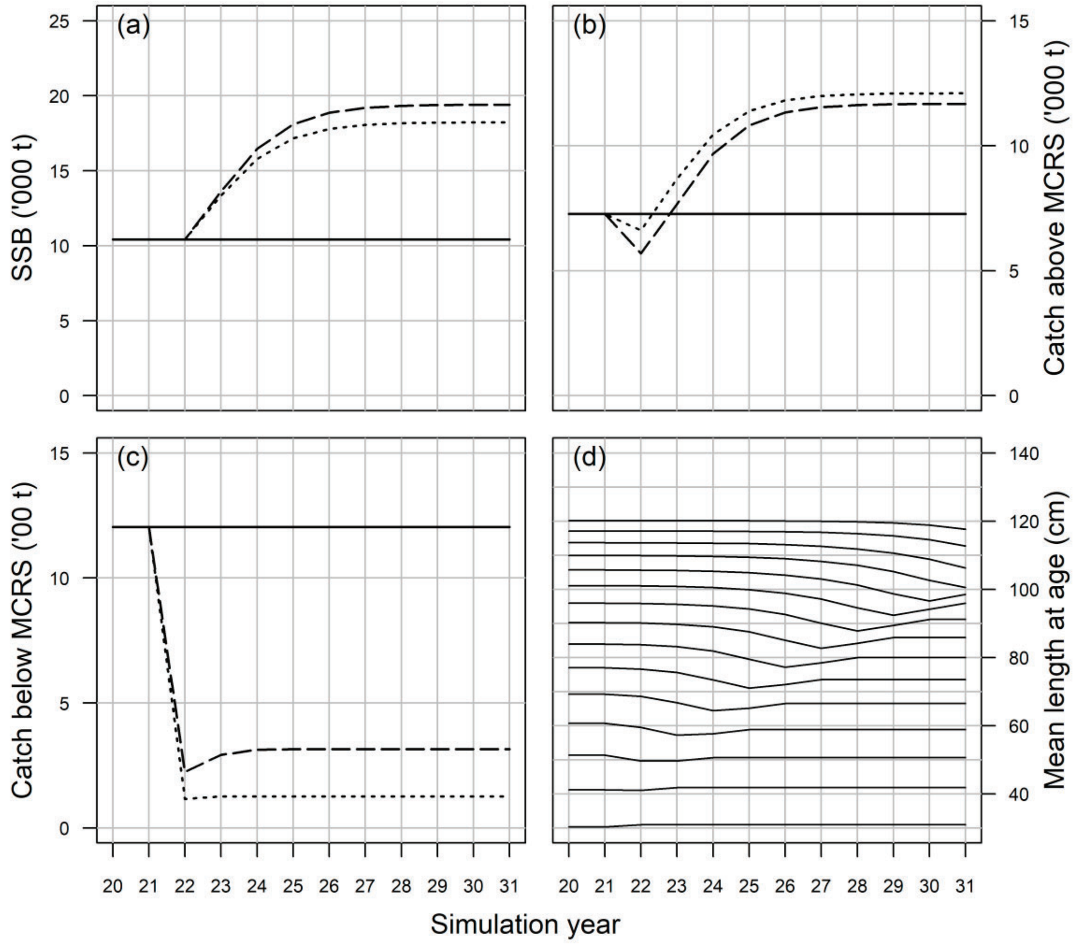

Figure 3. 1; from Kraak *et al.* (2019). Scenario 2.1. F_{full} = 1. Development of SSB (a), catch above (b), and catch below MCRS (c) compared to *status quo* and mean length-at-age (d) over time when, from simulation year 22 onwards, L_{50} is increased from 30 to 40 cm. In (a–c), the solid line is when no change occurs, the stippled line represents results from the dynamic length-based model, and the dashed line represents results under the assumption of fixed length-at-age. In (d), the solid lines represent mean lengths in month 12 at ages 1–15 years from bottom to top. The biases amount to +6, –3, and +150% of the actual SSB, yield, and catch below MCRS, respectively, in year 31 (year 10 after the change).

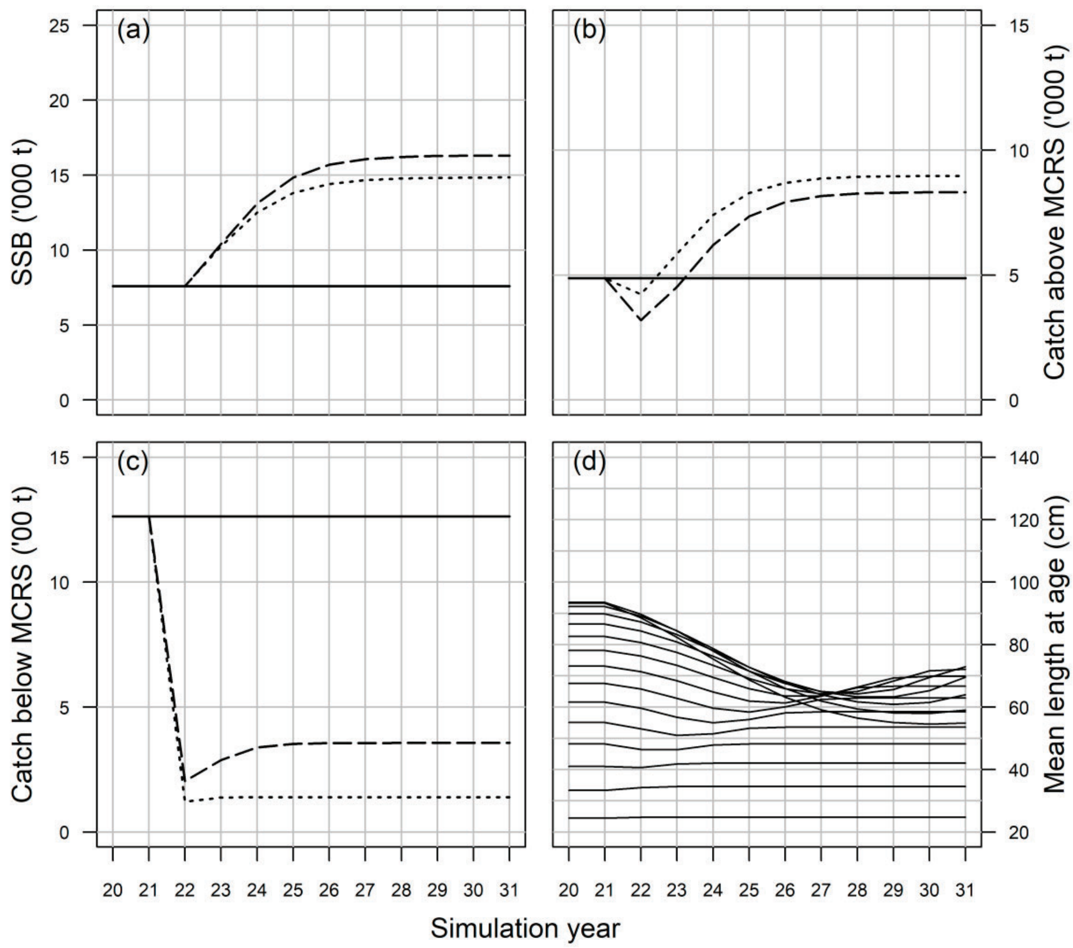

Figure 3..2. from Kraak *et al.* (2019). Scenario 2.5. F_{full} = 1. Development of SSB (a), catch above (b), and catch below MCRS (c) compared to *status quo* and mean length-at-age (d) over time when, from simulation year 22 onwards, L_{50} is increased from 30 to 40 cm under slow growth (mean L_∞ = 178.5 cm, mean K = 0.073 year^{-1} as opposed to the default values mean L_∞ = 154.56 cm, mean K = 0.11 year^{-1}). In (a–c), the solid line is when no change occurs, the stippled line represents results from the dynamic length-based model, and the dashed line represents results under the assumption of fixed length-at-age. In (d), the solid lines represent mean lengths in month 12 at ages 1–15 years from bottom to top (as in year 21). The biases amount to +10, −7, and +157% of the actual SSB, yield, and catch below MCRS, respectively, in year 31 (year 10 after the change).

3.2.5 Global Sensitivity Analysis of a complex multi-stock and multi-fleet simulation model: Application to Iberian Waters case study.

Dorleta Garcia

Summary: As all models are wrong but some are useful, the key is to ensure that they are good enough for the stated purpose. This is exactly the objective of model validation. Models can never be fully validated, and validation needs to be carry out in the whole process of development and implementation of simulation models. Global sensitivity analysis is one of the techniques available to delve in the validation of models. Basically, it consists of the characterization of output variance as a function of the variance in the input factors. In study we combined one of the two most used methods, the Morris elementary effects screening method and the Sobol variance decomposition method.

We illustrated the approach using the demersal mixed fishery that operates in the Atlantic part of the Iberian Peninsula. The Morris method discarded almost all the economic factor, retained the biological ones and retained half of the observation errors and the technical parameters. The variance decomposition method showed that most of the variance of the output variables came from the interaction between input factors. Effort share and the weight and natural mortality of most of the stocks were the input factors with the highest contribution to the variance of the output variables. On the contrary, all the input factors directly related with the stock recruitment process were in the lower part of the table. The combination of GSA and MSE approaches can be used to guide the research effort for the uncertainty conditioning of simulation models, to ensure the model is behaving as intended and detect codding errors, to measure the impact of the observation errors in the performance of the system or with an adequate experimental design to identify the stocks for which an accurate stock assessment is not needed.

3.2.6 Management of target and bycatch species in Bay of Biscay

Dorleta Garcia

Summary: This presentation showed progress in the evaluation of management strategies to protect target and bycatch in the Bay of Biscay. This work is framed in the European project ProbyFish. The demersal fishery in the Bay of Biscay catches a great number of species, most of them very data limited bycatch species. As including all of them in the evaluation would be practically impossible an extended productivity sensitivity analysis, including value and discards, was carried out. We selected the 25 stocks that accounted for more than 95% of the catches of the Spanish fleet that operates in the area. Eight of them have an analytical assessment and the assessment model was the basis for the incorporation of the stocks in the simulation model. The rest were all in ICES category 3 or below. From the remaining 18 stocks, seven were selected to be conditioned using a dynamic approach due to their position in the ranking and the data availability. Six of them were conditioned using DLMToolkit and the other, the black anglerfish, was conditioned using Fla4a including uncertainty in the growth process. Four scenarios were run which depend on the implementation or not of the landing obligation and the exclusion from the TAC system of the non-target species. Excluding some of the species from the TAC system did not have a big impact on the results which were more affected by the implementation or not of the landing obligation.

3.2.7 Using FLBEIA in an EBFM context in the Celtic Sea

Paul Bouch

Summary: This was an update on the Celtic Sea FLBEIA model under development for the ProByFish and FishKOSM projects. These projects consider mixed fisheries within an Ecosystem Based Fisheries Management (EBFM) approach. As well as including the commercial stocks that are age based, the model includes biomass dynamic stocks that allow the incorporation of data-limited stocks including three *Nephrops* functional units and the SPiCT assessed Plaice stock in areas 7fg. With the ProByFish goal of looking at bycaught species, three very data limited species are included, through the use of survey and observer data (*Scyliorhinus canicula, Chelidonichthys cuculus* and *Raja clavata*).

When comparing the min scenario and the previous scenario, all stocks are likely to be above B_{lim}, yet under the previous scenario, several stocks including cod, haddock and whiting showed the biomass trending towards or below the B_{lim} reference point. There is a large degree of uncertainty around the parameters for the data poor species, and that uncertainty means there is some risk of these dropping below B_{lim}. Upcoming work will focus on the impact of changes in gear selectivity. Current and potential

selectivity ogives have been created for a wide range of species for the BT2, TR1 and TR2 metiers. This work will be completed soon as well as tackling a variety of other scenarios.

3.2.8 Estimating catchability trends

Klaas Sys

Summary: This presentation showed a method developed during the Probyfish project to estimate short and long term trends in catchabilities. The methods integrates survey and observer data in a geospatial framework using the INLA software. Assuming that the survey has a constant catchability, and therefore reflect only spatiotemporal variation in abundance over time, the additional spatiotemporal variation underlying the observer data can be attributed to changes in catchability. The model, fitted to survey data (BTS) and observer data of sole and plaice in the North Sea included a linear trend to estimate technological creep over time, and an additional monthly trend to capture small-scale variation e.g. caused by seasonal patterns.

The second part of the method showed work in progress on how catchability estimates could be defined for a given spatiotemporal fishing effort scenario for a single metier. Using logbook data and biomass estimates from the assessment model, spatiotemporal catchability trends were derived. This were turned into a single estimate by fitting a multivariate model to the resampled data given a predefined spatiotemporal pattern of fishing effort distribution. An example was shown for the Belgian beam trawl fleet (TBB_DEF_70-99) sole and cod in the Celtic Sea for three different spatiotemporal scenarios.

3.2.9 An evaluation of multispecies management strategies

Harriet Cole

Summary: The preliminary results of a Scottish national project on evaluating multispecies management strategies are presented. The strategies considered were proposed by various industry groups, policy makers and scientists. They are designed to address issues arising from the mismatch between realised catch and available quota with regard to the EU Landing Obligation. The strategies included either allow for a fleet’s quota to be transferred between stocks or prescribe a new quota system. The multi-species, multi-fleet, bioeconomic model, FLBEIA, was used to simulate each of these strategies for stocks and fleets for the North Sea with a focus on the impact on Scottish fleets when compared to a baseline simulation (ICES MSY approach). Each strategy resulted in a reduction in foregone catch though usually at the expense of exceeding the TAC for certain stocks, though all stocks were seen to remain above their MSY $B_{trigger}$ values over the course of the projection. Future work will focus on adding more complexity to the model setup and developing the implementation of each strategy to provide more realistic results.

Discussion: The discussion focused mainly on the flexibility of FLBEIA in that bespoke fishing effort models can be written and used (as in this project) instead of using the defaults. There was also some discussion on the performance of the default “quotaSwap” function (used for CFP interspecies flexibility calculations) which had not been extensively tested by the FLBEIA team. The results of the CFP interspecies flexibility strategy used in this project agree with results from other studies suggesting that the “quotaSwap” function is working as expected.

3.2.10 Inclusion of West of Scotland into the North Sea FCube model

Harriet Cole

Summary: This presentation presented results from an updated North Sea-West of Scotland (NS-WoS) implementation of FCube. The inclusion of West of Scotland stocks (i.e. cod in 6.a, whiting in 6.a) into the North Sea FCube model has been attempted before though the small number of WGMIXFISH members at the time meant that it was not developed further. This older implementation is reproduced and updated here with the most recent data available in 2019 and the model is run using the same setup and data processing as the North Sea implementation. Some category 3 stocks were included using the methods proposed during the initial NS-WoS implementation. A comparison of the results show that the NS-WoS gives larger catches across most stocks for the maximum, status quo effort and value scenarios whereas the North Sea implementation gives larger catches for the minimum and cod-ns scenarios. These differences are not just due to the inclusion of the WoS stocks but are also due to some slight differences in the model setup.

Discussion: The group think it is worthwhile continuing to develop this implementation and get the West of Scotland stocks included in the Mixed Fisheries advice. As the North Sea implementation is moving to FLBEIA during 2021 the inclusion of WoS may have to be delayed until after this development. Marine Scotland Science will try to add another member to the group to help work on this and group members from AFBI are also keen to be involved. Another discussion point was on the behaviour of fleets in the min and max scenarios where fleets may be restricted by fishing on NS stocks by WoS quota and vice versa and stop fishing completely whereas in reality these fleets would continue to fish in the other area. Some thought as to the defining/conditioning/modelling of behaviour will be needed to address this. In addition, there is potentially a HAWG perspective to consider here as to a mixed fishery on two herring stocks covering these areas. There was also some discussion on the various adjustments needed to the intermediate year assumptions and the group feel that we should be reporting our results and decisions on this more.

4 ToR C - Respond to the outcomes and issues encountered during WGMIXFISH-ADVICE

Annually a number of issues arise during WGMIXFISH-Advice, which are later addressed by this methods working group. All issues, analysis and advances are outlined below:

4.1 Celtic Sea

4.1.1 Incorporation of *Nephrops*

In 2020, it is planned to include *Nephrops* in the production of mixed fisheries advice for the Celtic Sea. In preparation for this WGMIXFISH-Methods focused on data collation, code development and model exploration during this meeting. The methods and code used to incorporate *Nephrops* into the mixed fisheries advice for the North Sea was reviewed and implemented in the Celtic Sea advice production framework. Previous explorations by the Celtic Seas subgroup were also considered and incorporated.

Updated catches (up to 2019) were provided by a WGNEPS attendee, and were formatted into stock objects for the inclusion in the Fcube framework. The 2020 survey abundances will be added to these stock objects after the data analysis of the UWTV surveys in September, in time for inclusion in the WGMIXFISH-Advice meeting in October 2020. All single species data processing and stock object production is documented on TAF (ices-taf/2020_CS_MixedFisheriesAdvice). Efforts were made to streamline this process of updating the stock objects. Now the single species advice is fully reproduced, splitting the unwanted catch into dead and surviving discards.

Nephrops is assessed at the spatial resolution of Functional Unit (FU). However, *Nephrops* management, specifically TAC allocation, is at the level of ICES Subarea, with a TAC being provided for all of Subarea 27.7 (except FU16, which has its own '*of which*' quota). Some explorations were made to investigate trends over time in landing proportions by FU (Figure 4.1) and real TAC uptakes (Figure 4.2).

As Subarea 7 contains both Celtic Sea (FU16, FU17, FU19, FU2021, FU22, out.fu) and Irish Sea (FU14 and FU15), first we would need to split the TAC between these two regions. Landing proportions have changed over time (Figure 4.1). Irish Sea landings account for 52% of the total landings in long term (2000-2019 average), but only for 45% in recent years (2016-2019). At FU level, these proportions have changed as well: increased from 9.5% to 16% in FU16, decreased from 4.5% to 2.5% in FU17 and FU19, increased from 13% to 14.5% in FU2021 and increased from 15% to 17.5% in FU22.

Nephrops Subarea 7 TAC is usually not fully uptake (Figure 4.2); some countries generally fish their quota, while others do not. Assumptions for landings in the intermediate year should take this into account. In any case, *Nephrops* single species advice is entirely based in stock abundance and mean weights, hence these assumptions are not as important as for other species.

All the above need to be further investigated in order to identify clearly the Celtic Sea FUs that actually have mixed fisheries and need to be included in the model.

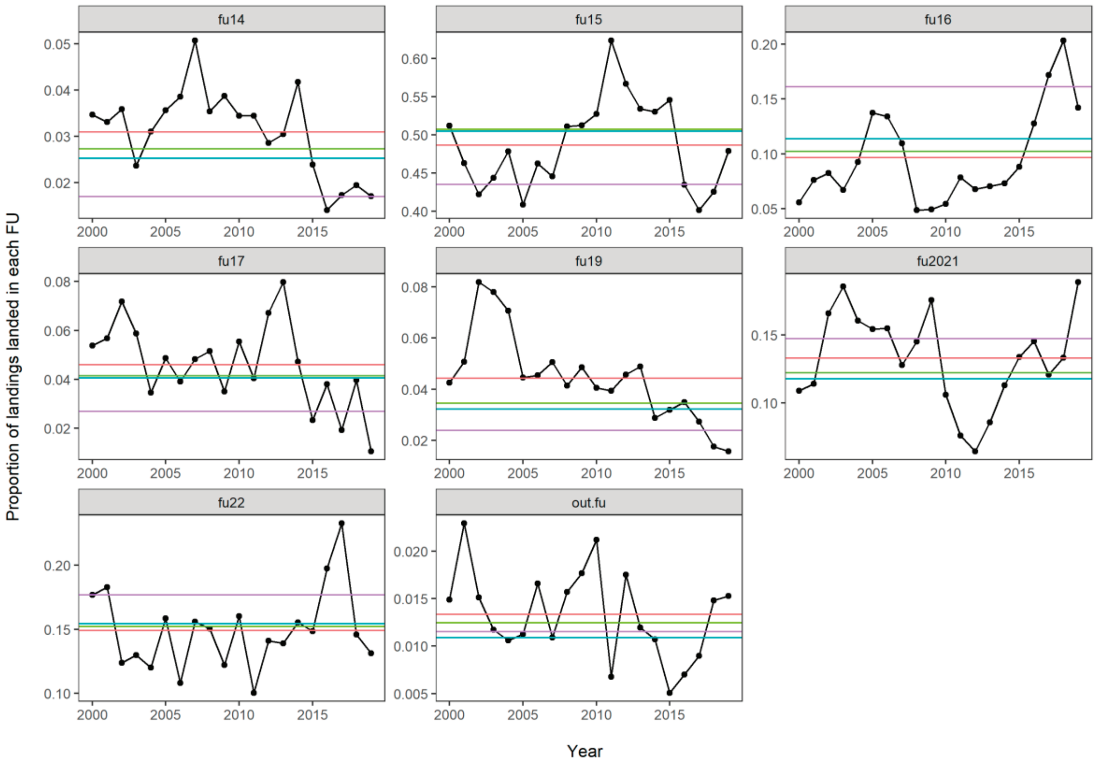

Figure 4.1. Celtic Sea; Incorporation of *Nephrops*: Proportion of landings landed in each FU over time for Subarea 7 (in black). Note that scale in the Y axis is very different for each FU. In colours, averages for various time series (red: 2000-2019, green: 2009-2019, blue: 2011-2019, purple: 2016-2019).

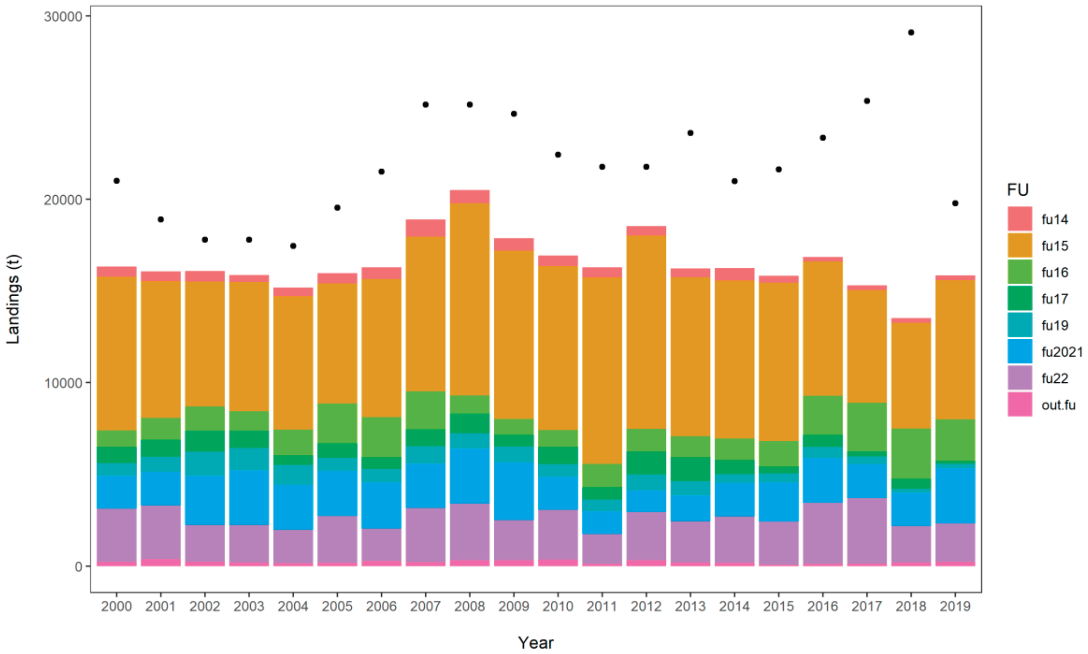

Figure 4.2. Celtic Sea; Incorporation of *Nephrops*: Landings from each FU over time for Subarea 7 (stacked columns in colours). Black points represent TAC.

4.1.2 Forecasts

During the production of mixed fisheries advice, each advice region will produce a baseline run. This baseline run provides a quality control step to ensure that the projections produced but the FCube script are set up correctly and match the original single species forecast and assumptions. This baseline run also provides an incidental quality control check on the projections produced by the single species assessment group. Although both the mixed fisheries and single species forecast should match, some differences can occur in the forecast calculations, which can often be attributed to the variation in the diverse number of single-stock assessment methods currently implemented. When such difference occur WGMIXFISH investigates the reasons and where possible makes adjustments to the FCube forecasts to minimize these difference. During the 2019 WGMIXFISH-Advice working group a number of issues were met and are summarized below per stock:

Hake 3a46-8abd: Difficulties reproducing exactly the catch forecast (~5% difference) and SSB forecast (~33% difference). This is not a model issue and is considered an issue in how the model accounts for catches from other areas outside of the Celtic Sea (e.g. 4, 6, 8, 7a).

Meg 7b-k8abd: Age-based Bayesian model, where we take the median from the assessment as input to a deterministic forecast. Some problems here in replicating the forecast to a reasonable degree of accuracy. As a widely spread stock it is difficult to account for catches from other areas (e.g. 4, 6, 8, 7a). Some issues with splitting the catches among species due to multiple FAO codes in data submissions. Need to make assumptions consistent with the assessment.

Mon 7b-k & 8abd: Some issues with splitting the catches among species due to multiple FAO codes in data submissions. Need to make assumptions consistent with the assessment.

4.1.3 Celtic Sea FLBEIA

An FLBEIA short-term forecast model was conditioned on the same inputs as those used for the 2018 Celtic Sea FCube model used for advice in 2019. The goals were:

- To assess the consistency between an FCube forecast for advice and an FLBEIA forecast for advice in the Celtic Sea,
- To evaluate any areas where additional work needs to be done to be able to produce advice using the FLBEIA model,
- To explore what advantages might be gained by moving over to an FLBEIA advisory model in future, and whether and when this should be put forward for review.

There are a number of advantages to using FLBEIA to produce the Celtic Sea mixed fisheries advice. FLBEIA provides the ability to produce age-based forecasts and incorporate different types of stocks (e.g. biomass-dynamic, SPiCT, constant CPUE). Regular code updates of this package and developments by a community of users mean that this is an area of active development that can grow with mixed fisheries challenges. FLBEIA provides the flexibility to undertake hypothesis testing on the dynamics of fisheries through different scenarios that take account of changes in selectivity, different target species assumptions, landing obligation rules and bycatch quotas, Finally, FLBEIA would enable us the ability to recycle the conditioned data for use in MSE simulations, allowing the group to provide long term strategic advice.

These advantages would allow the advice to respond more readily to new scenarios and measures that are being requested by mangers (e.g. the EC standing request on catches of zero-TAC stocks as bycatch in other target fisheries).

There were some challenges in precisely replicating the same fishing mortality rates for the TACs in the FLBEIA application. This was due mainly to:

- Inconsistent FLStock objects where the catch numbers did not analytically evaluate to the same fishing mortality-at-age. It was agreed that the group should request from stock coordinators to have the catch numbers output from the stock assessment, as well as the input values in InterCatch so that forecasts could be produced consistently.
- Non-standard selectivity conditioning. For example, the Celtic Sea haddock single-stock forecast conditioned the landings and discard split in the forecast on the entire time-series (1993–2017) and fleet-based data was only available for 2013–2017. Work needed to continue to address this, as a first step the same selectivity split could be applied to all métier based on those used in the single-stock forecast. It was noted, however, that this would limit evaluating the impact of different métier effort on the selection pattern at the stock level (e.g. if more effort transferred from the *Nephrops* fishery to the gadoid fishery).
- Deal with statistical catch-at-age assessment modelled catch number output. Differences (in some cases large differences) are apparent between the catch-number at age from the assessment output (the modelled catch numbers) and the fleet-disaggregated numbers in InterCatch (input catch numbers), especially where there was a strong model assumption on selection that resulted in a different distribution of catches to the input data. This creates a problem in producing short-term forecasts consistent with the single-stock advice under the same settings. There was a need to identify a solution to this issue as it will increasingly be a problem for stocks as they move to assessments in statistical catch-at-age frameworks (e.g. the move for Celtic Sea cod and whiting from XSA to SAM this year). Ideally these would all be modelled as the same process (i.e. métier disaggregated data would be used directly in the assessment), but irrespective it was

agreed that the assessment data should take precedence. As a first step to addressing this issue it was agreed to explore modelling the fleet-based catch-data to adjust it to be consistent with the overall output from the assessment. It was important in doing so to maintain individual fleets selection patterns and the Sum of Products (catch numbers x catch weight) was equal to the input total catch for the fleets. This would be investigated inter-sessionally.

Some examples of how FLBEIA could be used to tailor scenarios to the current management problems were presented. These included more nuanced fleet restrictions, e.g. an 'either or' limitation where a zero TAC stock could be excluded from a 'min' scenario, but all other stocks restrict the fishery, which would be useful when provided catch forecasts for zero TAC stocks. A hypothetical change in catchability for a stock would be useful in identifying the scale of gear (or spatial) adaptation needed to avoid over-quota catches of limiting stocks. Removing a métier from the scenario, would help if considering closing a directed-fishery for a stock and that fishery can be appropriately characterised as a métier (supplementary information would be needed to do this beyond the current data call). Exploring the impact of effort reallocation between métier through a model-based approach by using of a simple 'gravity' model to reallocate effort in the métier – by way of example rather than a realistic attempt to model effort redistribution (more details on this approach can be found in Annex 1. Finally, evaluating the impact of different assumptions on catchability and their impact on catch forecasts for zero TAC stocks in other fisheries. This would be useful for evaluating sensitivity of the advice to the input settings in forecasts.

The attendees of this working group agreed that:

1. Work would continue addressing some of the issues outlined above before the October advisory meeting.
2. An FLBEIA model would be implemented *in parallel* to the FCube model for this year's advice, for information only.
3. A model would be finalised for review and audit with a view to using the new model for advice in 2021 subject to an agreed review procedure (the WG are developing recommendations for this procedure elsewhere).

An RMarkdown script to convert the FCube inputs into those required for FLBEIA and the conditioning code to set up the short term forecasts can be found at Annex 1.

4.1.4 WKCELTIC

The WKCELTIC benchmark has led to a change of stock assessment model for cod, haddock, and whiting by moving from FLXSA to SAM in February 2020 (ICES 2020). Data for these stocks were updated and new biological reference points were derived during that benchmark. After the benchmark major issues were found in the French data submission which had used a different approach than in previous years to compute numbers-at-age leading to some substantial changes in the stock structure of several species.

As the datasets needed to be revised and resubmitted, the initial outcomes of the benchmark were therefore cancelled and a new benchmark is planned for September 2020. At the time of the writing of this report, the immediate consequence is that, while the choice of the model is known, the ways the assessments for those stocks are carried out are not set. There are still pending discussions regarding some biological parameters such as natural mortality. Biological reference points need to be updated as well. The forecast procedures need also to be formally adopted. With the assessment and forecast processes

not set, no update of the assessments were carried out during WGCSE in spring 2020. This work will need to be carried out after the benchmark and prior to the WGMIXFISH-advice meeting late October 2020. Following the September benchmark, the new reference points will be integrated in the code where needed. Discards rate from the updated dataset will be estimated and the code will also be upgraded accordingly. The main pending portion of work will be related to adapting the FCube code to reproduce the advice if the single stock assessments move from FLSTF to the SAM forecasts.

4.2 North Sea

4.2.1 Documentation

The North Sea mixed fisheries stock annex and associated documentation on GitLab/TAF were reviewed to ascertain how much documentation existed on the processing of input data. The stock annex held little information on the processing of input data. Some documentation exists regarding the format of the catch and effort data (accessions) and the InterCatch data used as well as a detailed description of the steps taken to process the InterCatch data. Gaps in the documentation of data processing will be added in the form of Rmarkdown documents. The documentation on data processing will be expanded and completed as the 2020 data is processed in line with the timescale needed for production of advice at the autumn meeting.

The following notes correspond to specific suggestions for the North Sea case study documentation:

Stock Annex:

- **Fisheries:** The description of the Fishery is extensive and with high detail. If there are no reasons to believe that the fishery has changed since 2017 to 2020. Revision of the section should be done periodically, but is of lesser priority.
- **Ecosystem aspects:** The section could benefit from the inclusion of the main ecosystem features of the North Sea, especially in relation to trophic interactions between the commercial species.
- **Data:** This section would benefit from a more detailed explanation of the data used on each part of the process in the mixed fisheries assessment method used by WGMIXFISH. For example, a description of the FIDES data is lacking.
- **Methods:** this section could be extended slightly to explain the process followed to produce the WGMIXFISH advice. In the WGMIXFISH advice 2019 report there are some steps that are not explained in the stock annex; for example, the that single species stock baseline runs are conducted with the goal of reproducing as closely as possible the single species advice produced by WGNSSK, and act as the reference scenario for subsequent mixed fisheries analyses.

Code on GitLab/TAF:

- Although the code is in general well explained with comments along the code, additional explanatory comments are desired that better explain what each code file is intended to do. This addition will facilitate external reviews and audits. A brief description of the goals of each code file could be enough. This documentation is underway via the creation of Rmarkdown documents describing the repository scripts (see "Technical documentation" below for specific suggestions).
- Additional comments should be added to the scripts themselves to describe specific steps. The use of RStudio's header coding should be used to numerate sections and be consistent with the aforementioned Rmarkdown documents. More periodic comments should be used throughout the scripts to define intermediate calculations and procedures.

- Some parameters require additional comments to document their use/meaning (e.g. the variable 'popSize' in the model_04_03_Optim.R).
- Global setting parameters (e.g. 'assessment_yr', 'advice_yr') should be defined once at the beginning of the TAF procedure (e.g. within 'data.R'), recorded and called by subsequent scripts in order to minimize the possibility of incorrect variable definitions when updating scripts between years.

Technical documentation (e.g. Rmarkdown documents):

Input data descriptions:

- Stock objects: where do these objects come from? What is their format? How are Nephrops stock objects updated and where does the data come from? A brief description on how the single stock advice spreadsheet (used for reproduce the advice) is made and where the data come from.
- MIXFISH accessions data: A description of the submission and quality control process
- InterCatch data: Check that description is up-to-date.

Data processing:

- Description of script to standardise the stock objects (data_00_Standardising_FLStocks.R)
- Description of MIXFISH (accessions) data processing script (data_01_get_catch_effort_data.R)
- Description of data merging script (data_02_make_fleet_aggregation_with_age_dist.R). This includes checking the description of the InterCatch processing steps that is already documented and expanding to include the other steps taken in the code.
- Description of how the fleet objects are made (data_03_make_new_fleets_aa_ad.R)

4.2.2 Adapting the FIDES scenario for FLBEIA

In 2019, the FIDES data was used in the mixed fisheries advice for the North Sea. This database records the exchanges of quotas at the national scale. Accounting for quota shares allows correcting for choke species effects in the “min” scenario for fleets that, in reality, received quotas from other national fleets and did not choke on this particular species. The FIDES data is used to identify when a choked species is real or not. If, in the “min” scenario, a species is choking a fleet but this fleet was not limited by this species in the past given the FIDES data, then this fleet will be set to fish at the status quo effort in the “min” scenario instead of being choked. Given the current developments of FLBEIA for the North Sea, the FIDES scenario that is already available for Fcube needs to be developed for FLBEIA. These developments are in progress and will be available on the North Sea FLBEIA GitLab repository by this year’s advice meeting.

4.2.3 Looking to parallelise the range scenario for FLBEIA

The F_{MSY} 'range' scenario was set-up by constructing a wrapper function in which the 'min' and 'max' scenarios are evaluated for a particular set of F_{MSY} values – sampled randomly between F_{MSY} lower and upper ranges. The scenarios refer in regards to the stoppage rule used in limiting fleet fishing effort, based on either the uptake of first ('min') or last ('max') individual stock quotas. The optimal setting is defined as the F_{MSY} values that result in the least difference in total catches between the two scenarios, indicating lowest overall choking.

The F_{MSY} targets can be changed easily in the FLBEIA framework by modifying the arguments in the advice.ctrl object. Subsequently, the difference in predicted catches from both ('min' and 'max') simulations is calculated and returned from this function in order to estimate the "fitness" of a given set of F_{MSY}

values (i.e. fitness = (-abs(tot.catch.max – tot.catch.min)). This function was subsequently used as a fitness function within a Genetic Algorithm as implemented in the GA R-package (Scrucca, 2013). This package allows parallelization through the parallel package. To initialize the range scenario, a population of genes is constructed with the chromosomes representing values sampled from the F_{MSY} ranges from the stocks. Initial chromosomes are selected through a Latin Hypercube Sampling scheme.

FLBEIA requires a 2-step short-term forecast in order to adjust the fleet effort behaviour between the intermediate year assumption (fixed status quo effort) and the various scenarios used for the advice year (e.g. 'min' and 'max' fleet effort restrictions). Thus, the variable settings for F_{MSY} are only applied in the advice year, and the resulting total catches are used for measuring the fitness of a given set of F_{MSY} values. The developed routine shows the desired behaviour in terms of increasing fitness of the population over time/generation (Figure 4.3). The solution shown was calculated in ca. 4 hours with a population of 20 individuals, each run on a separate CPU in parallel. This compares to a computation time of more than 24 hours for a non-parallel version of the routine conducted with the current FCube model (30 individuals, 15 generations). Using the parallelized version, the number of individuals could be increased, depending on the available CPUs, without large reductions in computation time.

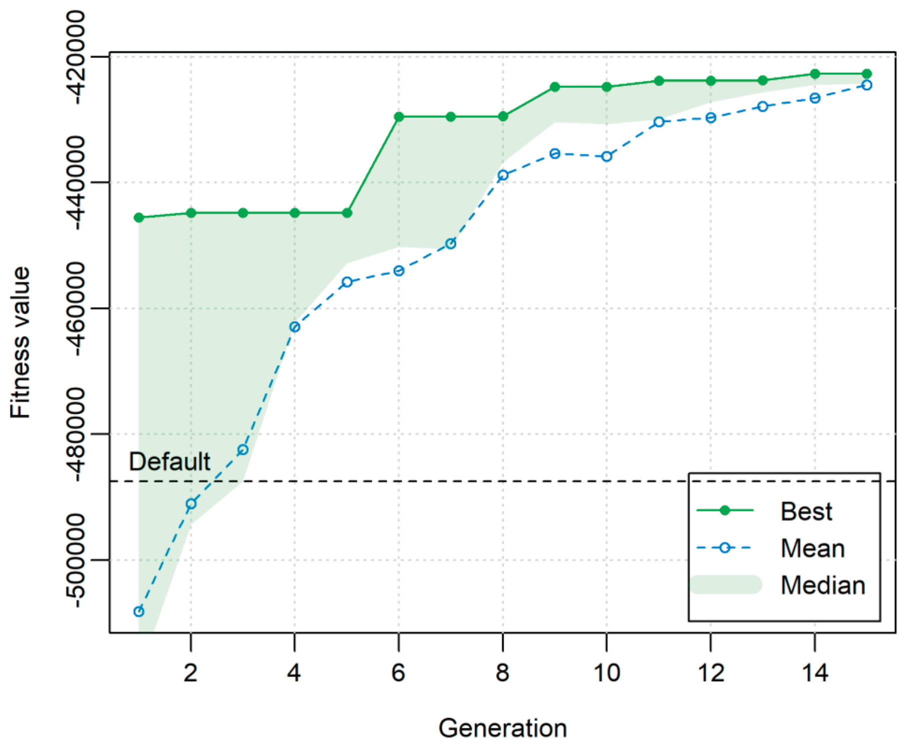

Figure 4.3. Development of population fitness as a function of generation. Median, mean, and best fitness values of the population are displayed, with the original Fmsy setting fitness shown for reference (dashed black line).

The optimal settings (Figure 4.4) were similar to those identified with the FCube model. Some differences exist, e.g. the range of values used for cod, although this reflects changes that need to be made to the harvest control rule used by FLBEIA ('IcesHCR') in terms of how F_{MSY} ranges are treated when SSB falls below Blim. The ongoing comparison between FCube and FLBEIA models of the North Sea case study will allow for a more in-depth testing of the routine, but initial evidence shows that it is performing as desired.

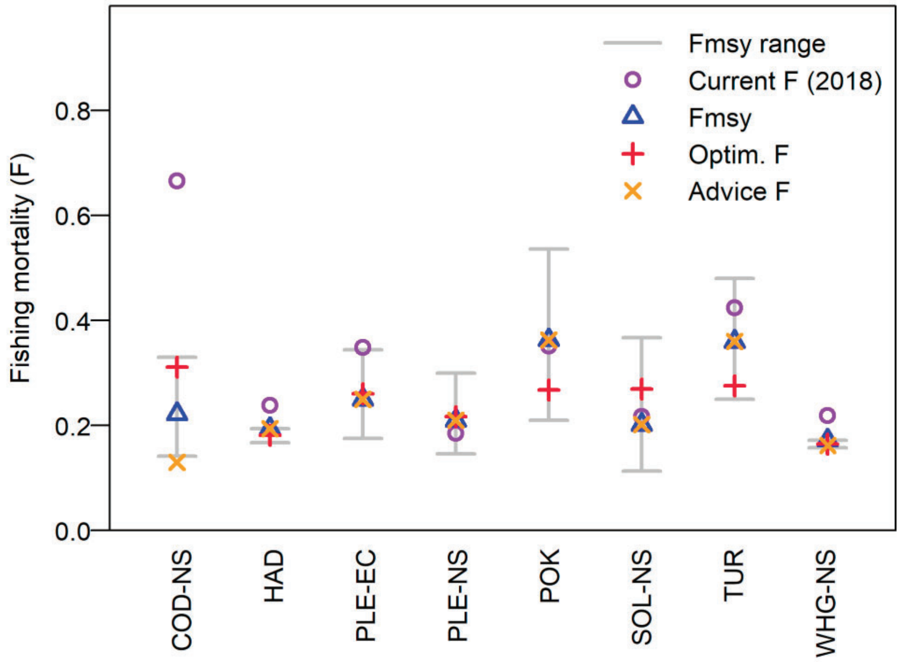

Figure 4.4. North Sea mixed-fisheries 2020 optimal fishing mortality within the F_{MSY} range (Optim. F), compared with FMSY, the current F (F in 2018), and F in the single-stock advice for 2020 (FLBEIA model parallelized range procedure output). The "range" F is the one giving the lowest difference in tonnage between the "Max" and the "Min" scenario across all stocks and fleets.

4.2.4 Comparing non-FIDES scenarios between FLBEIA and FCube

An in-depth comparison between the FLBEIA and FCube models for the North Sea is planned for early 2021 and will be subjected to an external review. Some substantial differences between the models exist, so it is unreasonable to expect perfect equivalency; however, general consistencies should exist given that the two models use a similar approach in describing stock dynamics and fleet behaviour. The more significant differences between the two models include: 1. FLBEIA uses age-disaggregated catchability among fleet/metiers, allowing for differences in selectivity; 2. The relationship between effort and catch is described by the Baranov catch equation in FCube, and Cobb-Douglas function in FLBEIA. Until now, these differences have not been explored in detail. Despite these differences, the FLBEIA model of the North Sea is conditioned using the same data as FCube. It has been used primarily in medium- to long-term scenarios, for which it is particularly appropriate given its MSE framework. In order to move towards a short-term forecast, a two-step projection was developed during the working group (intermediate year assumption of status quo fishing effort followed by application of ICES harvest control rules for advice in future years), as has been done in other case studies (BoB, CS). With the similar assumptions for the intermediate year, a comparison between the models' short-term projections could be done for the first time.

The 'min' and 'max' scenarios were conducted and choking behaviour was compared between the FLBEIA and FCube models. The FCube output corresponds to the non-FIDES scenario, since the routine to relax the number of restrictive stocks based on FIDES data is still being translated into the FLBEIA model conditioning scripts.

The 'min' scenario shows the expected behaviour following the intermediate year (2019), whereby each fleet's effort is limited by the most restrictive stock (typically cod) (Figure 4.5). Limitations to fishing effort are typically presented via a 'rose plot' (Figure 4.6), which highlights the most (i.e. choke) and least limiting stocks to fishing effort. Effort required for quota uptake is not an output from FLBEIA, but approximations of relative values were estimated using quota uptake ratios (Catch/TAC) for the advice year (2020), and standardizing values by a factor needed to scale the least limiting ratio to 1.0. The corresponding rose plot for the FLBEIA model is shown in Figure 4.7. Patterns are largely consistent, with cod being the most limiting in 35 of 42 fleets for FCube and 41 of 42 for FLBEIA. Differences in most limiting stocks (n=6) were where WHG was identified by FCube but COD-NS was identified by FLBEIA. Least limiting stocks showed less consistency, where only 25 of 42 fleets identified the same stock.

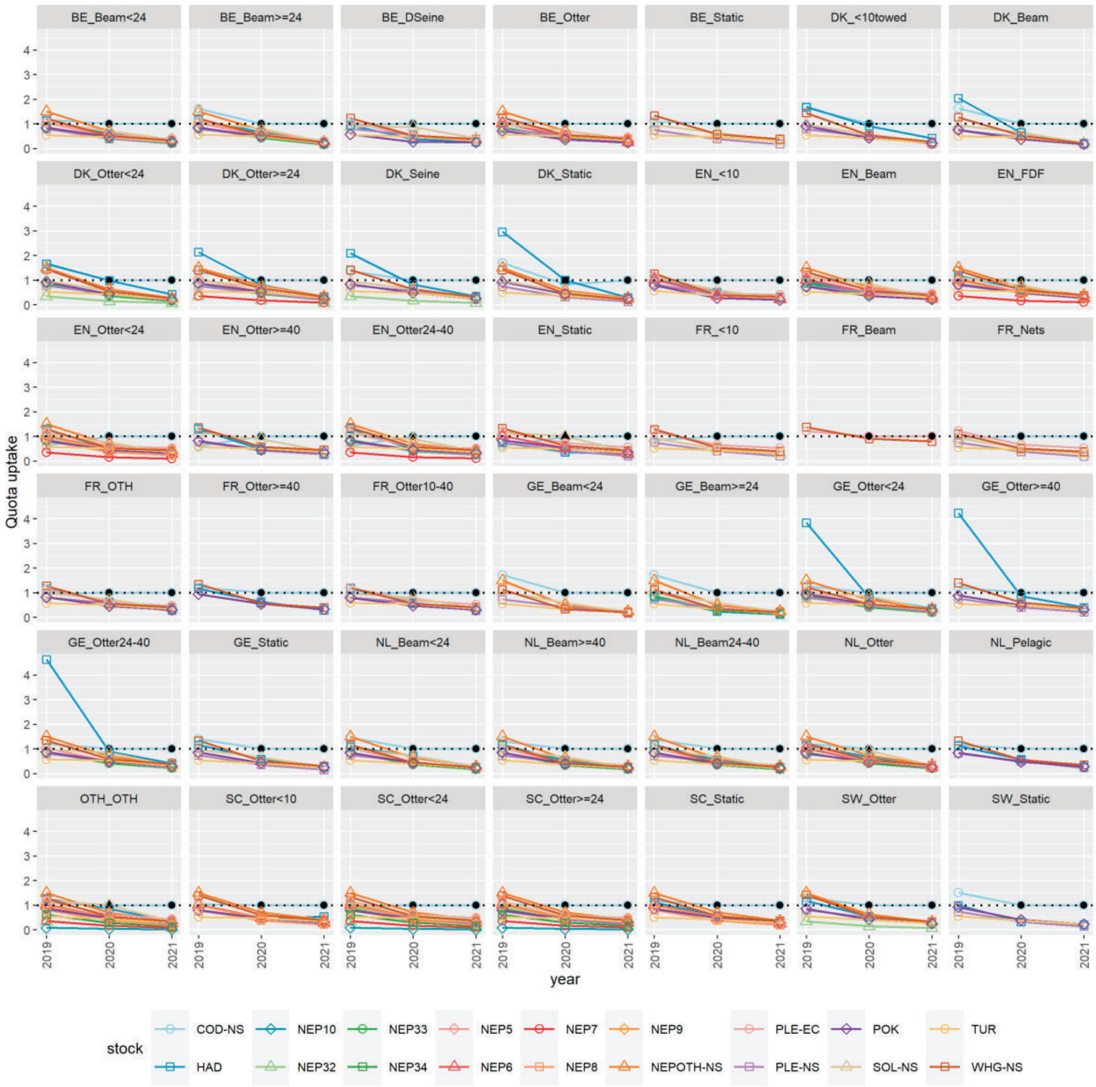

Figure 4.5. Plot of quota uptake (Catch/TAC) by fleet, stock and year in the 'min' scenario of the FLBEIA North Sea case study model. Choking stocks by year are shown by black filled symbols.

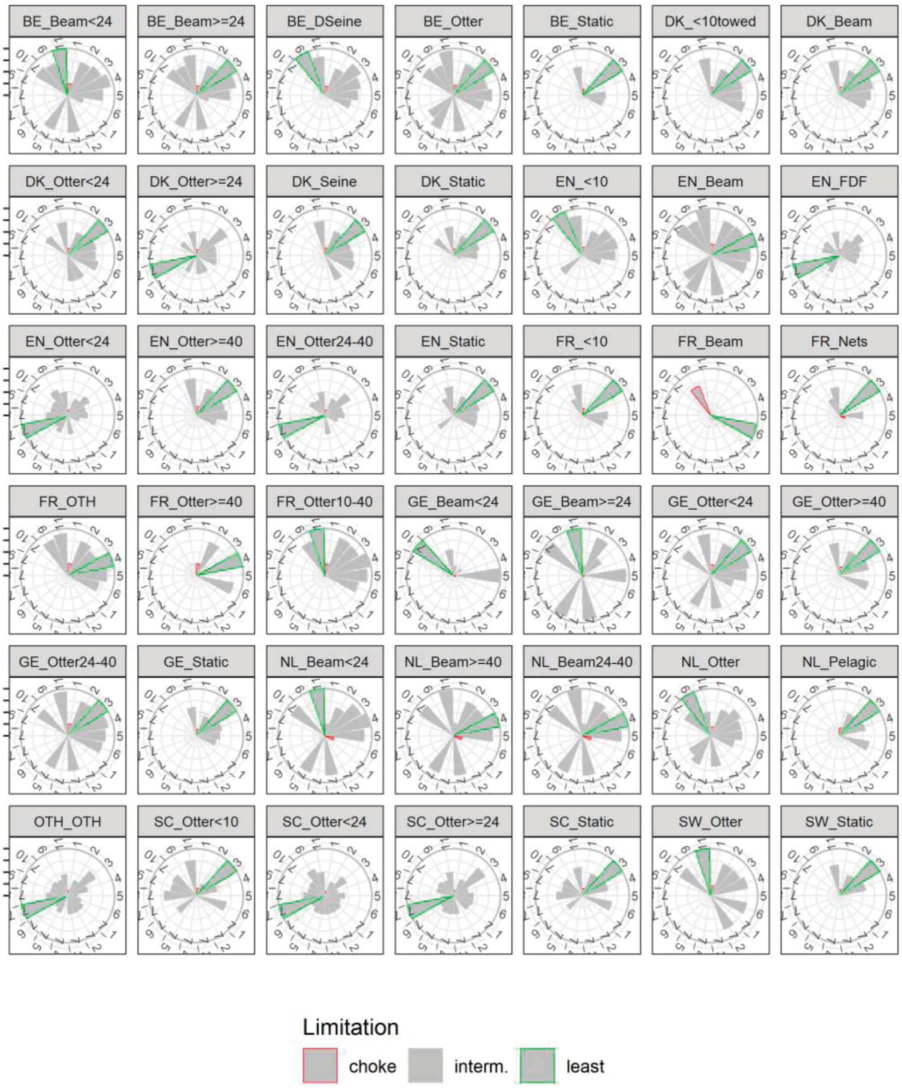

Figure 4.6. Mixed fisheries for the North Sea (FCube model, WGMIXFISH-Advice 2020). Estimates of effort by fleet needed to reach the single-stock advices. Red triangles highlight the most limiting species for that fleet in 2020 ("choke species"), whereas the green triangles highlight the least limiting species. (1: cod.27.47d20; 2: had.27.46a20; 3: ple.7.420; 4: pok.27.3a46; 5: sol.27.4; 6: whg.27.47d; 7_1: nep.fu.10; 7_2: nep.fu.32; 7_3: nep.fu.33; 7_4: nep.fu.34; 7_5: nep.fu.5; 7_6: nep.fu.6; 7_7: nep.fu.7; 7_8: nep.fu.8; 7_9: nep.fu.9; 7_10: nep.27.4outFU; 9: ple.27.7d; 11: tur.27.4). Fleet names are given by country (BE = Belgium, DK = Denmark, EN = England, FR = France, GE = Germany, IE = Ireland, NI = Northern Ireland, NL = the Netherlands, SC = Scotland, SW = Sweden, OTH = Others) and by meaningful combinations of main gear and vessel size differing across countries and based on homogeneous average fishing patterns. FDF = Fully Documented Fisheries vessels. Vessels in the various fleet segments can engage in several fisheries (métiers) over the year.

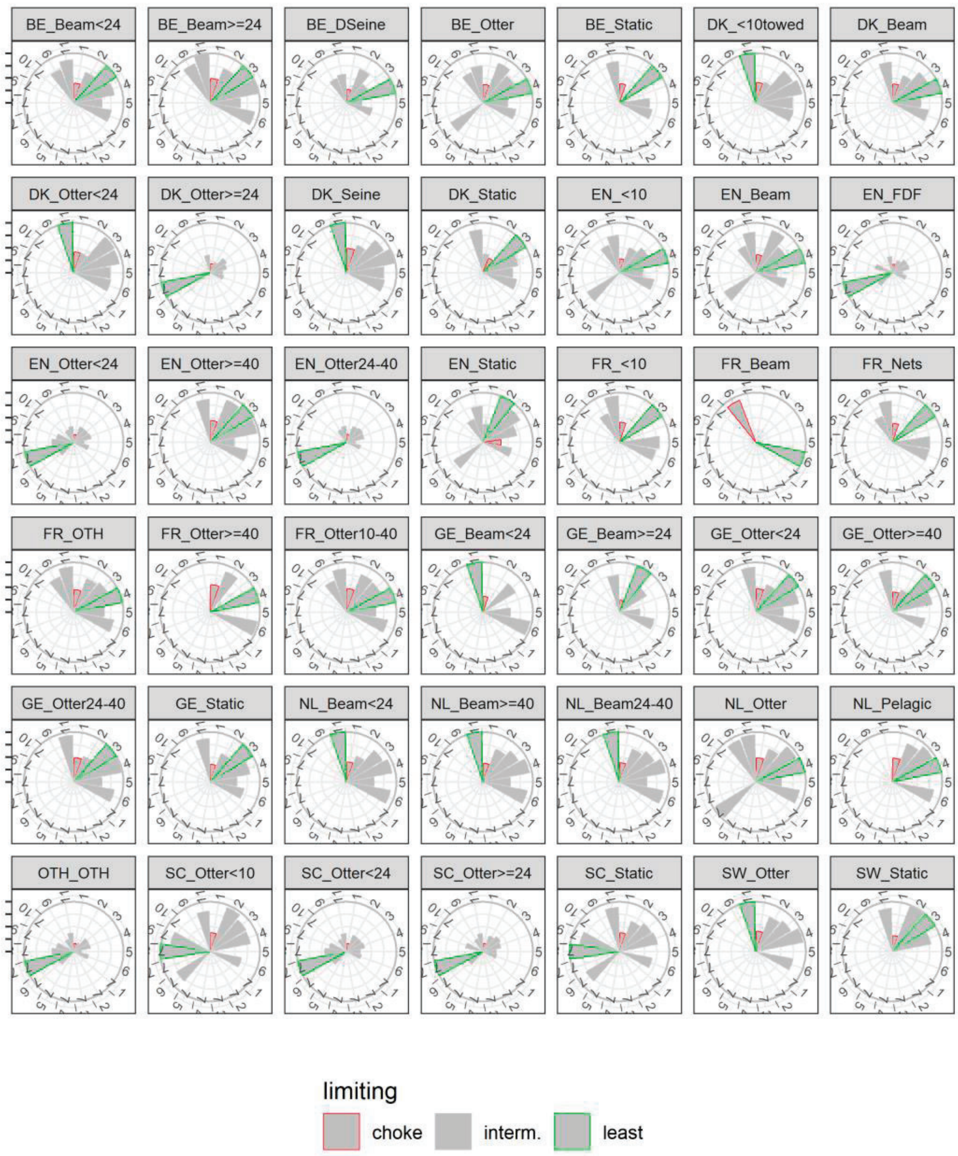

Figure 4.7. Mixed fisheries for the North Sea (FLBEIA model). Estimates of effort by fleet needed to reach the single-stock advices. Red triangles highlight the most limiting species for that fleet in 2020 ("choke species"), whereas the green triangles highlight the least limiting species. See Figure 4.2.4.2 legend for additional details.

A more thorough comparison will be conducted in preparation for the planned external review. A complete list of the specific outputs for comparison still needs to be determined, but is likely to include:

1. Conditioned model – Compare between conditioned mixed-fishery models, especially for final year; e.g. catch composition by fleet/metier, FLBEIA stocks (reconstructed from FLBiols and FLFleetsExt).

2. Intermediate year forecast – Compare between mixed-fishery models and between mixed-fishery models and single-species forecast assumptions, e.g. F, catch, and SSB.

3. Projection year forecast – Compare between mixed-fishery models in terms of harvest control rule behaviour (e.g. how IcesHCR in FLBEIA deals with cases below Blim). Compare and between mixed-fishery models and single-species forecast assumptions, e.g. F, catch, and SSB. Compare between mixed-fishery models in terms of choke species identification (using similar metric, such as Catch/TAC). Disconnect between the stochastic and deterministic short term forecast for SAM fit models (Vanessa Trijolet and Thomas Brunel). Forward function was developed to deal with SAM stock assessment

4.2.5 Extension of North Sea Fcube into the West of Scotland

A Special Request was submitted last year for WGMIXFISH to assess likely levels of bycatch for certain stock which have zero catch advice including cod and whiting in division 27.6.a. In addition to using mixed fisheries data to provide a description of these fisheries, an extension of the North Sea FCube model into the West of Scotland (27.6.a) was developed. The inclusion of the West of Scotland into the North Sea FCube model has been attempted before though the small number of WGMIXFISH members at the time meant that it was not developed further due to the extra data processing involved (ICES 2013). The North Sea-West of Scotland (NS-WoS) implementation was updated here with the most recent data available in 2019 and the model was run using the same setup and data processing as the North Sea implementation. Some category 3 stocks were included using the methods previously used by WGMIXFISH (ICES 2013). A working document detailing the steps taken to set up the NS-WoS FCube model and the results for the Special Request can be found in the Annex 2.

Unfortunately, due to illness the Special Request results were not able to be presented at WGMIXFISH-ADVICE 2019 and so the results went unused. A comparison of the NS-WoS model results against the North Sea model results (used for the 2019 mixed fisheries advice) was conducted for this meeting (section 3.2.10). This comparison showed that the NS-WoS gives larger catches across most stocks for the maximum, status quo effort and value scenarios whereas the North Sea implementation gives larger catches for the minimum and cod-ns scenarios. However, these differences are not just due to the inclusion of the WoS stocks but are also due to some slight differences in the model setup.

Further development and improvement of the NS-WoS implementation will be conducted in the future. The timeline for this is uncertain due to the planned move from FCube to the FLEBEIA model for the North Sea implementation as this development will need to happen first before extending the FLBEIA model into the West of Scotland. Another development point is a need to consider the behaviour of fleets in the minimum and maximum scenarios where fleets may be restricted by fishing on North Sea stocks by West of Scotland quota and vice versa. This is because it is likely that the current model setup does not allow these fleets to move areas to continue fishing as they would in reality. Some thought as to the defining, conditioning or modelling of behaviour will be needed to address this. In addition, there is the potential to consider including pelagic fleets to assess the mixed fishery on two herring stocks covering these areas.

4.2.6 Incorporation of data poor species

In the North Sea case study, 10 *Nephrops* functional units are included but with fixed dynamics. Of these, only 4 (FUs 5, 6, 7, and 8) are actively assessed using an underwater TV survey with absolute abundance estimates. For those FUs, the FCube forecasted TAC is based on a ratio of change from the current yields to the ICES advice for the same FUs. The FLBEIA model has been used to assess whether fishing restrictions based on currently managed stocks is sufficient to protect other data-poor stocks. For example,

several additional stocks have been incorporated into the model whose dynamics are based on biomass dynamics only (i.e. assessed through surplus-production models - SPiCT). These include: Brill (BLL), Dab (DAB), Anglerfish (ANF), Lemon sole (LEM), and Ling (LIN). These assessment are not all approved for advice, yet the inclusion of their dynamics in the model may still provide some first insights into their health.

4.3 Iberian Waters

Discrepancies were found between the FLBEIA baseline runs and the single stock forecasts. Discrepancies in catches were important for hake, four-spot megrim and white anglerfish (Table 4.1). The discrepancies are attributable to:

- The catch production used to describe the relationship between effort and catch (Cobb Douglass function in FLBEIA vs. Baranov catch equation in most age structured models).
- The projection of the stock from year [y-1] (the data year) to year [y-1] the assessment year using the observed catch at age at fleet levels instead of the estimated by the model. This affects only Hake and Monkfish because the model estimates de catch at age.
- In the case of hake and white anglerfish the discrepancies are also attributable to methodological differences between the length-based, seasonal and statistical assessment models used by WGBIE and the age-based annual forecast used by WGMIXFISH. The differences in the SSB and fishing mortality for four spot megrim and hake are high (Table 4.1), 13% in SSB of hake and around 11% in the fishing mortality of four-spot megrim. There are differences in the weights-at-age of hake and four spot megrim in both approaches that should be investigated.

Table 4.1. Iberian waters: FLBEIA baseline run outputs for SSB and F relative to ICES advice.

	SSB_2018	SSB_2019	SSB_2020	SSB_2021	F_2018	F_2019	F_2020
HKE	0.99	1	1	0.87	1.03	0.91	0.96
LDB	1	1	1	1	1	0.89	0.91
MEG	1	1	0.99	0.98	1	1	0.98
MON	1	1.02	1.03	1.06	1	1.02	1.05

The problems mentioned above interact between themselves and it is not easy, or even possible, to disaggregate the effects. The actions described below will be taken in the next advice working group to solve the problems detected. The following measures are suggested:

- Define clearly the confidence intervals of the assessment, and determine if this variation is with the bounds of this interval.
- Coordinate with single species stock assessors to determine the best values to be report in the advice sheets. Some SAM advice sheets report different values – median projection values from 2022 are obtained from resampling of over 20 years data and are unstable (i.e. North Sea saithe). Assessors should provide a geometric mean from that period and we can see if this improves out deterministic forecast.
- These issues need to be recorded along with a summary of difference in the report, so that end-user and ADG can reference them.

- In FLBEIA Baranov catch equation will be included to describe the relationship of effort and catch. As the calculation of effort and catch is done fleet by fleet, it is necessary to make an assumption about overall fishing mortality that could generate discrepancies with other approaches.
- The projection of the population in year [y-1] (the data year) will be avoided in FLBEIA changing the internal code and asking the stocks coordinators for the stock abundance estimates at the beginning of the assessment year [y]. This will ensure that the forecast starts in the same conditions.

5 ToR D - Review of updated data call, identifying possible areas of improvements

This year's data call requested a complete resubmission of the mixed fisheries dataset back to 2009. The aim of this resubmission was to clean up some of the persistent data issues encountered by the group when processing the input data and improve consistency between the datasets. Ideally, any data cleaning issues should be followed up and corrected with data submitters rather than being addressed by the WGMIXFISH group. This will enable group members to focus their time on advancing the mixed fisheries advice that is produced rather than spending it on addressing data issues.

To review the submissions from the new data call a quality control (QC) report was produced for each country that submitted data (example annex 3). These individual country specific reports break the data down by ecoregion and plot the data time series to aid group members with checking that the codes submitted match those listed in the data call (covering countries, areas, metiers, years, quarters, FDF flags, units of data, consistency between files). Any discrepancies were reported in a feedback form which will be sent back to national data submitters to request updates to their submissions.

Common issues found so far include:

- Missing years – only data for 2019 was submitted;
- Some duplication of records;
- Reporting of non-standard area codes (i.e. not at ICES division level);
- Data separated by semi-colon rather than comma separated;
- Confusion on how to report catch for *Nephrops* functional units (functional unit should be indicated in the species code and not in the area code).

This review process should be completed and data submitters notified within a week. As getting this data is key to being able to start progress on the production of mixed fisheries advice the data submitters will be given a week to respond.

6 TOR E - Assess the fleet and métier definition in the Bay of Biscay fisheries

Before models of mixed fisheries scenarios can be parameterised the fleets and metiers much be defined. Fleets and metiers are the unit by which we account for the key technical interactions occurring in the fishery. In preparation for the next Working Group on Mixed Fisheries Advice to be held in October 2020 (WGMIXFISH-ADVICE), which will be requested to provide the first mixed fisheries considerations for the Bay of Biscay, the Working Group on Mixed Fisheries Advice Methodology (WGMIXFISH-METHODS) was tasked with assessing already available fleet and métier definitions and suggesting a way forward on that topic/issue. Several approaches have been recently conducted over various projects and/or working groups for the definition of fleets and métiers in the Bay of Biscay. The main are summarised below:

6.1 French demersal fleets typology used to parameterize the IAM simulation model

A Bay of Biscay French fleet typology was developed in collaboration with stakeholders during both a partnership bio-economic working group implemented in a project funded by the French DPMA (Macher et al., 2011) and the European funded project GEPETO (Uriarte Andres, 2014). One of the aims of both projects was to provide a detailed description of the fleets, their métiers and strategies and, *in fine* assess the potential bio-economic impacts of various management scenarios. 21 fleets and 12 métiers were considered in the analysis (Fig 6.1 and Table 6.1). The fleets are subsets of the EU DCF fleet segments. Sole gillnetters, mixed gillnetters, *Nephrops* trawlers, mixed demersal and mixed demersal coastal trawlers, hake long liners and hake gillnetters are considered, each fleet being divided in vessel length (VL) categories. 3 fleets were considered as small scale fleets (SSF) according to EC definition (Vessels <12m using passive gears exclusively). These SSF represent 38% of the vessels number, most of them being sole gillnetters.

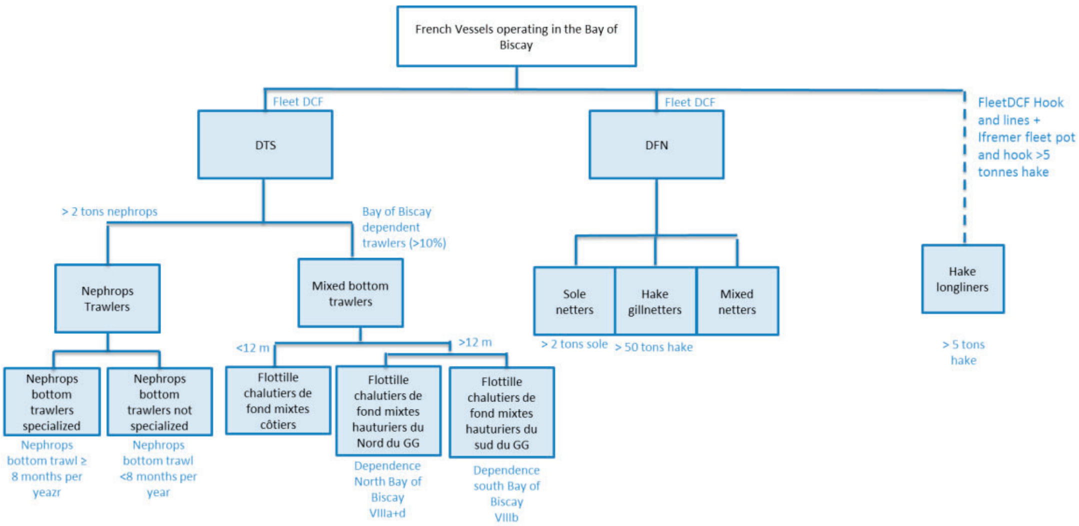

Figure 6.1. Fleets and métiers defined in the Bay of Biscay demersal fishery by the partnership bio-economic working group (Macher *et al.*, 2011)

Table 6.1. Fleets and métiers defined in the Bay of Biscay demersal fishery by the partnership bio-economic working group (Macher *et al.*, 2011)

Fleet	Lenght class
Hake gillnetters	VL1840
Hake longliners	VL0010
	VL1012
Mixed coastal demersal trawlers	VL0010
	VL1012
Mixed demersal trawlers North Bay Biscay	VL1218
	VL1824
Mixed demersal trawlers South Bay Biscay	VL1218
	VL1824
Mixed gillnetters	VL0010
	VL1018
	VL1840
Nephrops trawlers (specialized)	VL0012
	VL1224
Nephrops trawlers (unspecialized)	VL0012
	VL1218
	VL1824
Sole gillnetters	VL0010
	VL1012
	VL1218
	VL1824

Métiers
Demersal trawl Cephalopods
Demersal trawl Other species
Demersal trawl Anglerfish
Demersal trawl Nephrops
Demersal trawl Sole
Pelagic trawl Other species
Net Other species
Net Hake
Net Sole
Longline Other species
Longline Hake
Other

This fleet segmentation was used to parameterise the IAM bio-economic simulation model. The IAM model has subsequently been used for several management plan evaluations and research studies including: STECF impact assessment of the ecological, economic and social effects of a range of possible measures applicable in the context of multiannual plans applicable to demersal fisheries in South-western EU waters: subareas VIII, IX (STECF, 2015), ICES evaluation of proposed harvest control rules for

Bay of Biscay sole (Merzéreaud et al., 2013), development of the eco-viability approach for fisheries management plan evaluations (Gourguet et al., 2015; Briton et al., 2020).

6.2 Fleet and métier typology based on landing and effort data provided under the ICES Accession data call

Two alternative fleets and métiers typologies were defined on the basis of the landing and effort data requested by the WGMIXFISH-ADVICE data call and the InterCatch data used for single stock assessments. A first typology was carried out during the 2018 WGMIXFISH-METH (ICES, 2018) and a second as part of the EU funded project Probyfish aiming at assessing the impact of fisheries on bycaught species.

WGMIXFISH-METH identified the main technical interactions between fleets, gears and the resulting composition of species in the retained catch for the parameterization of FCube for the Bay of Biscay. Only three stocks were considered in the analysis (Northern Hake (HKE), Northern megrim (MEG) and Bay of Biscay sole (SOL)). The procedures to define the fleets and métier were similar to those already applied by the working group for the North Sea or the Celtic Sea, namely:

– Fleets were defined by aggregating landing and effort across country, gear group and vessel length (where applicable).
    - Fleet landing small amount of any of the stocks included in the analysis was binned into an “others” (“OT”) fleet together with fleets from country fishing outside the Bay of Biscay to reduce the dimensions of the model.
    - Effort and landing files were matched to ensure consistency, métiers with effort and no landing were aggregated to the “Other fleet”.

Within a fleet, métiers were defined as a combination of gear, target species (e.g. demersal fish, DEF, or crustaceans, CRU) and areas (either “Bay of Biscay” or “Other areas” (Celtic Sea, West of Scotland and North Sea).

This resulted in the definition of 35 national fleets from four countries (Table 6.2), covering landing and effort for the years 2015, 2016, and 2017. These fleets engage in one to eight different métiers each, among a total of 13 métiers.

Table 6.2. Fleets defined by MIXFISH-METH and corresponding total landings by year and stock

	2015			2016			2017		
Fleets	HKE	MEG	SOL	HKE	MEG	SOL	HKE	MEG	SOL
ESP_Gillnet_<10 m							12	0	1
ESP_Gillnet_10<24 m	19	0		9	0		13		0
ESP_Gillnet_24<40 m	271	0		298	1		362	0	
ESP_Gillnet_all	1965	2	0	2378	5	0	1622		0
ESP_Longline_10<24 m	48			45			108		0
ESP_Longline_24<40 m	1751			3267			3009		

	2015			2016			2017		
ESP_Longline_all	21283			24009			15469		
ESP_Trawl_>=40 m	131	46		126	53		233	47	2
ESP_Trawl_24<40 m	7747	3697	6	8553	3743	4	5869	3120	4
FR_Gillnet_all	21750		2561	20412		2257	20508	5	2161
FR_Longline_all	8782			10422			11014		
FR_Other_all	322	52	23	267	29	20	74	102	17
FR_Trawl_<10 m	8	0		10	0		7	0	
FR_Trawl_>=40 m	1986	0		2851	0		2668	0	
FR_Trawl_10<24 m	1037	2600		1252	2760		1520	477	
FR_Trawl_24<40 m	2305	413		2608	349		2333	2351	
FR_Trawl_all	6475		907	6774		822	6417	2170	797
IE_Gillnet_10<24 m	581	47		776	68		826	56	
IE_Gillnet_24<40 m	87			111	1		111	0	
IE_Trawl_10<24 m	1061	1732		1363	2092		1427	1878	
IE_Trawl_24<40 m	961	1276		1138	1398		1003	1379	
OT_Gillnet_10<24 m	207			122			160		
OT_Other_<10 m	6			17			28		
OT_Other_10<24 m	497			781	0		85		
OT_Other_24<40 m	12	0		17			2543	0	
OT_Trawl_10<24 m	736	0		456	0		326	0	
OT_Trawl_24<40 m	5040	495		5818	597		3608	733	
UK_Gillnet_all	1278	4	0	1239	5		1427	5	
UK_Longline_all	4379			5124	0		4210		
UK_Other_all	855	3		1431	3		736	2	
UK_Trawl_<10 m	2	13		2	11		1	18	
UK_Trawl_>=40 m	180			162			162		
UK_Trawl_10<24 m	947	260		604	258		939	240	

	2015			2016			2017		
UK_Trawl_24<40 m	3661	2544		4785	2458		5257	2262	
UK_Trawl_all	8	1		2	0		8	1	
Total	**96378**	**13187**	**3497**	**107230**	**13831**	**3103**	**94099**	**14848**	**2983**

The balance of landings of the stocks across gear categories is shown in Figure 6.2. As a large proportion of hake and megrim landings are caught in area outside the Bay of Biscay, technical interaction with the Bay of Biscay sole stock is limited to few métiers.

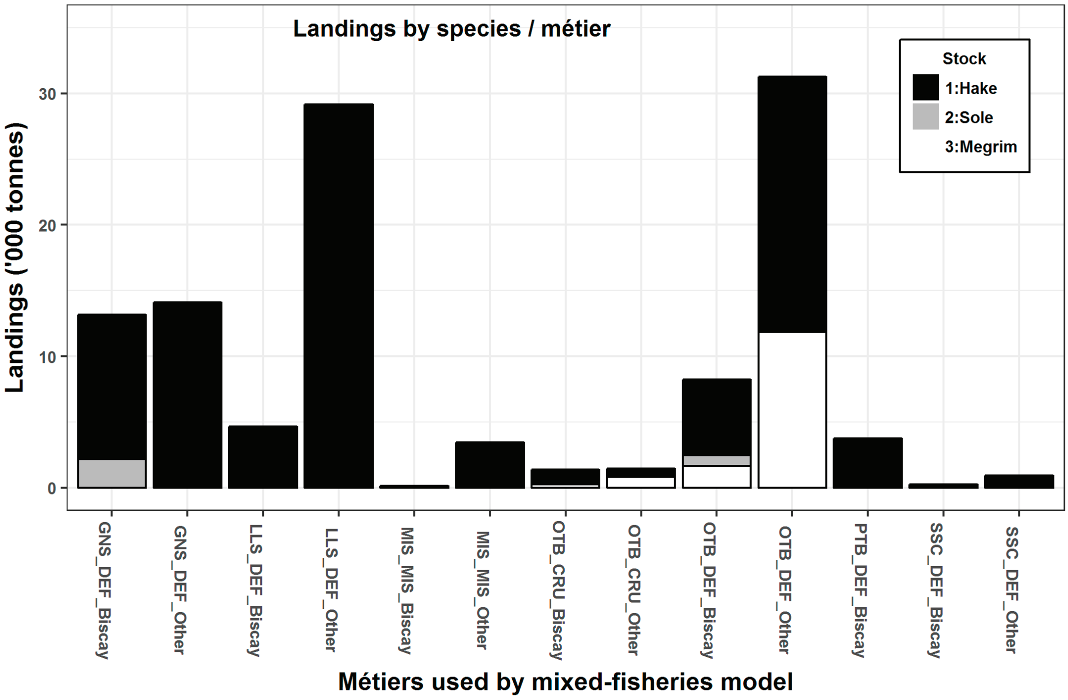

Figure 6.2. Landing distribution of species by métier.

Based on the same rationale than the WGMIXFISH-METH working group, a typology developed in the Probyfish project to parameterise the FLBEIA simulation model resulted in the definition of 10 fleet based on the combination of country and main gear used and 13 métiers based on the combination of gear, target species and areas. (Table 6.3)

Table 6.3. Fleets defined by Probyfish

Fleet	métier
GN8_SP	GNS_DEF_8
GNS_FR	GNS_DEF_8
LLS_FR	LLS_DEF_8

LS8_SP	LLS_DEF_S_8
LV8_SP	LLS_DEF_V_8
OT8_SP	OTB_DEF_>=70_8 OTB_MCF_>=70_8 OTB_MPD_>=70_8 OTB_SPF_>=70_8
OTB_FR	OTB_DEF_>=70_8 OTB_CRU_>=70_8 MIS_8
OTM_FR	OTM_DEF_>=70_8 MIS_8
OTT_FR	OTT_CRU_>=70_8 OTT_DEF_>=70_8
PT8_SP	PTB_DEF_>=70_8

6.3 Which way forward for the definition of fleet and métier for the Bay of Biscay for the next MIXFISH-ADVICE working groups?

The working group notes that the French fleet segmentation of the Bay of Biscay implemented in IAM provides a very detailed description of the fleets and their interactions. To further assess the biological impact of management scenarios, this segmentation has allowed to account for key economic aspects in the bio-economic simulations carried out to date, especially those associated with vessel lengths (as cost structures are strongly determined by the length of the vessel), and for the potential redistribution of fishing effort at the vessel level towards alternative gears and/or métiers.

The group notes however that in terms of métiers, the information currently available from the ICES Accession data call is not sufficient to carry out such a segmentation and a revision of the data call would be needed if such a segmentation were to be implemented in WGMIXFIH-ADVICE.

The working group conducted a preliminary analysis of the landing profiles (in terms of species caught) by métiers and vessel lengths category as available in the Accession data provided by France from 2009 to 2019. Figure 6.3 presents an example of landing profiles for two métiers available in the Accession database. It shows two contrasting cases in terms of variation of landing profiles between vessels size classes which would lead to a segmentation based on vessel length for LLS_DEF (left panel) but not based on vessel length for OTB_CRU>=70_0_0 (right panel).

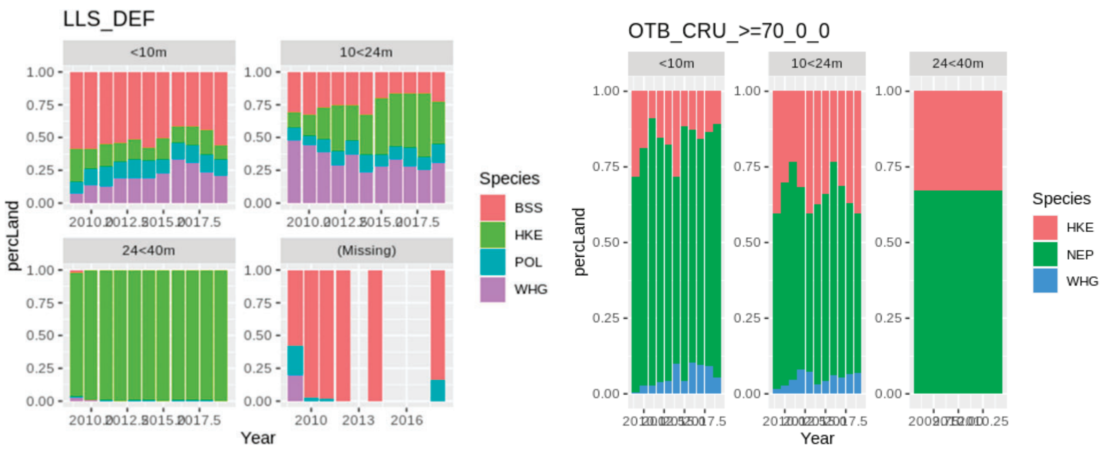

Figure 6.3. Two examples of landing profiles (proportion of landing by stock) estimated from the Accession data provided by France (2009–2019) ; left panel, longline targeting demersal species (LLS_DEF) ; right panel, trawl targeting *Nephrops* (OTB_CRU_>=70_0_0).

This preliminary analysis shows that a rather simple structure of fishing units (based on the country of provenance, the fishing location, the gear, the vessel length and the target species, as currently available in Accession) should be, as a first step, sufficient to describe the complex nature of the Bay of Biscay mixed fishery and assess the biological short-term consequences of various management scenarios. A fleet and métier segmentation based on the current Accession database will thus be developed for the next WGMIXFISH-ADVICE scheduled in October 2020. This will build on the current available fleet segmentation (ICES 2018). On the longer term, the group considers that this segmentation may evolve, especially in the context of the inclusion of economic considerations into the advice and the need to assess any economic impacts of mixed fisheries scenarios. Some work is also needed to assess the best way of identifying the polyvalent fleets (vessels using more than one gear during the year) from the available databases. As identified and modelled in IAM, several vessels are not pure trawlers or gill netters or liners but might combine these fishing technics during the year. From the accession data it is not directly possible to identify these fleets from the "pure" trawlers, gill netters or liners.

7 ToR F - Development of mixed fisheries advice in new areas

7.1 Irish Sea FCube

7.1.1 Background

The Irish Sea, ICES Division 27.7.a, is a relativity enclosed sea basin situated between Ireland and Great Britain. Within this region seven species are managed using TAC; cod, haddock, herring, plaice, sole, whiting and *Nephrops*. In 2019, an FCube model incorporating five fish species, cod, haddock, plaice, sole and whiting was developed and tested by WGMIXFISH (ICES 2019a). Herring was not included, as it is not generally considered to be an important component of mixed fishery interactionsg, due to differences in both its ecology and in fishing approaches. In 2019, it was identified that the next steps should be the inclusion of *Nephrops* stocks in the FCube model. *Nephrops* are a key fishery in the Irish Sea region, and there is considerable mixing of species in the catch by the associated métiers and fleets.

The addition of *Nephrops* stocks to the FCube model involves several challenges. These include differences in single-species assessment methods, the division of resulting TAC between ecoregions (i.e. a single TAC is given for the Celtic Sea and Irish Sea), discard estimation and the integration of multiple functional units within ecoregions (e.g. FU14 and FU15 in the Irish Sea).

7.1.2 Implementation

The work-flow during this workshop focused on the adaptation of the previously existing Irish Sea FCube model to incorporate elements from the FCube model used for advice in the Greater North Sea region in 2019 (https://github.com/ices-taf/2019_NrS_MixedFisheriesAdvice). Model development focused on the addition of *Nephrops* to a model containing three fish species; cod, haddock and whiting. *Nephrops* data were added to the new model from FU15, from which 96% of *Nephrops* landings in the Irish Sea region were made in 2018. R scripts were updated and single species advice for these four species was successfully reproduced. Related metier and fleet data were added and quality controlled, and conditioned for use in the model. FCube model scripts were then adapted to include the new data and fleet objects. The resulting FCube model was run across the following scenarios, ‘min – fleets stop fishing when single TAC limit is reached’, ‘max – fleets stop fishing when TAC limit is reached for all species’ and ‘Baseline – fishing pressure as predicted in single-species stock assessments’. The results of these models are for testing purposes only, and further refinement of both data and models are needed before model results can be trusted. Related code for the current stage of model development is stored on ice-TAF at https://github.com/ices-taf/2020_IrS_MixedFisheriesAdvice.

7.1.3 Next steps

The current aim of FCube model development for the Irish Sea region is to reach a suitable advice model based on 6 TAC stocks: cod, haddock, herring, plaice, sole, whiting and *Nephrops.* The next steps of model development will involve the refinement of the underlying model data for *Nephrops*, and the incorporation of both data and single-species advice for cod, haddock, whiting and *Nephrops* for 2019.

The appropriate division of the *Nephrops* TAC between ecoregions and FUs was discussed at this meeting, and remains an outstanding issue. This issue will be explored in conjunction with members of the Celtic Seas mixed fisheries group intersessionally. For model development in the intervening period the division of TAC will be based on the proportion of *Nephrops* landings between the Irish Sea (48%) and the Celtic Sea (52%) over the period (2000-2018).

In 2019 Cod in division 7.a was changed to a category 3 species for single species stock assessment and advice. Thus, the Irish Sea FCube model needs to be adapted to reproduce this stock advice category. The implementation of category 3 stock assessment within FCube has been demonstrated for the West of Scotland region, and Irish Sea FCube model will draw on these methods.

This year's R code for the Irish Sea FCube model transferred onto the ices-TAF platform. It is expected that this code will be refined according to the ices-TAF framework at the specialised ices-TAF workshop planned for later in 2020.

7.1.4 Summary

The core output of this ToR has been the integration of *Nephrops* stocks into the Irish Sea FCube model. This is a key development given the importance of *Nephrops* fisheries for the Irish Sea region, and the fisheries overlap between *Nephrops* and fish species previously included in the Irish Sea FCube model. The model remains in the testing phase, and further development will be required before it can be used as the basis for advice. The core of this development is expected to take place in 2020-2021.

7.2 Kattegat

During the 2020 WGMIXFIS Methods meeting efforts have been made in order to start developing a mixed fisheries model for Kattegat to be able to produce the technical service for Kattegat cod, given the 0 TAC advice for 2021. Scripts and information were collected from the other ecoregions and a plan has been formulated in order to be able to produce the technical service in time for the WGMIXFISH Advice meeting. The first steps will include a description of the Kattegat fisheries that target or have cod as a bycatch species. Further steps will be the development of a mixed fisheries model including all the major species fished in Kattegat. Realistically the model will not be ready in time for this year WGMIXFISH Advice meeting.

8 ToR G - Continued development of the combined implementation of FCube and FLBEIA in conjugation with STECF/WGECON economists

R scripts have been developed by members of WGECON that should allow for the extraction and aggregation of STECF economic data according to WGMIXFISH fleet/métier definitions. The scripts will need to be run by each member state individually, which is of less utility than a centralized, single extraction, but is necessary to maintain the anonymity of sensitive and identifiable parameters. The testing of these scripts is planned for the North Sea case study, later in 2020, as part of ongoing work in the *PANDORA* project (PAradigm for New Dynamic Ocean Resource Assessments and exploitation, https://www.pandora-fisheries-project.eu/).

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Annex 1: Celtic Sea FLBIEA

Celtic Sea FLBEIA short-term forecast model

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Overview

This WD is to record a simple FLBEIA set-up for mixed fisheries forecasts in the Celtic Sea. It outlines the following steps:

- Set-up the control parameters for the simulations
- Conditioning of the *FLBiols* objects
- Conditioning of the *FLFleetExts* object
- Set-up the *Stock-Recruit* objects

Main control object

Here we set out the bounds of our forecasts.

```
## main ctrl

first.yr.sim <- 2018

last.yr.sim <- 2020

main.ctrl <- list()

main.ctrl$sim.years <- c(initial = first.yr.sim, final = last.yr.sim)

main.ctrl$SimultaneousMngt <- FALSE        ## Note, this relates to the multi-stock HCR
```

Load Fleet and Biol objects

We take some short-cuts, in that the FLFleetExt and FLBiol objects are already converted from FLFLeets and FLStocks objects created for FCube. The code is available elsewhere for this as its a bit tedious.

Loading in the fleet and biols objects. Note that its important the FLFleets object has the same sum catches as the FLBiols object. . . .

fleets

```
load(file.path("..", "fleets", "fleets.RData"))

summary(fleets)

#> An object of class "FLFleetsExt"

#>

#> Elements: BE_Beam_24<40m EN_Beam_24<40m EN_Otter_10<24m EN_Static_all FR_Otter_10<24m
FR_Otter_24<40 #>

#> Name: BE_Beam_24<40m

#>          Description:

#>          Range:     min       max minyear maxyear

#>          NA         NA        2009      2017


#>    Quant: age
#>    dim: 1 1 1
#> Name: EN_Beam_24<40m
#>    Description:
#>    Range:       min          max minyear maxyear
#>    NA           NA     2009  2017
```

#> Quant: age
#> dim: 1 1 1
#> Name: EN_Otter_10<24m
#> Description:
#> Range: min max minyear maxyear
#> NA NA 2009 2017
#> Quant: age
#> dim: 1 1 1
#> Name: EN_Static_all
#> Description:
#> Range: min max minyear maxyear
#> NA NA 2009 2017
#> Quant: age
#> dim: 1 1 1
#> Name: FR_Otter_10<24m
#> Description:
#> Range: min max minyear maxyear
#> NA NA 2009 2017
#> Quant: age
#> dim: 1 1 1
#> Name: FR_Otter_24<40m
#> Description:
#> Range: min max minyear maxyear
#> NA NA 2009 2017
#> Quant: age
#> dim: 1 1 1
#> Name: FR_Otter_all
#> Description:
#> Range: min max minyear maxyear
#> NA NA 2009 2017
#> Quant: age
#> dim: 1 1 1
#> Name: IE_Beam_24<40m

```
#>     Description:
#>     Range:      min         max minyear maxyear
#>     NA          NA    2009    2017
#>     Quant: age
#>     dim: 1 1 1
#> Name: IE_Otter_10<24m
#>     Description:
#>     Range:      min         max minyear maxyear
#>     NA          NA    2009    2017
#>     Quant: age
#>     dim: 1 1 1
#> Name: IE_Otter_24<40m
#>     Description:
#>     Range:      min         max minyear maxyear
#>     NA          NA    2009    2017
```

#> Quant: age

#> dim: 1 1 1

#> Name: OTH_OTH

#> Description:

#> Range: min max minyear maxyear

#> NA NA 2009 2017

#> Quant: age

#> dim: 1 1 1

biols

load(**file.path**("..", "biols", "biols.RData"))

summary(biols)

#> An object of class "FLBiols"

#>

#> Elements: COD HAD WHG

#>

#> Name: COD

Description: Imported from a VPA file. (C:/Users/eleluher/Desktop/EXPER-
#>TISE/2018_ELL/3_WGCSE/2_dat

#>Range: min max pgroup minyear maxyear minfbar maxfbar

#>1 7 7 1971 2017 2 5

#>Quant: age

#>dim: 7 47 1 1 1

#> Name: HAD

```
#>Description: Haddock in Celtic Sea
#>Range:   min   max pgroup   minyear   maxyear   minfbar maxfbar
#>0      8  8   1993   2017   3   5
#>Quant: age
#>dim: 9 25 1 1 1
#> Name: WHG
#>Description: Whiting in Celtic Sea
#>Range:   min   max pgroup   minyear   maxyear   minfbar maxfbar
#>0      7  7   1999   2017   2   5
#>Quant: age
#>dim: 8 19 1 1 1

stks <- sort(names(biols))
```

Expand the FLFleetExt and FLBiol object

We ensure each object has the same year dimensions as FLBEIA references internally from 1 to n years. This is for both the FLBiols and FLFleetsExt.

- *We take the smallest and largest years from the biols objects to frame our year*
- *range*

```
data.yrs <- c(range(biols)[["minyear"]], range(biols)[["maxyear"]])

# Expand the FLBiols Expand the biols to simulation years

biols <- FLBiols(lapply(biols, window, data.yrs[1], last.yr.sim))

# Expand the FLFleetsExt

fleets <- lapply(fleets, window, data.yrs[1], last.yr.sim)     # Note: keep as list, as slower to access F
```

Condition the FLBiol object

Here we condition the biol/stock objects for the simulation. This includes the mean weights, maturity and natural mortality for each age.

```
# Now fill the slots in projection years for FLBiols Note, we will want to do
# specifically for each stock and this is a short-cut

stk.avg.yrs <- 2015:2017

biols <- FLBiols(lapply(names(biols), function(x) {

s <- biols[[x]]

s@m[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(s@m[, ac(stk.avg.yrs)])

s@wt[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(s@wt[, ac(stk.avg.yrs)])

mat(s)[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(s@mat$mat[, ac(stk.avg.yrs)])

fec(s)[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(s@fec$fec[, ac(stk.avg.yrs)])

s@spwn <- s@n

s@spwn[] <- 0

return(s)

}))
```

Fleet conditioning

Here we condition the FLFleetsExt for the simulation. We assume a simple average of values in the projection years, but in principle its possible to make this particular for a fleet or parameter. We recalculate the catchabilities for the fleet-metier-stock combinations to ensure they are consistent; we have assumed that alpha and beta are 1 for the simulations, though these can be estimated from the historic data by fleet-metier-stock.

Note:: We may want here to split the OTH_OTH fleet into a series of fleets, one for each stock, e.g. OTH_COD, OTH_HKE etc. . .

NOTE: We have also included a flag to load an already conditioned fleet, as it take a long time....Cond_Fleet <- TRUE

```
fl.proj.avg.yrs <- 2015:2017     ## weights including landings.wt, discards.wt

sel.yrs <- 2015:2017             ## the selection pattern including effort, effshare, catch.q, landings.sel, disca

if (Cond_Fleet) {


nms.fls <- names(fleets)

l.fls <- length(nms.fls)

for (i in 1:l.fls) {

print(nms.fls[i])

nms.metiers <- names(fleets[[i]]@metiers)

l.metiers <- length(nms.metiers)

fleets[[i]]@effort[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(fleets[[i]]@effort[, ac(sel.yrs)])

fleets[[i]]@fcost[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(fleets[[i]]@fcost[, ac(fl.proj.avg.yrs)])

fleets[[i]]@capacity[, ac(first.yr.sim:last.yr.sim)] <- yearMeans(fleets[[i]]@capacity[,
```

ac(fl.proj.avg.yrs)])

fleets[[i]]@crewshare[, **ac**(first.yr.sim**:**last.yr.sim)] <- **yearMeans**(fleets[[i]]@crewshare[, **ac**(fl.proj.avg.yrs)])

for (j **in** 1**:**l.metiers) {

fleets[[i]]@metiers[[j]]@effshare[, **ac**(first.yr.sim**:**last.yr.sim)] <- **yearMeans**(fleets[[i]][**ac**(sel.yrs)])

fleets[[i]]@metiers[[j]]@vcost[, **ac**(first.yr.sim**:**last.yr.sim)] <- **yearMeans**(fleets[[i]][[j] **ac**(fl.proj.avg.yrs)])

nms.stks <- **names**(fleets[[nms.fls[i]]]@metiers[[nms.metiers[j]]]@catches)

l.stks <- **length**(nms.stks)

for (k **in** 1**:**l.stks) {

Normally the weights are average of 3 years while the selection is the rescaled

F, but we need to be stock specific

if (nms.stks[k] **%in%** **c**("HAD")) {

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.wt[, **ac**(first.yr.sim**:**last.yr.sim)] <-**ac**(2017)])

fleets[[i]]@metiers[[j]]@catches[[k]]@discards.wt[, **ac**(first.yr.sim**:**last.yr.sim)] <-**ac**(2017)])

} **else** {

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.wt[, **ac**(first.yr.sim**:**last.yr.sim)] <-**ac**(fl.proj.avg.yrs)])

```
fleets[[i]]@metiers[[j]]@catches[[k]]@discards.wt[, ac(first.yr.sim:last.yr.sim)] <-ac(fl.proj.avg.yrs)])

}

## selection

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)] <- y ac(sel.yrs)])

# set any NAs in the proj year to 0 (in case of no catch)

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)][is.n

ac(first.yr.sim:last.yr.sim)])] <- 0

# discards selectivity as the inverse of the landings sel

fleets[[i]]@metiers[[j]]@catches[[k]]@discards.sel[, ac(first.yr.sim:last.yr.sim)] <- 1

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)]

fleets[[i]]@metiers[[j]]@catches[[k]]@catch.q[, ac(first.yr.sim:last.yr.sim)] <- yearMe

ac(sel.yrs)])

fleets[[i]]@metiers[[j]]@catches[[k]]@catch.q[, ac(first.yr.sim:last.yr.sim)][is.na(fle

ac(first.yr.sim:last.yr.sim)])] <- 0

# Catch prod values
```

```
fleets[[i]]@metiers[[j]]@catches[[k]]@alpha[, ac(first.yr.sim:last.yr.sim)] <- yearMean ac(fl.proj.avg.yrs)])

fleets[[i]]@metiers[[j]]@catches[[k]]@beta[, ac(first.yr.sim:last.yr.sim)] <- yearMeans

ac(fl.proj.avg.yrs)])


fleets[[i]]@metiers[[j]]@catches[[k]]@price[, ac(first.yr.sim:last.yr.sim)] <- yearMean ac(fl.proj.avg.yrs)])


}

}

}

fleets <- FLFleetsExt(fleets)

save(fleets, file = file.path("..", "model_inputs", "fleets_conditioned.RData"))

}

if (!Cond_Fleet) {

load(file.path("..", "model_inputs", "fleets_conditioned.RData"))

}

## Fix the problem French fleet - metier with zero effort share

fleets[["FR_Otter_all"]]@metiers[["OTM_DEF_27.7.e"]]@effshare excl_met <- "OTM_DEF_27.7.e"
mets <- fleets[["FR_Otter_all"]]@metiers@names
```

mets <- mets[**!**mets **%in%** excl_met]

fleets[["FR_Otter_all"]]@metiers <- **FLMetiersExt**(fleets[["FR_Otter_all"]]@metiers[["OTH"]],

fleets[["FR_Otter_all"]]@metiers[["OTT_CRU_27.7.g"]],
fleets[["FR_Otter_all"]]@metiers[["OTT_CRU_27

fleets[["FR_Otter_all"]]@metiers[["OTT_DEF_27.7.g"]], fleets[["FR_Otter_all"]]@metiers[["OTT_DEF_27

fleets[["FR_Otter_all"]]@metiers[["OTT_DEF_27.7.j"]])

fleets[["FR_Otter_all"]]@metiers@names <- **as.character**(**sapply**(fleets[["FR_Otter_all"]]@metiers, **function**(x) x@name)[])

Stock-Recruit

Here we set up the recruitment parameters for the short-term forecasts. As with FCube, we use the values from the single stock assessment, but here we do this in the form of an FLSRsim object - using a geomean model with the parameters set to the values in the single stock assessment.

For the *Nephrops* stock (or any fixed biomass stock) we would create a dummy FLSRsim object with an arbitrary large value.

######################### 1. SR objects for STF

Empty FLQuant with the right dimensions

flq_dims <- **FLQuant**(1, dim = **c**(1, **length**(data.yrs[1]**:**last.yr.sim)), dimnames = **list**(quant = "all",

year = data.yrs[1]**:**last.yr.sim))

For each ASPG stock, fill the recruitment used in the single stock assessment

forecast

COD.sr <- **FLSRsim**(rec = biols[["COD"]]@n[1,], ssb = **ssb**(biols[["COD"]]), uncertainty = flq_dims, proportion = flq_dims, model = "geomean", name = "COD")

COD.sr@params[] <- 2439

HAD.sr <- **FLSRsim**(rec = biols[["HAD"]]@n[1,], ssb = **ssb**(biols[["HAD"]]), uncertainty = flq_dims, proportion = flq_dims, model = "geomean", name = "HAD")

HAD.sr@params[] <- 265133

WHG.sr <- **FLSRsim**(rec = biols[["WHG"]]@n[1,], ssb = **ssb**(biols[["WHG"]]), uncertainty = flq_dims, proportion = flq_dims, model = "geomean", name = "WHG")

WHG.sr@params[] <- 971263

SRs <- **list**(COD = COD.sr, HAD = HAD.sr, WHG = WHG.sr)

Biols Control

Here we fix the type of growth model for each stock. Normally this would be ASPG (Age-structured population growth), though BDPG (biomass dynamic) and fixedPopulation are also available. We use the latter for the *Nephrops* stocks.

Baranov <- **c**(FALSE, FALSE, FALSE)

growth.model <- **ifelse**(**!**Baranov, **c**(COD = "ASPG", HAD = "ASPG", WHG_NS = "ASPG"), **c**(COD = "ASPG_Baranov", HAD = "ASPG_Baranov", WHG = "ASPG_Baranov"))

names(growth.model) <- **c**("COD", "HAD", "WHG") growth.model <- growth.model[**sort**(**names**(growth.model))]

biols.ctrl <- **create.biols.ctrl**(stksnames = stks, growth.models = growth.model)

Advice controls

Here we set two elements which are not used in a short-term forecast: firstly, there is no **observation model** so each stock is set to *'perfectObs'*; secondly there is no **assessment model** so each stock is set accordingly (*NoAssessment*).

For the **advice model**, we want to specify the TACs for the stocks rather than a specific HCR. Therefore the HCR is *fixedAdvice*, which we set to be on the basis of 'catch' rather than 'landings'.

Obs ctrl - as a STF, we assume perfect obs

stkObs.models <- **rep**("perfectObs", **length**(stks))

names(stkObs.models) <- stks

obs.ctrl <- **create.obs.ctrl**(stksnames = stks, stkObs.models = stkObs.models)

obs.ctrl <- obs.ctrl[**sort**(**names**(obs.ctrl))]

assess ctrl - as a STF, we do not do an assessment

assess.models <- **rep**("NoAssessment", **length**(stks))

names(assess.models) <- stks

assess.ctrl <- **create.assess.ctrl**(stksnames = stks, assess.models = assess.models) assess.ctrl <- assess.ctrl[**sort**(**names**(assess.ctrl))]

################ advice ctrl

We use the actual TAC advice

advice.ctrl <- **create.advice.ctrl**(stksnames = stks, HCR.models = **rep**("fixedAdvice", **length**(stks)))

Or ICES HCR ref.pts.COD <- matrix(c(7300, 10300, 0.35),ncol = 1, dimnames =

list(c('Blim', 'Btrigger', 'Fmsy'), c(1))) ref.pts.HAD <- matrix(c(6700, 10000,

0.4), ncol = 1, dimnames = list(c('Blim', 'Btrigger', 'Fmsy'), c(1)))

ref.pts.WHG <- matrix(c(25000, 35000, 0.52),ncol = 1, dimnames = list(c('Blim',

'Btrigger', 'Fmsy'), c(1))) advice.ctrl <- create.advice.ctrl(stksnames = stks,

HCR.models = rep('IcesHCR', length(stks)), ref.pts.COD = ref.pts.COD,

ref.pts.HAD = ref.pts.HAD, ref.pts.WHG = ref.pts.WHG, first.yr = 1993, last.yr

= last.yr.sim)

advice based on catch, not landings advice.ctrl**$**COD**$**AdvCatch[] <- TRUE advice.ctrl**$**HAD**$**AdvCatch[] <- TRUE advice.ctrl**$**WHG**$**AdvCatch[] <- TRUE

TAC advice

Here we specify the actual **TAC advice** for each stock in both the *intermediate* and the *TAC* years. We also specify our assumption of the future quota share across fleets, which here is set to the same average years as the rest of the fleet parameters.

advice <- **list**(TAC = **FLQuant**(NA, dimnames = **list**(stocks = stks, year = data.yrs[1]**:**last.yr.sim)), quota.share = **lapply**(stks, **function**(x) {

```
FLQuant(NA, dimnames = list(fleets = names(fleets), year = data.yrs[1]:last.yr.sim))

}))

##          TACs for intermediate and TAC year (note, we extend this to TAC yr + 1) This is

##          the actual TAC, not the catches from the stf

advice$TAC["COD", ac(2018:2020)] <- c(3076, rep(0, 2))

advice$TAC["HAD", ac(2018:2020)] <- c(6910, rep(6317, 2))

advice$TAC["WHG", ac(2018:2020)] <- c(22213 - 3443, rep(15841, 2))

kable(reshape2::dcast(as.data.frame(advice$TAC[, ac(2018:2019)]), stocks ~ year,
value.var = "data"), caption = "TAC advice in intermediate and TAC year")
```

Table 1: TAC advice in intermediate and TAC year

stocks	2018	2019
COD	3076	0
HAD	6910	6317
WHG	18770	15841

```
names(advice$quota.share) <- stks

for (st in stks) {
```

```
for (fl in names(fleets)) {
```

```
if (st %in% catchNames(fleets[[fl]])) {

advice$quota.share[[st]][fl, ] <- quantSums(catchWStock.f(fleets[[fl]],

st))/quantSums(catchWStock(fleets, st))

advice$quota.share[[st]][fl, ac(data.yrs[1]:last.yr.sim)] <- yearMeans(advice$quota.share[[

ac(sel.yrs)])      ## change to sel.yrs

} else advice$quota.share[[st]][fl, ] <- 0

}

}
```

Fleets controls

Here we set up a simple fleets control object. We will use this as a template for the mixed fisheries scenarios.

It includes:

- The **fleet model**: to match FCube we used *'fixedEffort'* and *SMFB* (simple mixed fisheries behaviour) with an appropriate catch rule (min, max or stock). But here we just set up a template which we will alter later dependent on the scenario.
- We define a *catch restriction*, i.e. landings or catch.
- We define the *catch model* per stock. These should match the biol model, i.e . CobbDouglasAge or CobDouglasBio
- There are other features which we could use here. For example, the *landing obligation* including de minimis and other rules.
- Other features such as captial and price models can also be configured. However, these have additional data requirements which enter in the Covars,

```
LO <- FALSE
```

fls <- **names**(fleets)

n.fls <- **length**(fleets) *#number of the fleets*

n.stks <- **sum**(**sapply**(**sapply**(fleets, catchNames), length)) *# number of the fleet/stocks*

n.flts.stks <- **sapply**(**lapply**(fleets, catchNames), length) *# number of stocks caught by each fleet.* flts.stksnames <- NULL

for (f **in** 1**:length**(fleets)) flts.stksnames <- **c**(flts.stksnames, **catchNames**(fleets[[f]]))

FLEET MODELS Fixed effort, SMFB etc... SMFB, min equivilent to FCube min effort.models <- **rep**("SMFB", n.fls)

names(effort.models) <- fls eff.res <- "prev"

using SMFB set the effort limitation by fleet, i.e. vector with n.fl values ## with min, max etc.. using SMFB, set a restriction on 'catch' or 'landings' by ## fleet

restriction <- **rep**("catch", n.fls) **names**(restriction) <- fls

CATCH MODELS Can change for each fleet/stock c.mod <- **stack**(**lapply**(fleets, catchNames)) c.mod**$**catch.mod <- **sapply**(c.mod**$**values, **function**(x) {

if (x **%in%** **c**("COD", "HAD", "WHG")) **return**("CobbDouglasAge") **else** **return**("CobbDouglasBio")

})

catch.models <- c.mod**$**catch.mod

names(catch.models) <- **paste**(c.mod**$**ind, c.mod**$**values, sep = ".")

```
###          CAPTIAL MODELS Options are: capital.models <- rep("fixedCapital", n.fls)
names(capital.models) <- fls

###          PRICE MODELS Options are:

price.models <- rep("fixedPrice", n.stks)

names(price.models) <- paste(c.mod$ind, c.mod$values, sep = ".")

flq <- FLQuant(dimnames = list(quant = "all", year = data.yrs[1]:last.yr.sim, season = 1), iter = 1)

fleets.ctrl <- create.fleets.ctrl(fls = fls, n.fls.stks = n.flts.stks, fls.stksnames = flts.stksnames,

effort.models = effort.models, catch.models = catch.models, capital.models = capital.models,

price.models = price.models, flq = flq, `effort.restr.BE_Beam_24<40m` = eff.res,

`effort.restr.EN_Beam_24<40m` = eff.res, `effort.restr.EN_Otter_10<24m` = eff.res,

effort.restr.EN_Static_all = eff.res, `effort.restr.FR_Otter_10<24m` = eff.res,

`effort.restr.FR_Otter_24<40m` = eff.res, effort.restr.FR_Otter_all = eff.res,

`effort.restr.IE_Beam_24<40m` = eff.res, `effort.restr.IE_Otter_10<24m` = eff.res,

`effort.restr.IE_Otter_24<40m` = eff.res, effort.restr.OTH_OTH = eff.res)

if (LO) {
```

for (f **in** **names**(fleets)) {

fleets.ctrl[[f]]**$**LandObl <- **c**(**rep**(FALSE, **length**(data.yrs[1]**:**data.yrs[2])),

rep(TRUE, **length**(first.yr.sim**:**last.yr.sim)))

names(fleets.ctrl[[f]]**$**LandObl) <- **c**(data.yrs[1]**:**last.yr.sim)

fleets.ctrl[[f]]**$**LandObl_minimis <- **c**(**rep**(FALSE, **length**(data.yrs[1]**:**last.yr.sim)))

names(fleets.ctrl[[f]]**$**LandObl_minimis) <- **c**(data.yrs[1]**:**last.yr.sim)

fleets.ctrl[[f]]**$**LandObl_minimis_p <- **matrix**(0, nrow = **length**(**catchNames**(fleets[[f]])), ncol = **length**(data.yrs[1]**:**last.yr.sim), dimnames = **list**(**sort**(**catchNames**(fleets[[f]])),

c(data.yrs[1]**:**last.yr.sim)))

fleets.ctrl[[f]]**$**LandObl_yearTransfer <- **c**(**rep**(FALSE, **length**(data.yrs[1]**:**last.yr.sim)))

names(fleets.ctrl[[f]]**$**LandObl_yearTransfer) <- **c**(data.yrs[1]**:**last.yr.sim)

fleets.ctrl[[f]]**$**LandObl_yearTransfer_p <- **matrix**(0, nrow = **length**(**catchNames**(fleets[[f]])), ncol = **length**(data.yrs[1]**:**last.yr.sim), dimnames = **list**(**sort**(**catchNames**(fleets[[f]])),

c(data.yrs[1]**:**last.yr.sim)))

fleets.ctrl[[f]]**$**LandObl_discount_yrtransfer <- **array**(0, dim = **c**(**length**(**catchNames**(fleets[[f]]) **length**(data.yrs[1]**:**last.yr.sim), 1), dimnames = **list**(**sort**(**catchNames**(fleets[[f]])), **c**(data.yrs[1]**:**last.yr.sim), 1))

}

}

Recalculate the catchability for the projection years - uses either CobbDouglas

```
## or Baranov

fleets <- calculate.q.sel.flrObjs(biols, fleets, NULL, fleets.ctrl, sel.yrs, first.yr.sim:last.yr.sim)

#> BE_Beam_24<40m - TBB_DEF_27.7.e - COD
#> BE_Beam_24<40m - TBB_DEF_27.7.g - COD
#> EN_Beam_24<40m - TBB_DEF_27.7.e - COD
#> EN_Otter_10<24m - OTB_DEF_27.7.e - COD
#> EN_Otter_10<24m - OTH - COD
#> EN_Static_all - GNS_DEF_27.7.e - COD
#> EN_Static_all - GTR_DEF_27.7.e - COD
#> EN_Static_all - LLS_FIF_27.7.e - COD
#> FR_Otter_10<24m - OTB_DEF_27.7.e - COD
#> FR_Otter_10<24m - OTB_DEF_27.7.f - COD
#> FR_Otter_10<24m - OTB_DEF_27.7.g - COD
#> FR_Otter_10<24m - OTB_DEF_27.7.h - COD
#> FR_Otter_10<24m - OTH - COD
#> FR_Otter_24<40m - OTB_DEF_27.7.b - COD
#> FR_Otter_24<40m - OTB_DEF_27.7.e - COD
#> FR_Otter_24<40m - OTB_DEF_27.7.f - COD
#> FR_Otter_24<40m - OTB_DEF_27.7.g - COD
#> FR_Otter_24<40m - OTB_DEF_27.7.h - COD
#> FR_Otter_24<40m - OTB_DEF_27.7.j - COD
#> FR_Otter_24<40m - OTH - COD
#> FR_Otter_all - OTH - COD
#> FR_Otter_all - OTT_CRU_27.7.g - COD
#> FR_Otter_all - OTT_CRU_27.7.h - COD
#> FR_Otter_all - OTT_DEF_27.7.g - COD
#> FR_Otter_all - OTT_DEF_27.7.h - COD
#> FR_Otter_all - OTT_DEF_27.7.j - COD
#> IE_Beam_24<40m - OTH - COD
#> IE_Beam_24<40m - TBB_DEF_27.7.g - COD
#> IE_Otter_10<24m - OTB_CRU_27.7.g - COD
```

```
#> IE_Otter_10<24m - OTB_DEF_27.7.b - COD
#> IE_Otter_10<24m - OTB_DEF_27.7.g - COD
#> IE_Otter_10<24m - OTB_DEF_27.7.j - COD
#> IE_Otter_10<24m - OTH - COD
#> IE_Otter_10<24m - SSC_DEF_27.7.g - COD
#> IE_Otter_10<24m - SSC_DEF_27.7.j - COD
#> IE_Otter_10<24m - SSC_DEF_27.7.b - COD
#> IE_Otter_24<40m - OTB_CRU_27.7.g - COD
#> IE_Otter_24<40m - OTB_DEF_27.7.b - COD
#> IE_Otter_24<40m - OTB_DEF_27.7.g - COD
#> IE_Otter_24<40m - OTB_DEF_27.7.j - COD
#> IE_Otter_24<40m - OTH - COD
#> IE_Otter_24<40m - SSC_DEF_27.7.g - COD
#> IE_Otter_24<40m - SSC_DEF_27.7.j - COD
#> IE_Otter_24<40m - OTB_DEF_27.7.f - COD
#> OTH_OTH - OTH - COD
#> BE_Beam_24<40m - TBB_DEF_27.7.e - HAD
#> BE_Beam_24<40m - TBB_DEF_27.7.g - HAD
#> EN_Beam_24<40m - TBB_DEF_27.7.e - HAD
#> EN_Otter_10<24m - OTB_DEF_27.7.e - HAD
#> EN_Otter_10<24m - OTH - HAD

#> EN_Static_all - GNS_DEF_27.7.e - HAD
#> EN_Static_all - GTR_DEF_27.7.e - HAD
#> EN_Static_all - LLS_FIF_27.7.e - HAD
#> FR_Otter_10<24m - OTB_DEF_27.7.e - HAD
#> FR_Otter_10<24m - OTB_DEF_27.7.f - HAD
#> FR_Otter_10<24m - OTB_DEF_27.7.g - HAD
#> FR_Otter_10<24m - OTB_DEF_27.7.h - HAD
#> FR_Otter_10<24m - OTH - HAD
#> FR_Otter_24<40m - OTB_DEF_27.7.b - HAD
#> FR_Otter_24<40m - OTB_DEF_27.7.e - HAD
#> FR_Otter_24<40m - OTB_DEF_27.7.f - HAD
```

```
#> FR_Otter_24<40m - OTB_DEF_27.7.g - HAD
#> FR_Otter_24<40m - OTB_DEF_27.7.h - HAD
#> FR_Otter_24<40m - OTB_DEF_27.7.j - HAD
#> FR_Otter_24<40m - OTH - HAD
#> FR_Otter_all - OTH - HAD
#> FR_Otter_all - OTT_CRU_27.7.g - HAD
#> FR_Otter_all - OTT_CRU_27.7.h - HAD
#> FR_Otter_all - OTT_DEF_27.7.g - HAD
#> FR_Otter_all - OTT_DEF_27.7.h - HAD
#> FR_Otter_all - OTT_DEF_27.7.j - HAD
#> IE_Beam_24<40m - OTH - HAD
#> IE_Beam_24<40m - TBB_DEF_27.7.g - HAD
#> IE_Otter_10<24m - OTB_CRU_27.7.g - HAD
#> IE_Otter_10<24m - OTB_DEF_27.7.b - HAD
#> IE_Otter_10<24m - OTB_DEF_27.7.g - HAD
#> IE_Otter_10<24m - OTB_DEF_27.7.j - HAD
#> IE_Otter_10<24m - OTH - HAD
#> IE_Otter_10<24m - SSC_DEF_27.7.g - HAD
#> IE_Otter_10<24m - SSC_DEF_27.7.j - HAD
#> IE_Otter_10<24m - SSC_DEF_27.7.b - HAD
#> IE_Otter_24<40m - OTB_CRU_27.7.g - HAD
#> IE_Otter_24<40m - OTB_DEF_27.7.b - HAD
#> IE_Otter_24<40m - OTB_DEF_27.7.g - HAD
#> IE_Otter_24<40m - OTB_DEF_27.7.j - HAD
#> IE_Otter_24<40m - OTH - HAD
#> IE_Otter_24<40m - SSC_DEF_27.7.g - HAD
#> IE_Otter_24<40m - SSC_DEF_27.7.j - HAD
#> IE_Otter_24<40m - OTB_DEF_27.7.f - HAD
#> OTH_OTH - OTH - HAD
#> BE_Beam_24<40m - TBB_DEF_27.7.e - WHG
#> BE_Beam_24<40m - TBB_DEF_27.7.g - WHG
#> EN_Beam_24<40m - TBB_DEF_27.7.e - WHG
#> EN_Otter_10<24m - OTB_DEF_27.7.e - WHG
```

```
#> EN_Otter_10<24m     -     OTH       -     WHG
#> EN_Static_all       -     GNS_DEF_27.7.e - WHG
#> EN_Static_all       -     GTR_DEF_27.7.e - WHG
#> EN_Static_all       -     LLS_FIF_27.7.e - WHG
#> FR_Otter_10<24m     -     OTB_DEF_27.7.e               -     WHG
#> FR_Otter_10<24m     -     OTB_DEF_27.7.f               -     WHG
#> FR_Otter_10<24m     -     OTB_DEF_27.7.g               -     WHG
#> FR_Otter_10<24m     -     OTB_DEF_27.7.h               -     WHG
#> FR_Otter_10<24m     -     OTH       -     WHG
#> FR_Otter_24<40m     -     OTB_DEF_27.7.b               -     WHG
```

```
#> FR_Otter_24<40m - OTB_DEF_27.7.e - WHG
#> FR_Otter_24<40m - OTB_DEF_27.7.f - WHG
#> FR_Otter_24<40m - OTB_DEF_27.7.g - WHG
#> FR_Otter_24<40m - OTB_DEF_27.7.h - WHG
#> FR_Otter_24<40m - OTB_DEF_27.7.j - WHG
#> FR_Otter_24<40m - OTH - WHG
#> FR_Otter_all - OTH - WHG
#> FR_Otter_all - OTT_CRU_27.7.g - WHG
#> FR_Otter_all - OTT_CRU_27.7.h - WHG
#> FR_Otter_all - OTT_DEF_27.7.g - WHG
#> FR_Otter_all - OTT_DEF_27.7.h - WHG
#> FR_Otter_all - OTT_DEF_27.7.j - WHG
#> IE_Beam_24<40m - OTH - WHG
#> IE_Beam_24<40m - TBB_DEF_27.7.g - WHG
#> IE_Otter_10<24m - OTB_CRU_27.7.g - WHG
#> IE_Otter_10<24m - OTB_DEF_27.7.b - WHG
#> IE_Otter_10<24m - OTB_DEF_27.7.g - WHG
#> IE_Otter_10<24m - OTB_DEF_27.7.j - WHG
#> IE_Otter_10<24m - OTH - WHG
#> IE_Otter_10<24m - SSC_DEF_27.7.g - WHG
#> IE_Otter_10<24m - SSC_DEF_27.7.j - WHG
#> IE_Otter_10<24m - SSC_DEF_27.7.b - WHG
#> IE_Otter_24<40m - OTB_CRU_27.7.g - WHG
#> IE_Otter_24<40m - OTB_DEF_27.7.b - WHG
#> IE_Otter_24<40m - OTB_DEF_27.7.g - WHG
#> IE_Otter_24<40m - OTB_DEF_27.7.j - WHG
#> IE_Otter_24<40m - OTH - WHG
#> IE_Otter_24<40m - SSC_DEF_27.7.g - WHG
#> IE_Otter_24<40m - SSC_DEF_27.7.j - WHG
#> IE_Otter_24<40m - OTB_DEF_27.7.f - WHG
#> OTH_OTH - OTH - WHG
```

```
##          Haddock selection is average of 1993 - 2017 Recalculate here load(file.path("..", "data",
"stocks", "HAD-CS.RData"))

had.sel <- apply(stock@landings.n/(stock@landings.n + stock@discards.n), 1, mean) had.sel[1, ] <- 0
had.sel[8:9, ] <- 1


##          Whiting the landings and discards weights are different

load(file.path("..", "data", "stocks", "WHG-CS.RData"))

whg.lwt <- apply(stock@landings.wt[, ac(2015:2017)], 1, mean)

whg.dwt <- apply(stock@discards.wt[, ac(2015:2017)], 1, mean)

## loop

l.fls <- length(fleets)          #

nms.fls <- names(fleets)


for (i in 1:l.fls) {

print(nms.fls[i])

nms.metiers <- names(fleets[[i]]@metiers)

l.metiers <- length(nms.metiers)
```

```
for (j in 1:l.metiers) {

nms.stks <- names(fleets[[nms.fls[i]]]@metiers[[nms.metiers[j]]]@catches)

l.stks <- length(nms.stks)

for (k in 1:l.stks) {

## weight

if (fleets[[i]]@metiers[[j]]@catches[[k]]@name == "WHG") {

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.wt[, ac(first.yr.sim:last.yr.sim)] <- wh

fleets[[i]]@metiers[[j]]@catches[[k]]@discards.wt[, ac(first.yr.sim:last.yr.sim)] <- wh

}

## selection

if (fleets[[i]]@metiers[[j]]@catches[[k]]@name == "HAD") {

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)] <- h

} else {

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)] <- y ac(sel.yrs)])

}

# set any NAs in the proj year to 0 (in case of no catch)
```

```
fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)][is.na(fl

ac(first.yr.sim:last.yr.sim)])] <- 0

# discards selectivity as the inverse of the landings sel

fleets[[i]]@metiers[[j]]@catches[[k]]@discards.sel[, ac(first.yr.sim:last.yr.sim)] <- 1 -

fleets[[i]]@metiers[[j]]@catches[[k]]@landings.sel[, ac(first.yr.sim:last.yr.sim)]

fl <- i

mt <- j

st <- nms.stks[k]

## recalculate the catchability

B <- biols[[st]]@n * exp(-biols[[st]]@m/2)

C <- (fleets[[fl]]@metiers[[mt]]@catches[[st]]@discards.n + fleets[[fl]]@metiers[[mt]]@catc
alpha <- fleets[[fl]]@metiers[[mt]]@catches[[st]]@alpha beta <-
fleets[[fl]]@metiers[[mt]]@catches[[st]]@beta

E <- fleets[[fl]]@effort * fleets[[fl]]@metiers[[mt]]@effshare

fleets[[fl]]@metiers[[mt]]@catches[[st]]@catch.q <- C/((E %^% alpha) * (B %^% beta))

## and the means for sim years

fleets[[fl]]@metiers[[mt]]@catches[[st]]@catch.q[, ac(first.yr.sim:last.yr.sim)] <- apply(f
ac(sel.yrs)], 1, mean)

}
```

```
}

}

#> [1] "BE_Beam_24<40m"

#> [1] "EN_Beam_24<40m"

#> [1] "EN_Otter_10<24m"

#> [1] "EN_Static_all"

> [1] "FR_Otter_10<24m"

#> [1] "FR_Otter_24<40m"

#> [1] "FR_Otter_all"

#> [1] "IE_Beam_24<40m"

#> [1] "IE_Otter_10<24m"

#> [1] "IE_Otter_24<40m"

#> [1] "OTH_OTH"

##        For whiting, let's check the catch weights are right, as per the reproduce the

##        advice

fleets <- FLFleetsExt(fleets)
```

QA / Reproduce the advice

Here we seek to mimic the reproduce the advice process, by forecasting each stock as the limiting factor and comparing the catch, F and SSB indicators against those for the single stock advice. This is a bit tedious with a number of stocks, and it may be something that can be automated in a loop and computed in parallel.

```
################ QA - equivilent to reproduce the advice

fleets.ctrl.COD <- fleets.ctrl

fleets.ctrl.HAD <- fleets.ctrl

fleets.ctrl.WHG <- fleets.ctrl

##          All others are already set to SMFB effort.model, so we just need to modify the

##          option

for (fl in names(fleets)) {

fleets.ctrl.COD[[fl]][["effort.restr"]] <- "COD"

}

for (fl in names(fleets)) {

fleets.ctrl.HAD[[fl]][["effort.restr"]] <- "HAD"

}

for (fl in names(fleets)) {
```

```
fleets.ctrl.WHG[[fl]][["effort.restr"]] <- "WHG"

}

##            We do a forecast with the catch from the single stock advice

##            This is a pain, so might want to automate


######### COD

advice.cod <- advice

advice.cod$TAC["COD", ac(c(2018, 2019))] <- c(2354, 0)      # catch int yr, TAC. Note that for
cod this is

## Run FLBEIA with fleets constrained by COD TAC

for (fl in names(fleets)) {

fleets[[fl]]@capacity[] <- 1e+12

} # ensure not cap limited

cod <- FLBEIA(biols = biols, SRs = SRs, BDs = NULL, fleets = fleets, indices = NULL,


advice = advice.cod, main.ctrl = main.ctrl, biols.ctrl = biols.ctrl, fleets.ctrl = fleets.ctrl.COD,
covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ctrl)


## Compare to the single stock advice
```

```
ss_cod <- fb_cod <- matrix(NA, ncol = 3, nrow = 5, dimnames = list(metric = c("F", "SSB",
"catches", "landings", "discards"), year = c(2018:2020)))

ss_cod["F", ] <- c(0.612, 0, NA)

ss_cod["SSB", ] <- c(4179, 3618, 6905)

ss_cod["catches", ] <- c(2551, 0, NA)

ss_cod["landings", ] <- c(2354, 0, NA)

ss_cod["discards", ] <- c(197, 0, NA)

## Need to include a discard 'top-up' for cod

DR <- 0.0718

cod.flbeia <- bioSum(cod, years = ac(2018:2020))

## cod top up

cod.fb <- cod.flbeia %>% filter(stock == "COD")

cod.fb$catch[cod.fb$stock == "COD"] <- cod.fb$landings[cod.fb$stock == "COD"]/(1 - DR)

cod.fb$discards[cod.fb$stock == "COD"] <- cod.fb$catch[cod.fb$stock == "COD"] -
cod.fb$landings[cod.fb$ "COD"]


fb_cod["F", ] <- cod.fb$f

fb_cod["SSB", ] <- cod.fb$ssb

fb_cod["catches", ] <- cod.fb$catch
```

```
fb_cod["landings", ] <- cod.fb$landings

fb_cod["discards", ] <- cod.fb$discards
```

Table 2: Single stock forecast for COD

	2018	2019	2020
F	0.612	0	NA
SSB	4179.000	3618	6905
catches	2551.000	0	NA
landings	2354.000	0	NA
discards	197.000	0	NA

Table 3: FLBEIA STF for COD

	2018	2019	2020
F	0.611	0.000	0.000
SSB	4178.332	3565.123	6850.061
catches	2536.091	0.000	0.000
landings	2354.000	0.000	0.000
discards	182.091	0.000	0.000

Table 4: Relative difference between single stock and

FLBEIA forecasts

Metric	**2018**	**2019**	**2020**
F	0.999	NaN	

SSB	1	0.985	0.992
catches	0.994	NaN	
landings	1	NaN	
discards	0.924	NaN	

```
######### HAD

advice.had <- advice

advice.had$TAC["HAD", ac(c(2018, 2019))] <- c(10837, 6317)

## Run FLBEIA with fleets constrained by HKE TAC

for (fl in names(fleets)) {

fleets[[fl]]@capacity[] <- 1e+12

} # ensure not cap limited

had <- FLBEIA(biols = biols, SRs = SRs, BDs = NULL, fleets = fleets, indices = NULL,

advice = advice.had, main.ctrl = main.ctrl, biols.ctrl = biols.ctrl, fleets.ctrl = fleets.ctrl.HAD,
covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ctrl)



## Compare to the single stock advice

ss_had <- fb_had <- matrix(NA, ncol = 3, nrow = 5, dimnames = list(metric = c("F", "SSB",
"catches", "landings", "discards"), year = c(2018:2020)))

ss_had["F", ] <- c(0.66, 0.4, NA)

ss_had["SSB", ] <- c(19319, 13365, 21650)
```

```
ss_had["catches", ] <- c(10837, 6317, NA)

ss_had["landings", ] <- c(8225, 3761, NA)

ss_had["discards", ] <- c(2612, 2556, NA)

had.flbeia <- bioSum(had, years = ac(2018:2020))

had.fb <- had.flbeia %>% filter(stock == "HAD")

fb_had["F", ] <- had.fb$f

fb_had["SSB", ] <- had.fb$ssb

fb_had["catches", ] <- had.fb$catch

fb_had["landings", ] <- had.fb$landings

fb_had["discards", ] <- had.fb$discards
```

Table 5: Single stock forecast values for HAD

	2018	2019	2020
F	0.66	0.4	NA
SSB	19319.00	13365.0	21650
catches	10837.00	6317.0	NA
landings	8225.00	3761.0	NA

2018	2019	2020	
discards	2612.00	2556.0	NA

Table 6: FLBEIA forecast for HAD

	2018	2019	2020

F	0.684	0.389	0.258
SSB	18718.052	12298.685	20797.226
catches	10837.000	6317.000	6317.000
landings	7224.395	3109.276	2585.345
discards	3612.605	3207.724	3731.655

Table 7: Relative difference between single stock and FLBEIA forecasts for HAD

Metric	2018	2019	2020
F 1.04		0.973	
SSB	0.969	0.92	0.961
catches	1	1	
landings 0.878 0.827			
discards	1.38	1.25	

```
######### WHG

advice.whg <- advice

advice.whg$TAC["WHG", ac(c(2018, 2019))] <- c(15770, 15841)

## Run FLBEIA with fleets constrained by HKE TAC

for (fl in names(fleets)) {

fleets[[fl]]@capacity[] <- 1e+12

} # ensure not cap limited

whg <- FLBEIA(biols = biols, SRs = SRs, BDs = NULL, fleets = fleets, indices = NULL,
```

```
advice = advice.whg, main.ctrl = main.ctrl, biols.ctrl = biols.ctrl, fleets.ctrl = fleets.ctrl.WHG,
covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ctrl)

## Compare to the single stock advice

ss_whg <- fb_whg <- matrix(NA, ncol = 3, nrow = 5, dimnames = list(metric = c("F", "SSB",
"catches", "landings", "discards"), year = c(2018:2020)))

ss_whg["F", ] <- c(0.54, 0.52, NA)

ss_whg["SSB", ] <- c(40029, 42819, 44943)

ss_whg["catches", ] <- c(15770, 15841, NA)

ss_whg["landings", ] <- c(10322, 9882, NA)

ss_whg["discards", ] <- c(5571, 5960, NA)

whg.flbeia <- bioSum(whg, years = ac(2018:2020))

whg.fb <- whg.flbeia %>% filter(stock == "WHG")


fb_whg["F", ] <- whg.fb$f

fb_whg["SSB", ] <- whg.fb$ssb

fb_whg["catches", ] <- whg.fb$catch

fb_whg["landings", ] <- whg.fb$landings

fb_whg["discards", ] <- whg.fb$discards
```

Table 8: single stock forecast values for WHG

	2018	2019	2020
F	0.54	0.52	NA
SSB	40029.00	42819.00	44943
catches	15770.00	15841.00	NA
landings	10322.00	9882.00	NA
discards	5571.00	5960.00	NA

Table 9: FLBEIA forecast values for WHG

	2018	2019	2020
F	0.593	0.608	0.582
SSB	40166.875	41473.142	42178.665
catches	15770.000	15841.000	15841.000
land-ings	8665.647	8093.499	8090.183
discards	7104.353	7747.501	7750.817

Table 10: Relative difference between single stock and

FLBEIA forecasts for WHG

Metric	2018	2019	2020
F	1.1	1.17	
SSB	1	0.969	0.938
catches	1	1	
landings	0.84	0.819	
discards	1.27	1.3	

MixFish Scenarios set-up

```
## Now for FLBEIA on scenarios

sc <- c("Esq", "min", "max", "COD", "HAD", "WHG")


## We need to set up a fleets.ctrl object for each of these scenarios

fleets.ctrl.Esq <- fleets.ctrl

fleets.ctrl.min <- fleets.ctrl

fleets.ctrl.max <- fleets.ctrl

fleets.ctrl.COD <- fleets.ctrl

fleets.ctrl.HAD <- fleets.ctrl

fleets.ctrl.WHG <- fleets.ctrl

for (fl in names(fleets)) {


fleets.ctrl.Esq[[fl]][["effort.model"]] <- "fixedEffort"

}

##          All others are already set to SMFB effort.model, so we just need to modify the

##          option

for (fl in names(fleets)) {

fleets.ctrl.min[[fl]][["effort.restr"]] <- "min"
```

```
}

for (fl in names(fleets)) {

fleets.ctrl.max[[fl]][["effort.restr"]] <- "max"

}

for (fl in names(fleets)) {

fleets.ctrl.COD[[fl]][["effort.restr"]] <- "COD"

}

for (fl in names(fleets)) {

fleets.ctrl.HAD[[fl]][["effort.restr"]] <- "HAD"

}

for (fl in names(fleets)) {

fleets.ctrl.WHG[[fl]][["effort.restr"]] <- "WHG"

}
```

NEW scenarios

Additional Scenarios:

Here, we implement scenarios where:

1. The fleets are restricted by different stocks; these can be defined as inputs. Here, we do not restrict any fleet with < 20 % cod with the cod TAC (example bycatch quota).

2. The effort is allocated across metier according to a gravity model (only haddock and whiting restrict catches and contribute to income), cod is discarded.

3. We close the main cod metier, redistribute effort according to the gravity model.

4. We change the gear selectivity for cod for the main metier.

```
fleets.ctrl.stk <- fleets.ctrl.min

## 1. Bycatch quota. Only fleets with > 20 % of cod quota are restricted by cod -

## assume these are target fleets

advice$quota.share[["COD"]][, "2020"][advice$quota.share[["COD"]][, "2020"] > 0.2]

#> An object of class "FLQuant"

#> , , unit = unique, season = all, area = unique #>

#>          year

#> fleets   2020

#>          FR_Otter_24<40m 0.20116

#>          FR_Otter_all    0.22618

#>

#> units:   NA

for (f in names(fleets)) {

if (f %in% as.data.frame(advice$quota.share[["COD"]][, "2020"][advice$quota.share[["COD"]][, "2020"] > 0.1])$fleets) {
```

```
fleets.ctrl.stk[[f]]$stocks.restr <- c("COD", "HAD", "WHG")

} else {

fleets.ctrl.stk[[f]]$stocks.restr <- c("HAD", "WHG")

}

}

##          2. Effort recallocation How much could fleets maximise catch given a zero quota

##          for cod?

fleets.ctrl.grav <- fleets.ctrl.min

for (f in names(fleets)) {

if (f != "OTH_OTH") {

fleets.ctrl.grav[[f]][["effort.model"]] <- "SMFB_ES" fleets.ctrl.grav[[f]][["effshare.model"]] <-
"gravity.flbeia"   fleets.ctrl.grav[[f]][["gravity.model"]]   <-   "revenue"
fleets.ctrl.grav[[f]]$stocks.restr <- c("HAD", "WHG")

}

}

## Missing prices
```

```
fleets[["FR_Otter_10<24m"]]@metiers[[5]]@catches[["WHG"]]@price[, ac(2018:2020)] <-
fleets[["FR_Otter_1 ac(2017)]
```

```
fleets[["FR_Otter_24<40m"]]@metiers[[7]]@catches[["COD"]]@price[, ac(2018:2020)] <-
fleets[["FR_Otter_2 ac(2017)]
```

```
##      3. Close metier and reallocate the effort proportionally to other fished metier

##      We can do this by setting effshare to zero, and using a gravity model with

##      tradition = 1

advice$quota.share[["COD"]][, "2020"][advice$quota.share[["COD"]][, "2020"] > 0.1]
        ## fleets with > 10
```

```
#> An object of class "FLQuant"

#> , , unit = unique, season = all, area = unique

#>
#>                    year
#> fleets             2020
#>  FR_Otter_10<24m   0.15376
#>  FR_Otter_24<40m   0.20116
#>  FR_Otter_all      0.22618
#>  IE_Otter_10<24m   0.14977
#>  OTH_OTH           0.11008
#>
#> units: NA
```

```
met_close <- "OTB_DEF_27.7.g"
```

```
fleets.close <- fleets

for (f in names(fleets.close)) {

if (met_close %in% fleets.close[[f]]@metiers@names) {

met.eff <- as.numeric(fleets.close[[f]]@metiers[[met_close]]@effshare[, ac(2019)])

for (m in fleets.close[[f]]@metiers@names) {

if (m == met_close) {

fleets.close[[f]]@metiers[[m]]@effshare[, ac(2019)] <- 0

} else {

fleets.close[[f]]@metiers[[m]]@effshare[, ac(2019)] <- fleets.close[[f]]@metiers[[m]]@e
ac(2019)] + as.numeric(fleets.close[[f]]@metiers[[m]]@effshare[,

ac(2019)])/(1 - met.eff) * met.eff

}

}

}

}
```

```
fleets.ctrl.close <- fleets.ctrl.min

for (f in names(fleets)) {

if (f != "OTH_OTH") {

fleets.ctrl.close[[f]][["effort.model"]] <- "SMFB_ES" fleets.ctrl.close[[f]][["effshare.model"]]
<- "gravity.flbeia" fleets.ctrl.close[[f]][["gravity.model"]] <- "revenue"
fleets.ctrl.close[[f]][["gravity.tradition"]] <- 1 fleets.ctrl.close[[f]]$stocks.restr <- c("HAD",
"WHG")

}

}


## 4. We implement selectivity measures for DEF targeting metier that reduce cod
## catches by 20 in DEF fisheries %

fleets.sel <- fleets

for (f in names(fleets.sel)) {

for (m in grep("OTB_DEF", fleets.sel[[f]]@metiers@names, value = TRUE))

if ("COD" %in% fleets.sel[[f]]@metiers[[m]]@catches@names) {

fleets.sel[[f]]@metiers[[m]]@catches[["COD"]]@catch.q <- fleets.sel[[f]]@metiers[[m]]@catches[[ 0.8

}

}

fleets.ctrl.sel <- fleets.ctrl.min
```

for (f **in** **names**(fleets.sel)) {

fleets.ctrl.sel[[f]]**$**stocks.restr <- **c**("HAD", "WHG")

}

a had_whg combo

fleets.ctrl.had_whg <- fleets.ctrl.sel

accumulate, when

sc <- **c**(sc, "stk", "grav", "close", "sel", "had_whg")

sc <- sc[**!duplicated**(sc)]

Run MixFish Scenarios

First we do an Intermediate year forecast at status quo effort

 # Create new control objects We want the fixed effort for int year, scenarios for

 # TAC year

main.ctrl.Intyr <- main.ctrl.TACyr <- main.ctrl

main.ctrl.Intyr**$**sim.years[["final"]] <- 2019

main.ctrl.TACyr**$**sim.years[["initial"]] <- 2019

IntYr <- **FLBEIA**(biols = biols, SRs = SRs, BDs = NULL, fleets = fleets, covars = NULL, indices = NULL, advice = advice, main.ctrl = main.ctrl.Intyr, biols.ctrl = biols.ctrl, fleets.ctrl = fleets.ctrl.Esq, covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ctrl)

##################### Now we do the TAC year forecasts

Our new objects are the outputs from the intermediate year forecast biols <- IntYr**$**biols

```
SRs <- IntYr$SRs fleets <- IntYr$fleets advice <- IntYr$advice

##      Note, in windows need to export the objects, functions etc.. we just export the
##      global environment for ease but this isn't very efficient for memory

library(doParallel)

#> Loading required package: foreach

#>

#> Attaching package: 'foreach'

#> The following objects are masked from 'package:purrr':

#>

#>

#> Loading required package: parallel

registerDoParallel(cores = parallel::detectCores())


obj_to_pass <- c("biols", "SRs", ls(pattern = "fleets"), "advice", "main.ctrl.TACyr", "biols.ctrl",
ls(pattern = "fleets.ctrl"), "obs.ctrl", "assess.ctrl", "advice.ctrl")


runs <- foreach(i = sc, .export = obj_to_pass) %dopar% {

library(FLBEIA)

if (i %in% c("close", "sel")) {
```

res <- **FLBEIA**(biols = biols, SRs = SRs, BDs = NULL, fleets = **get**(**paste0**("fleets.", i)), covars = NULL, indices = NULL, advice = advice, main.ctrl = main.ctrl.TACyr, biols.ctrl = biols.ctrl, fleets.ctrl = **get**(**paste0**("fleets.ctrl.", i)),

covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ct

} **else** {

res <- **FLBEIA**(biols = biols, SRs = SRs, BDs = NULL, fleets = fleets, covars = NULL, indices = NULL, advice = advice, main.ctrl = main.ctrl.TACyr, biols.ctrl = biols.ctrl, fleets.ctrl = **get**(**paste0**("fleets.ctrl.", i)), covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ctrl)

}

}

stopImplicitCluster()

names(runs) <- sc

Summarise the results

bio <- **rbind**(**bioSum**(runs[["max"]], scenario = "max", years = **ac**(2018:2020)), **bio-Sum**(runs[["min"]],

scenario = "min", years = **ac**(2018:2020)), **bioSum**(runs[["Esq"]], scenario = "Esq",

years = **ac**(2018:2020)), **bioSum**(runs[["COD"]], scenario = "COD", years = **ac**(2018:2020)),

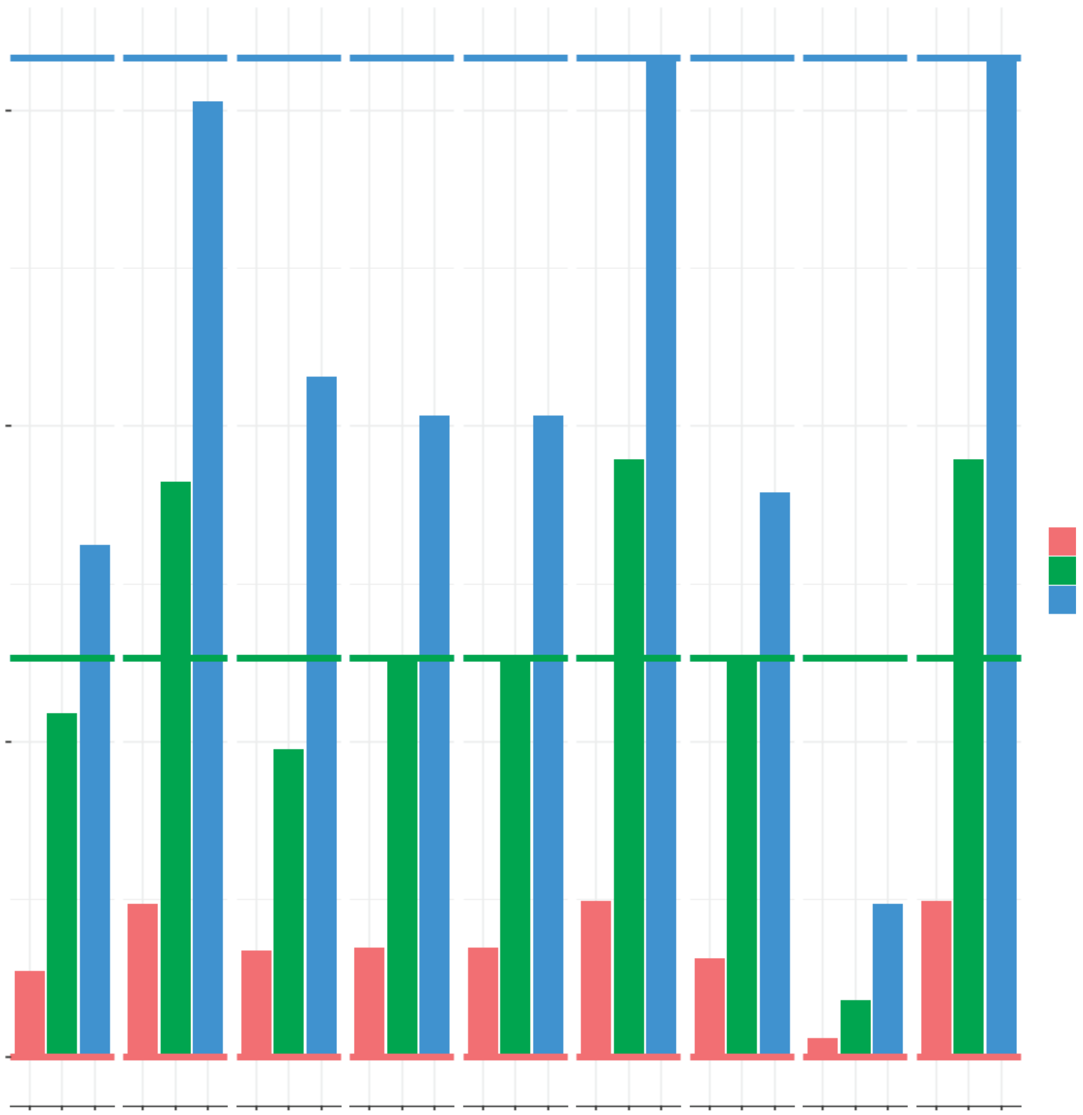
```
bioSum(runs[["HAD"]], scenario = "HAD", years = ac(2018:2020)), bio-
Sum(runs[["WHG"]],

scenario = "WHG", years = ac(2018:2020)), bioSum(runs[["stk"]], scenario = "stk",

years = ac(2018:2020)), bioSum(runs[["grav"]], scenario = "grav", years = ac(2018:2020)),

bioSum(runs[["close"]], scenario = "close", years = ac(2018:2020)), bioSum(runs[["sel"]],

scenario = "sel", years = ac(2018:2020)), bioSum(runs[["had_whg"]], scenario = "had_whg",

years = ac(2018:2020)))

bio$catch[bio$stock == "COD"] <- bio$catch[bio$stock == "COD"]/(1 - DR)

bio$discards[bio$stock == "COD"] <- bio$catch[bio$stock == "COD"] - bio$landings[bio$stock == "COD"]
```

Visualise outputs

```
#################### And for the plot
## Can create the proper plot, but just to check its worked

TACs <- as.data.frame(advice$TAC[, "2019"])

colnames(TACs)[c(1, 7)] <- c("stock", "value")

ggplot(filter(bio, year == 2019, !scenario %in% c("min", "COD")), aes(x = stock,

y = catch)) + geom_bar(stat = "identity", aes(fill = stock)) + facet_wrap(~scenario, nrow = 1)
+ geom_hline(data = TACs, aes(yintercept = value, colour = stock), linetype = 2, size = 2) +
theme_bw() + theme(axis.text.x = element_text(angle = -90, hjust = 0))
```

	close			Esq			grav			HAD			had_whg			max			sel			stk			WHG	
15000																										
10000																										
																										stock
catch																										HAD
																										COD
																										WHG
5000																										
0																										
COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG	COD	HAD	WHG
													stock													
Table outputs																										
										Table 11: Fishing mortality																

year	sce-nario	COD	HAD	WHG
2018	close	0.000	0.000	0.000
2018	COD	0.638	0.764	0.563
2018	Esq	0.638	0.764	0.563
2018	grav	0.638	0.764	0.563
2018	HAD	0.638	0.764	0.563
2018	had_whg	0.638	0.764	0.563
2018	max	0.638	0.764	0.563
2018	min	0.638	0.764	0.563



year	scenario	COD	HAD	WHG
2018	sel	0.000	0.000	0.000
2018	stk	0.638	0.764	0.563
2018	WHG	0.638	0.764	0.563
2019	close	0.182	0.200	0.182
2019	COD	0.000	0.000	0.000
2019	Esq	0.638	0.753	0.582
2019	grav	0.399	0.298	0.376

year	scenario	COD	HAD	WHG
2019	HAD	0.413	0.403	0.339
2019	had_whg	0.413	0.403	0.339
2019	max	0.654	0.803	0.594
2019	min	0.000	0.000	0.000
2019	sel	0.210	0.235	0.201
2019	stk	0.058	0.047	0.070
2019	WHG	0.654	0.803	0.594

Table 12: catches

year	scenario	COD	HAD
2018	close	0.000	0.000
2018	COD	2617.785	10345.262
2018	Esq	2617.785	10345.262
2018	grav	2617.785	10345.262
2018	HAD	2617.785	10345.262
2018	had_whg	2617.785	10345.262
2018	max	2617.785	10345.262
2018	min	2617.785	10345.262
2018	sel	0.000	0.000
2018	stk	2617.785	10345.262
2018	WHG	2617.785	10345.262
2019	close	1361.345	5437.265
2019	COD	0.000	0.000
2019	Esq	2417.166	9110.909
2019	grav	1673.142	4868.180
2019	HAD	1727.585	6317.000
2019	had_whg	1727.585	6317.000

2019	max	2460.335	9473.573
2019	min	0.000	0.000
2019	sel	1549.373	6317.000
2019	stk	288.721	892.617
2019	WHG	2460.335	9473.573

Table 13: Landings

year	scenario	COD	HAD	WHG
2018	close	0.000	0.000	0.000
2018	COD	2429.828	4606.493	8324.957
2018	Esq	2429.828	4606.493	8324.957
2018	grav	2429.828	4606.493	8324.957
2018	HAD	2429.828	4606.493	8324.957
2018	had_whg	2429.828	4606.493	8324.957
2018	max	2429.828	4606.493	8324.957
2018	min	2429.828	4606.493	8324.957
2018	sel	0.000	0.000	0.000
2018	stk	2429.828	4606.493	8324.957
2018	WHG	2429.828	4606.493	8324.957
2019	close	0.000	3417.859	4868.965
2019	COD	0.000	0.000	0.000
2019	Esq	0.000	3022.766	7445.103
2019	grav	0.000	2383.175	5438.175
2019	HAD	0.000	3022.766	5214.683
2019	had_whg	0.000	3022.766	5214.683
2019	max	0.000	3022.766	8142.521
2019	min	0.000	0.000	0.000

2019	sel	0.000	3875.335	5085.232
2019	stk	0.000	409.319	1282.218
2019	WHG	0.000	3022.766	8142.521

Table 14: Discards

year	scenario	COD	HAD	WHG
2018	close	0.000	0.000	0.000
2018	COD	187.957	5738.769	6784.647
2018	Esq	187.957	5738.769	6784.647
2018	grav	187.957	5738.769	6784.647
2018	HAD	187.957	5738.769	6784.647
2018	had_whg	187.957	5738.769	6784.647
2018	max	187.957	5738.769	6784.647
2018	min	187.957	5738.769	6784.647
2018	sel	0.000	0.000	0.000
2018	stk	187.957	5738.769	6784.647
2018	WHG	187.957	5738.769	6784.647
2019	close	1361.345	2019.406	3242.597
2019	COD	0.000	0.000	0.000
2019	Esq	2417.166	6088.143	7697.739
2019	grav	1673.142	2485.006	5339.780
2019	HAD	1727.585	3294.234	4949.822
2019	had_whg 1727.585 3294.234			4949.822
2019	max	2460.335	6450.807	7698.479
2019	min	0.000	0.000	0.000
2019	sel	1549.373	2441.665	3862.551
2019	stk	288.721	483.298	1133.297
2019	WHG	2460.335	6450.807	7698.479

Table 15: SSB

year	scenario	COD	HAD	WHG
2019	close	6433.258	22463.16	56812.25
2019	COD	3472.764	11779.56	42115.00

year	scenario	COD	HAD	WHG
2019	Esq	3472.764	11779.56	42115.00
2019	grav	3472.764	11779.56	42115.00
2019	HAD	3472.764	11779.56	42115.00
2019	had_whg	3472.764	11779.56	42115.00
2019	max	3472.764	11779.56	42115.00
2019	min	3472.764	11779.56	42115.00
2019	sel	6433.258	22463.16	56812.25
2019	stk	3472.764	11779.56	42115.00
2019	WHG	3472.764	11779.56	42115.00
2020	close	8521.703	30905.00	63038.30
2020	COD	6749.306	26244.15	58295.69
2020	Esq	4096.705	17197.71	43159.06
2020	grav	4914.241	21681.08	47613.98
2020	HAD	4853.509	20307.80	48303.99
2020	had_whg	4853.509	20307.80	48303.99
2020	max	4049.232	16795.04	42731.73
2020	min	6749.306	26244.15	58295.69
2020	sel	8320.194	30084.00	62080.42
2020	stk	6432.358	25401.05	55944.79
2020	WHG	4049.232	16795.04	42731.73

Catchability scenarios

```
## Here look at the catchability by fleet over past 5 years... Does it make a
## difference to choke ? Create a new set of fleets CHANGE THIS TO PARALLEL AS
## ITS SOOOO SLOW

registerDoParallel(cores = parallel::detectCores())
```

obj_to_pass <- **c**("fleets", "biols", "fleets.ctrl")

fleets_q <- **foreach**(y = 2013**:**2017, .export = obj_to_pass) **%dopar%** {

library(FLBEIA)

fleets <- **calculate.q.sel.flrObjs**(biols, fleets, NULL, fleets.ctrl, **ac**(y), first.yr.sim**:**last.yr.sim **return**(**assign**(**paste0**("fleets", y), fleets))

}

#> Warning in e$fun(obj, substitute(ex), parent.frame(), e$data): already exporting

#> variable(s): fleets, biols, fleets.ctrl

names(fleets_q) <- **as.character**(2013**:**2017)

######################## Run these catchability scenarios

registerDoParallel(cores = parallel**::detectCores**())

obj_to_pass <- **c**("biols", "SRs", "fleets_q", "advice", "main.ctrl.TACyr", "biols.ctrl", **ls**(pattern = "fleets.ctrl"), "obs.ctrl", "assess.ctrl", "advice.ctrl")

runs_q <- **foreach**(y = 2013**:**2017, .export = obj_to_pass) **%dopar%** {

library(FLBEIA)

q <- **FLBEIA**(biols = biols, SRs = SRs, BDs = NULL, fleets = fleets_q[[**as.character**(y)]], covars = NULL, indices = NULL, advice = advice, main.ctrl = main.ctrl.TACyr, biols.ctrl = biols.ctrl, fleets.ctrl = fleets.ctrl.had_whg, covars.ctrl = NULL, obs.ctrl = obs.ctrl, assess.ctrl = assess.ctrl, advice.ctrl = advice.ctrl)

```
}

#> Warning in e$fun(obj, substitute(ex), parent.frame(), e$data): already exporting

#> variable(s): biols, SRs, fleets_q, advice, main.ctrl.TACyr, biols.ctrl, #> fleets.ctrl.had_whg, obs.ctrl, as-sess.ctrl, advice.ctrl

stopImplicitCluster()

names(runs_q) <- as.character(2013:2017)

## Summarise the results

bio_q <- rbind(bioSum(runs_q[[as.character(2013)]], scenario = paste0("catch_q_", as.character(2013)), years = ac(2018:2020)), bioSum(runs_q[[as.character(2014)]],

scenario = paste0("catch_q_", as.character(2014)), years = ac(2018:2020)), bioSum(runs_q[[as.charac

scenario = paste0("catch_q_", as.character(2015)), years = ac(2018:2020)), bioSum(runs_q[[as.charac

scenario = paste0("catch_q_", as.character(2016)), years = ac(2018:2020)), bioSum(runs_q[[as.charac

scenario = paste0("catch_q_", as.character(2017)), years = ac(2018:2020)))

bio_q$catch[bio_q$stock == "COD"] <- bio_q$catch[bio_q$stock == "COD"]/(1 - DR)

bio_q$discards[bio_q$stock == "COD"] <- bio_q$catch[bio_q$stock == "COD"] - bio_q$land-ings[bio_q$stock "COD"]
```

And summarise the number of fleets choked by each stock under the different catchability inputs

```
## test <- fltStkSum(runs_q[[2]], years = ac(2018:2020)) filter(test, quotaUpt
## >0.8, year == 2019, stock !='COD') ## Still below 1 ??

save.image(file = file.path("..", "outputs", "FLBEIA_Run.RData"))
```

Annex 2: North Sea and West of Scotland implementation

1.Introduction

We want to know about possible levels of bycatch in cod and whiting in division 6.a. Since these stocks are bycatch species for target stocks that extend into the North Sea the North Sea FCube set up has been extended to include WoS stocks (cod6a, whg6a, anf, lez, nep11-13).

1.1. Cod in Division 6.a

Cod has had 0 TAC advice since 2004 but bycatch of cod may be landed provided it does not comprise of more than 1% of the live weight of the total catch retained on board per fishing trip. As a result catches of cod in 6a are heavily influenced by the changes in catch of target stocks. However, this exemption has not been applicable since 2015 for catches subject to the landing obligation. Cod in Division 6.a is not included in the multiannual plan for Western Waters (Council Regulation (EU) 2019/472). Cod in 6a is fully under the landing obligation from 2019.

Landings of cod in 2018 were more than double what they were in 2014. Cod catches are primarily from demersal fin fish trawl fleets targeting haddock, saithe and anglerfish. There are high levels of area misreporting (mostly caught in 6a but declared in 4a) with 65% of landings were misreported in 2018. The overall discard rate in 2018 was 40% however, this varies from 96% to 24% for different fleets. Discards are often a result of high grading.

Stock trends:

“The current spawning–stock biomass (SSB) is extremely low and has been below Blim since 1997. Recruitment has also been very low since 2001, and below the time-series average. Fishing mortality (F) declined between 2005 and 2014 but has remained between Fpa and Flim since 2014.”

Advice 2019:

“ICES advises that when the MSY approach is applied, there should be zero catches in each of the years 2020 and 2021.”

1.2. Whiting in Division 6.a

Whiting has had 0 TAC advice since 2006 but the agreed TAC has been a bycatch TAC set at 200-300 tonnes in the last few years. There has been no targeted whiting fishery since the early 2000s. Whiting in 6.a is fully under the landing obligation from 2019. There is no management plan for this stock though a plan is under development.

In general, landings of whiting have reduced over the last 10 years though discards have risen over this same time period. The overall discard rate in 2017 was 87%. Whiting catches are primarily in the form of discards from the *Nephrops* directed otter trawl fishery and could become a major choke species for the *Nephrops* fishery under the landing obligation.

Stock trends:

"The spawning–stock biomass (SSB) has been increasing since 2010 but remains very low compared to the historical estimates and is below Blim. Fishing mortality (F) has declined continuously since around 2000 and is estimated well below F_{MSY}. Recruitment is estimated to have been very low since 2002, but estimated to have increased in recent years."

Advice 2018:

"ICES advises that when the precautionary approach is applied, there should be zero catch in each of the years 2019 and 2020."

2. Data and model set up

This section will focus mostly on the changes made for the addition of WoS stocks rather than detailing the set up for the standard North Sea run.

2.1. Stock data

Assessment data for the West of Scotland stocks were taken from WGCSE 2019 (ICES 2019b). These were either available as a read-made FLStock object or the necessary data were available to allow the creation of FLStock objects. All stock and advice data used were taken following the autumn advice reopening process. The stocks included are summarised in Table A2.1.

Table A2.1: List of stocks included in NS-WoS run

	Stock name	Fcube name	WG
Full analytical stocks	Cod.27.47d20	COD-NS	WGNSSK
	Had.27.46a20	HAD	WGNSSK
	Ple.27.7d	PLE-EC	WGNSSK
	Ple.27.420	PLE-NS	WGNSSK
	Sol.27.4	SOL-NS	WGNSSK
	Tur.27.4	TUR	WGNSSK
	Whg.27.47d	WHG-NS	WGNSSK
	Cod.27.6a	COD-WS	WGCSE
	Whg.27.6a	WHG-WS	WGCSE
Non analytical fish stocks	Anf.27.3a46	ANF	WGCSE
	Lez.27.4a6a	LEZ	WGCSE
	Sol.27.7d	SOL-EC	WGNSSK
Nephrops FUs with UWTV surveys	Nep.fu.6	NEP6	WGNSSK
	Nep.fu.7	NEP7	WGNSSK

	Stock name	Fcube name	WG
	Nep.fu.8	NEP8	WGNSSK
	Nep.fu.9	NEP9	WGNSSK
	Nep.fu.11	NEP11	WGCSE
	Nep.fu.12	NEP12	WGCSE
	Nep.fu.13	NEP13	WGCSE
Other Nephrops stocks	Nep.fu.5	NEP5	WGNSSK
	Nep.fu.10	NEP10	WGNSSK
	Nep.fu.32	NEP32	WGNSSK
	Nep.fu.33	NEP33	WGNSSK
	Nep.fu.34	NEP34	WGNSSK
	Nep.27.4outFU	NEPOTH-NS	WGNSSK
	Nep.27.6aoutFU	NEPOTH-WS	WGCSE

Nephrops stocks were incorporated by functional unit and comprise of FU11-13 as well as *Nephrops* taken from areas outside of the functional units. *Nephrops* in the Firth of Clyde and Sound of Jura are considered separately within FU13 by ICES because the biology of the two areas are considered distinct. To simplify the mixed fisheries projections *Nephrops* data in the Firth of Clyde and Sound of Jura were combined and treated as one stock (FU13). The harvest rate for this FU was calculated as the average harvest rate of the two stocks, weighted by the total catches from each area. Catches outside of the West of Scotland functional units were considered as a separate FU (NEPOTH-WS) and treated in a similar way to other FUs in the North Sea which do not have a TV survey assessment.

Anglerfish, megrim, and Eastern Channel sole do not have full analytical assessments and advice is based on stock trend development. As a result the data used for these stocks comprise of catches and biomass only. Harvest rates were calculated as the proportion of the biomass taken in the catch. In the case of anglerfish and megrim the biomass was taken as total biomass as reported in WGCSE 2019 (ICES 2019b) whereas, spawning stock biomass was used for Eastern Channel sole to remain consistent with the data presented in the advice.

2.2. Fleets and métiers

2.2.1. Catch and effort data

Fleet data for Spain and Ireland were added to the usual North Sea fleet data and the standard data cleaning checks were applied (standardise codes, remove resubmissions and duplicates, correct units). Some additional data cleaning was required given the additional WoS data. Firstly, the data from Ireland included some level 4 metiers which were converted to level 6 métiers (for consistency) following the same conversions made for the Celtic Sea FCube data. Secondly, fleet capacity is set to the maximum number of vessels recorded in the data for Spain and Ireland in the Celtic Sea Fcube implementation (as

opposed to the sum as used in the majority of the North Sea) and so an adjustment was made to account for this difference.

Consistency checks between the catch and effort data and between the catch data and InterCatch data are performed as part of the data processing procedure. The result of these checks are a lookup table which solves various mismatches in the data. These lookup tables were updated to include the additional data from Spain and Ireland.

Landings of cod in Division 6.a from the fleet data were adjusted for area misreporting to improve the match in total catches between the fleet data and InterCatch (where misreporting is already taken into account). The percentage of misreported landings each year was reported in the WGCSE 2019 report (ICES 2019b) and this data was used to adjust the landings in the fleet data. The adjustment was applied to all fleets by year before the fleet data was merged with the InterCatch data.

The degree of agreement in landings and discards by stock is shown in figures A2.1 and A2.2. Norway do not report data to WGMIXFISH and so Norwegian catches will be missing from the fleet data total catches. Other discrepancies arise from areas not reported to WGMIXFISH or missing logbook information that means the landings cannot be allocated to a fleet. Coverage of the landings is within 15% for most stocks. The standard approach is to solve these discrepancies is to pool the differences into the "OTH" fleet.

Previously, Germany have not been able to provide sale value data each year and so sale prices provided for Germany in 2009 are used as a proxy for the rest of the time series. However, in 2018 sale value data were provided for some catches from Germany. Therefore, an adjustment was made to use this data where it existed for the mean sale price calculations. The results for Germany by stock are shown in Figure 3. Some stocks show a discontinuity in the mean price for 2018.

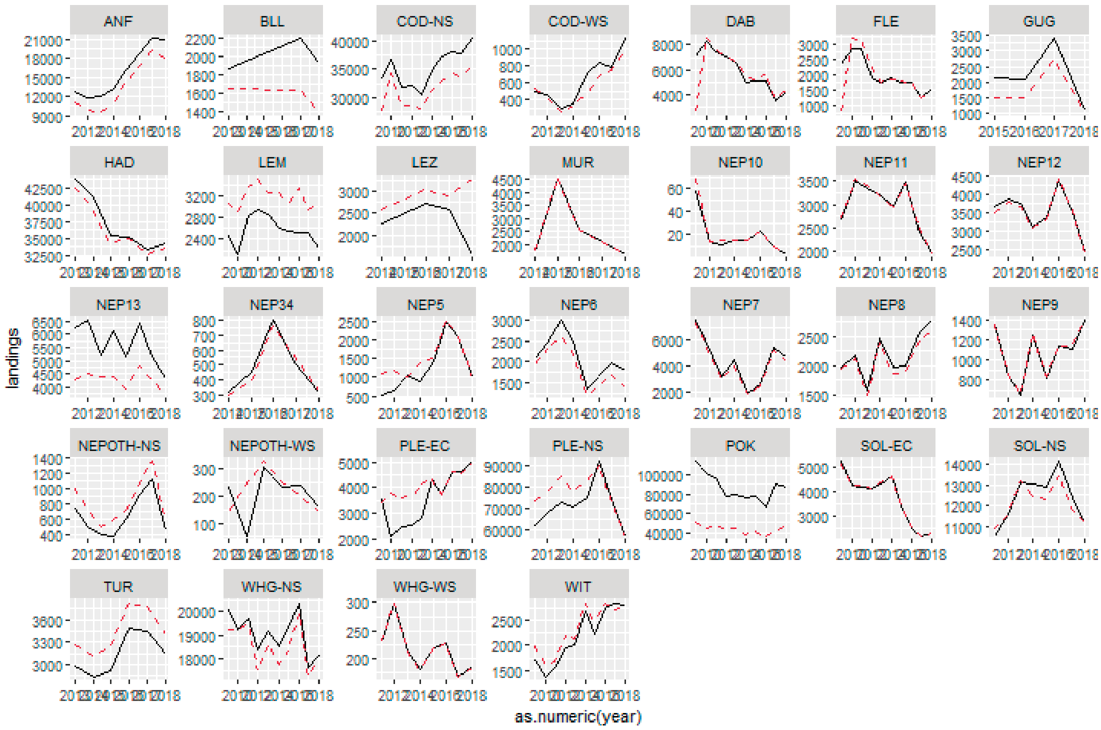


Figure A2.1. Comparison of total landings from fleet data submitted to WGMIXFISH (red) and as reported to InterCatch (black) over time by stock.

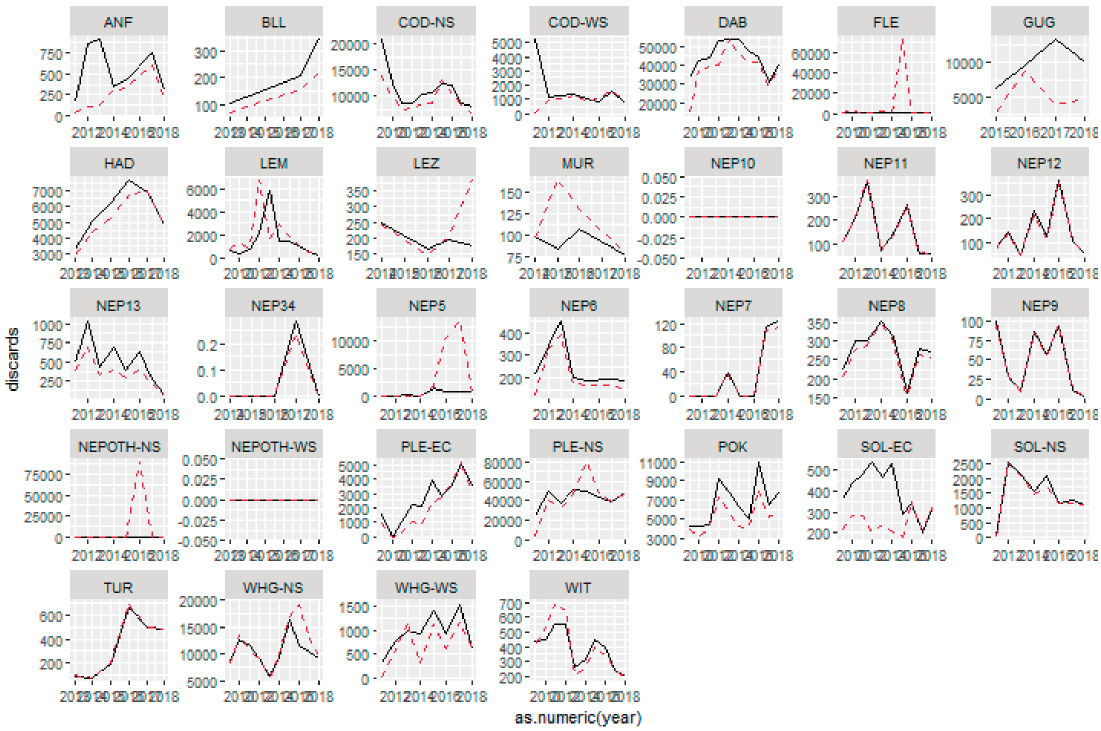


Figure A2.2. Comparison of total discards from fleet data submitted to WGMIXFISH (red) and as reported to InterCatch (black) over time by stock.

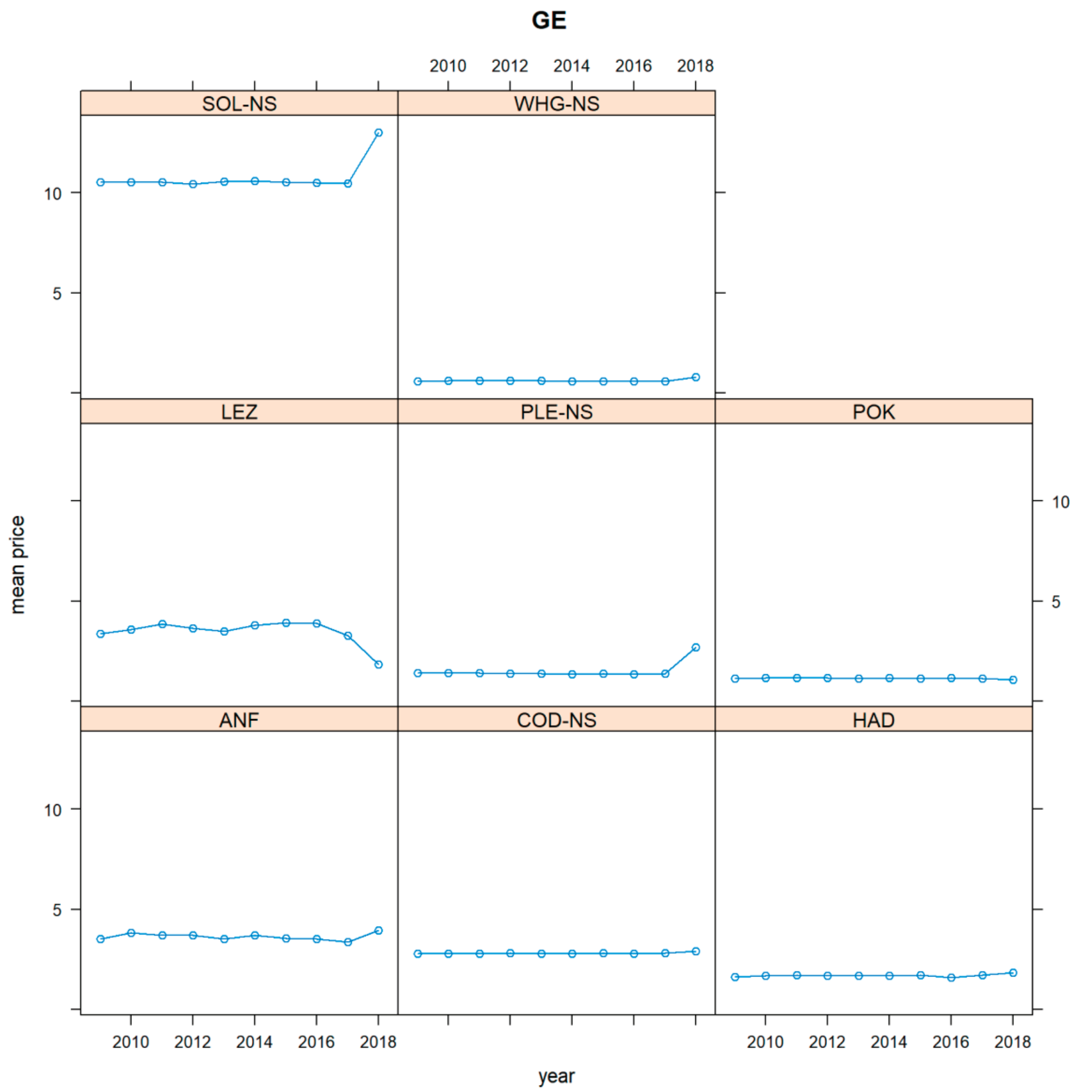


Figure A2.3. Mean sale price over time by stock for Germany

3. Forecasts

3.1 Baseline run set up (Reproduce the advice)

The baseline run reproduces the advice and ensures that the FLStock objects and ctrl objects for the forecasts are set up correctly. All data and forecast settings used are as detailed in the ICES advice published after the autumn reopening process.

For the demersal stocks with full analytical assessments the forecast settings detailed in the ICES advice are followed as closely as is possible given the wide range of software used for the single stock advice versus the unified framework used by WGMIXFISH.

Both Anglerfish and Eastern Channel sole were set up with a constant abundance in the intermediate and TAC years (equal to biomass estimate in 2018 for sole and the 2019 biomass estimate for anglerfish coming from the anglerfish surveys). A catch was then applied (and thus an implicit harvest ratio) in the intermediate and TAC years. ICES advice for Megrim is expressed in relative terms for which the reference values (Fmsy and Bmsy) are calculated within a surplus production model. This calculation could not be replicated here and so WGMIXFISH used the ratio between the 3 year average catch and the advised catch for 2020 as an harvest rate multiplier. For all 3 stocks adjustments needed to follow the single species advice for these stocks were applied to the 3 year (2016-2018) average harvest rate.

The UWTV survey abundance estimate is used for in the intermediate year and TAC year for *Nephrops* stocks with a UWTV survey assessment that were reopened in the autumn. Otherwise the abundance estimate used in the original June advice is used. The total TAC for *Nephrops* is split amongst the FUs (North Sea and West of Scotland are treated separately) and used to set the catch in the intermediate year from which a HR is calculated. The harvest rate in the TAC year is set at the Fmsy harvest rate for the stock and this is used to get the catch in the TAC year by reproducing the same calculation used to produce the advice. The catch in the TAC year for *Nephrops* stock that do not have a UWTV survey assessment is set to the advised catch.

3.2 Mixed fisheries run

3.2.1. Standard run

As a first step the mixed fisheries projections run were the 5 standard scenarios – max, min, cod-ns, sq_E and val. The standard procedure is to use status quo effort (F_{2018}) in the intermediate year for the projections. However, this resulted in unrealistically high catches (49 970 tonnes versus 35 358 tonnes in advice) in North Sea cod for the intermediate year which in turn reduced SSB to a level so low that a 0 TAC is set for the TAC year to recover SSB to 107 000 in subsequent year (TAC year+1). Therefore, an adjustment was made to replicate the TAC constraint used in the single stock advice for North Sea cod by reducing the effort for only the fleets that catch North Sea cod by the ratio of F_{2018} to F_{2019} as detailed in the ICES advice. The resulting catch for North Sea cod in the intermediate year were more realistic (38950 tonnes) and were comparable to the assumed catch in the ICES advice. The “status quo effort” scenario uses effort from 2018 in the TAC year (no adjustments made).

Both West of Scotland cod and whiting were removed as target stocks from the max and min scenarios. This prevents unrealistic results occurring where fleets are prevented from fishing because of the 0 TAC advice whereas in reality they are caught as bycatch of the target stocks. Turbot (new for this year) was also added to the list of bycatch stocks and was not considered as a target stock for these scenarios.

3.2.2. Special request scenarios

The three scenarios requested were:

- Scenario 1: that the other target stocks are set at the lowest MSY point in their lower range
- Scenario 2: that the other target stocks are set at the medium point between their lower range and the MSY point figure
- Scenario 3: that the other target stocks are set at their MSY point figure.

The request also specified that for data poor stocks of category 5 or 6, where only precautionary advice is available, ICES is requested to assume that these other target stocks are set in line with that advice.

The F_{MSY} values used in the TAC year were changed in each scenario for only those target stocks which affect West of Scotland cod and whiting and which had F_{MSY} ranges (haddock, saithe, FU11-13). The values are detailed in Table A2.2.

Table A2.2. F_{MSY} ranges for stocks in division 6.a

Stock	F_{MSY}	$F_{MSY\ lower}$	$F_{MSY\ higher}$	Lower range mid point
HAD	0.194	0.167	0.194	0.181
POK	0.363	0.21	0.536	0.29
COD-WS	0.29	NA	NA	NA
WHG-WS	0.18	NA	NA	NA
ANF	NA	NA	NA	NA
LEZ	NA	NA	NA	NA
NEP11	0.108	0.084	0.108	0.096
NEP12	0.117	0.093	0.117	0.105
NEP13*	0.148	0.098	0.148	0.123
NEPOTH-WS	NA	NA	NA	NA

*Combined values for FU13 are derived from weighted mean (using corresponding advised catch) of the F_{MSY} values reported for Firth of Clyde and Sound of Jura

4. Results

4.3. Baseline (Reproduce the advice)

There are often discrepancies between the ICES advice and the baseline results arising from differences in software used. The degree of agreement in the results is shown in Figures A2.4-6. A detailed discussion of these will be in the WGMIXFISH-ADVICE report (and also still need to be fully investigated) and so the focus here will be on the WoS stocks. Briefly, discrepancies arise from stochastic forecasting methods (SAM model, COD-NS) versus deterministic, difference derivation of intermediate year survivors arising from software differences (TSA – HAD, COD-WS, WHG-WS) and multi-fleet forecasting methods (MFDP – HAD, WHG-NS).

The comparison between the baseline results and the ICES advice for WHG-WS has been omitted. This is because the latest stock assessment results for WHG-WS have been used in the model setup but the advice is provided biennially and is therefore based on last year's assessment results. The decision to use the latest stock assessment results was made on the basis of having the most up to date perception

of the stock. However, because the advice produce last year would be based on a different assessment result the baseline results would not be directly comparable.

Reproduce the advice results:

- COD-WS - fine though need to clarify how mean weights are calculated as stf() did not get the same result as WG report
- WHG-WS – nothing to compare in 2019 and 2020 advice is 0 TAC.
- ANF – no issues reproducing the advice.
- LEZ – advice says that Fsq (average 2016-2018) is used but results would suggest that it is F2018.
- WoS NEP stocks – some minor differences (+/-2%).

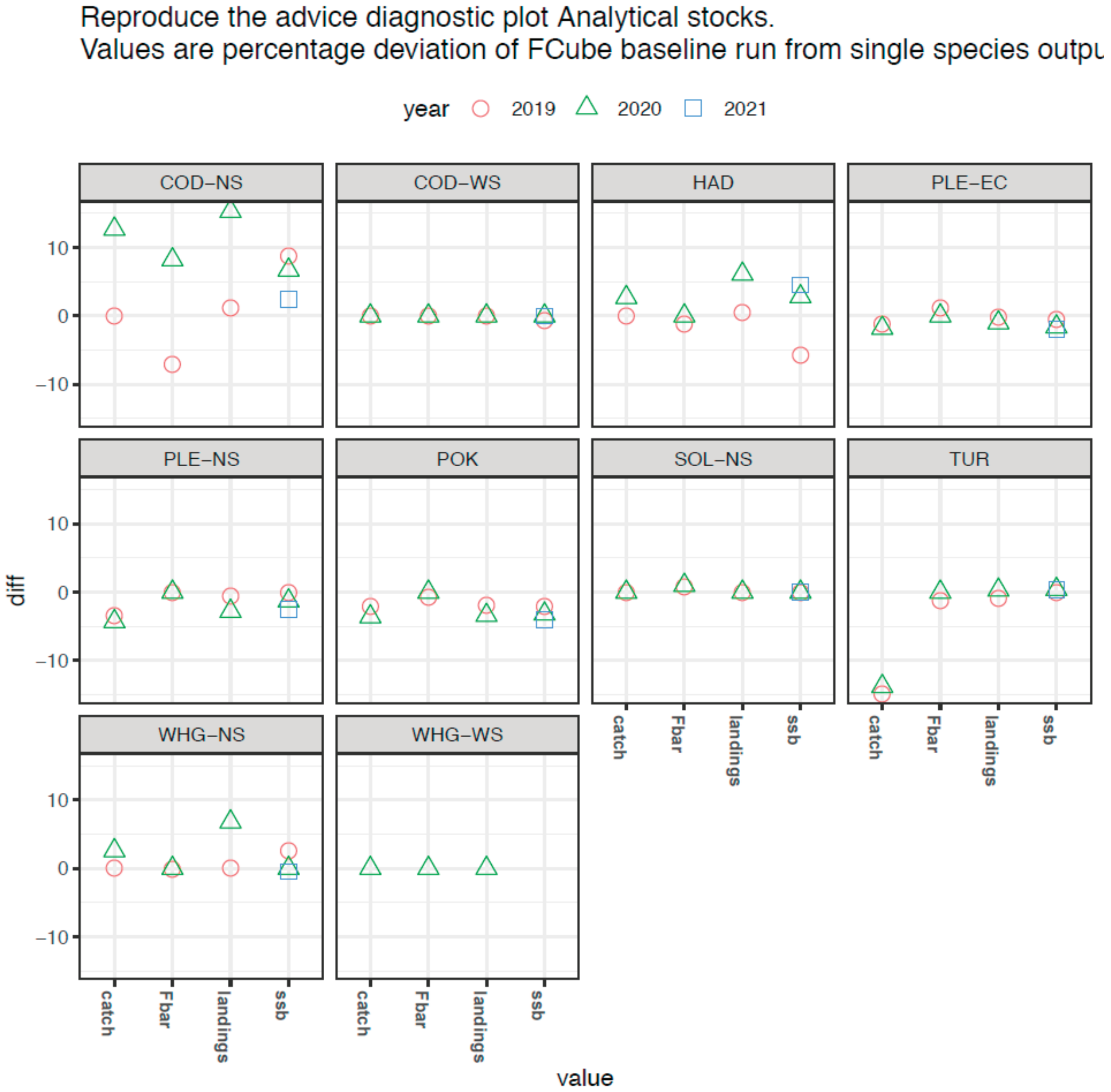


Figure A2.4. Percent difference in Baseline results and ICES advice by stock and year for the analytical demersal stocks.

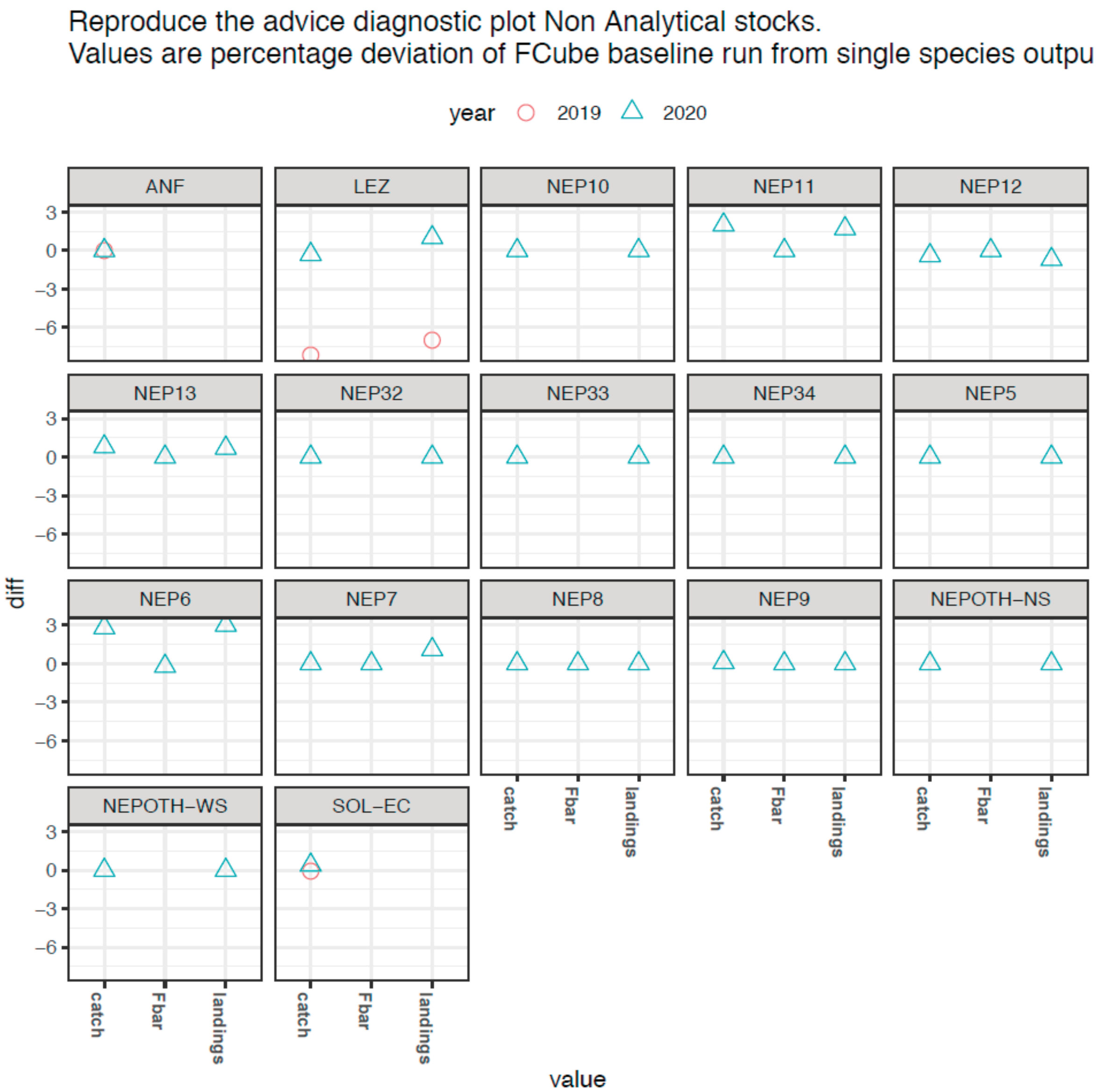


Figure A2.5. Percent difference in Baseline results and ICES advice by stock and year for the *Nephrops* stocks and non-analytical demersal stocks.

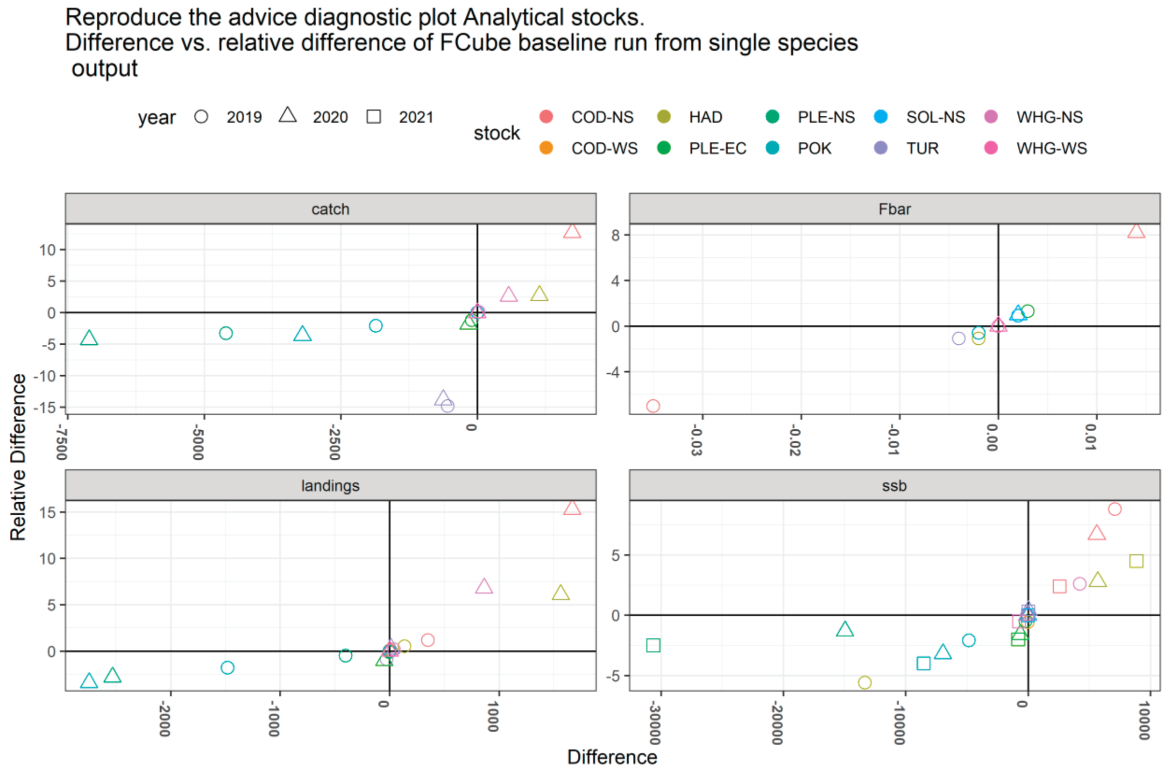


Figure A2.6. Absolute difference vs. relative difference between baseline results and ICES advice for the analytical demersal stocks

4.2. Mixed fisheries analyses

4.2.1. Standard run

The standard run results are presented below. North Sea cod is the most restrictive stock restricting the effort of 40 out of 44 fleets. The reduction in effort from 2018 to the min scenario in 2020 is 76%. Megrim is the least restrictive TAC followed by anglerfish. The effort in 2020 for the max scenario is 115% of effort in 2018.

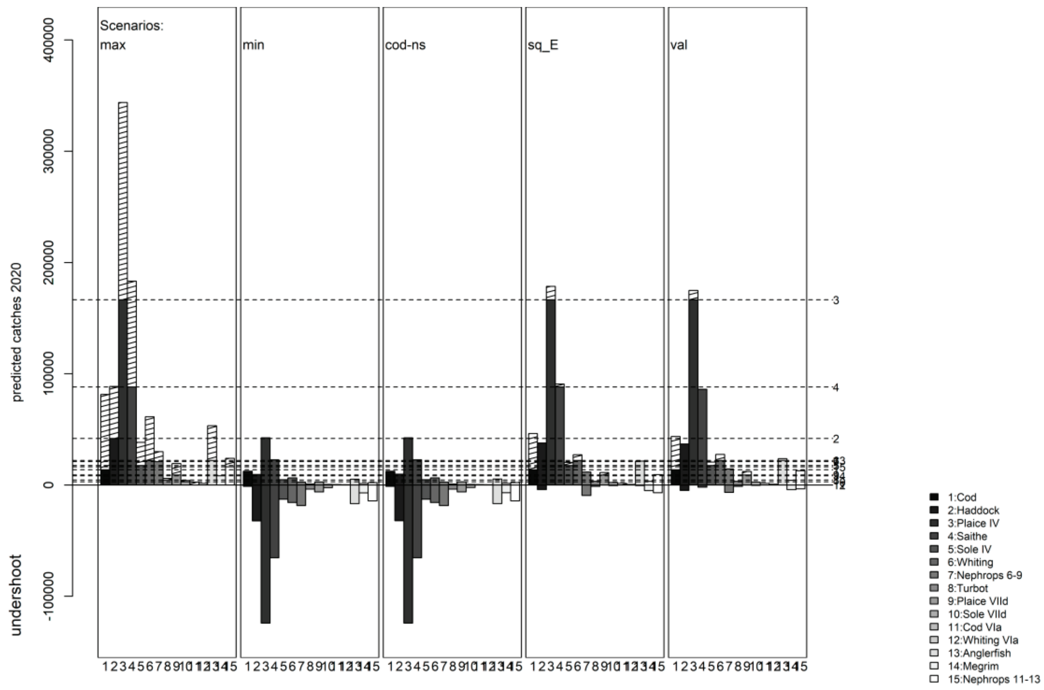


Figure A2.7. Main advice plot from standard mixed fisheries projections for all stocks showing predicted catches in 2020. Each box is a scenario, each bar is a stock. Hatched bars show TAC overshoot and shaded bars below the zero line show TAC undershoot.

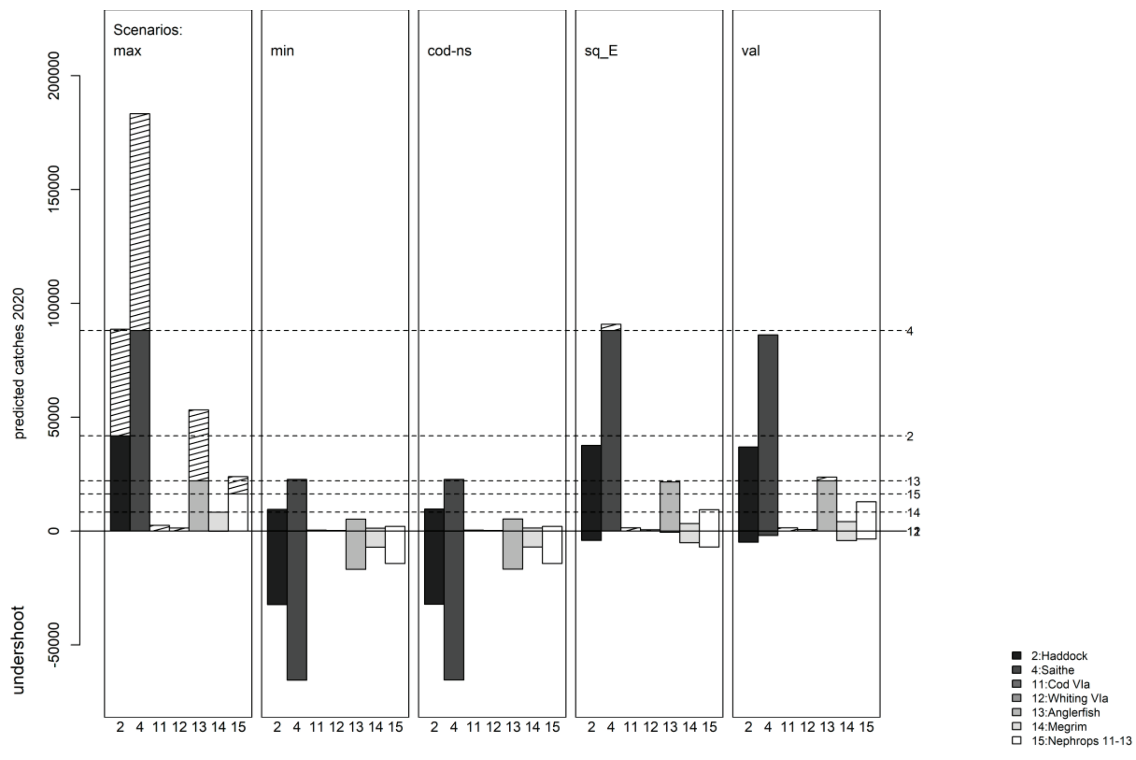


Figure A2.8. Advice plot from standard mixed fisheries projections for West of Scotland stocks showing predicted catches in 2020. Each box is a scenario, each bar is a stock. Hatched bars show TAC overshoot and shaded bars below the zero line show TAC undershoot.

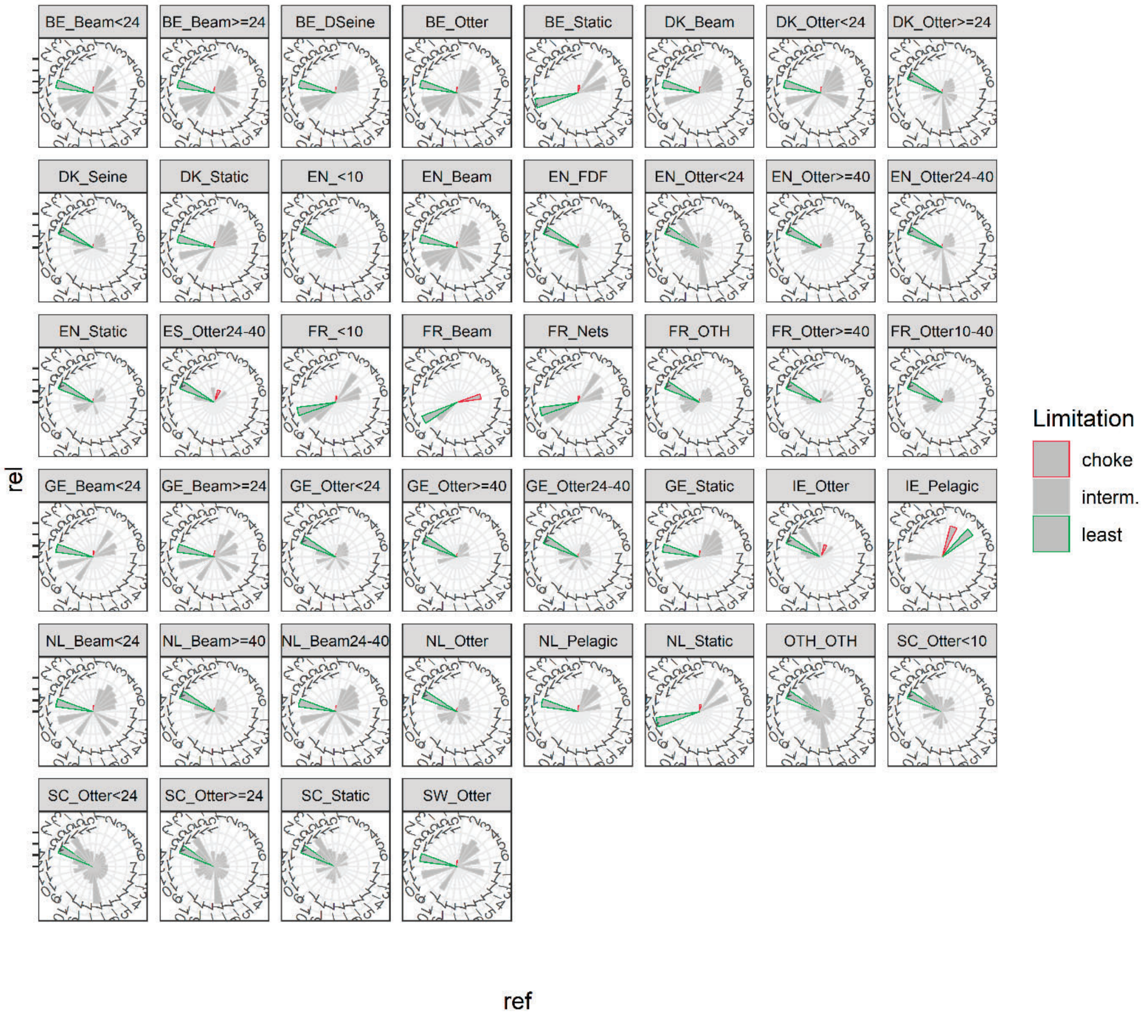


Figure A2.9. Rose plot to show most and least restrictive TAC. Numbers correspond to the stocks listed in Figure A2.6 with expanded numbering for the *Nephrops* stocks.

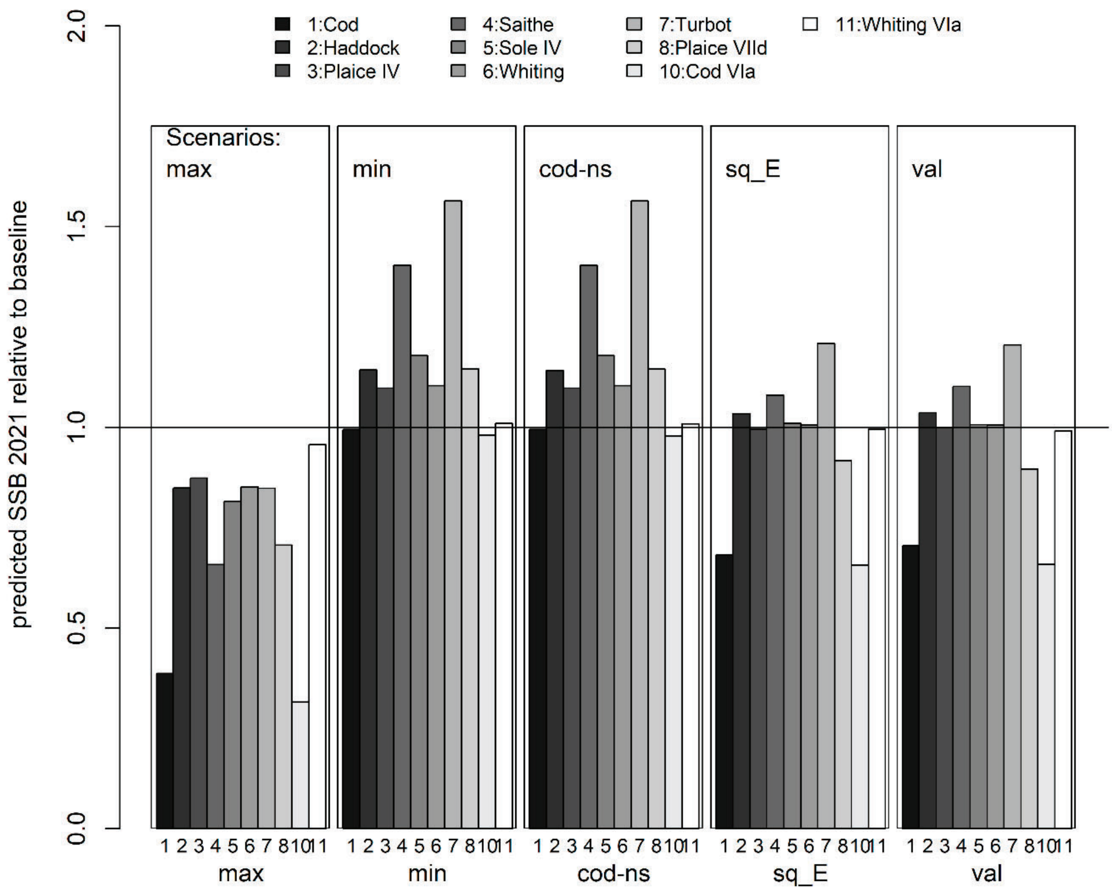


Figure A2.10. Predicted SSB in 2021 (TAC year plus 1) for the analytical demersal stocks for each scenario.

Table A2.3. Predicted SSB in 2021 (TAC year plus 1) for the analytical demersal stocks for each scenario.

	baseline	max	min	cod-ns	sq_E	val	Single-stock-advice
COD-NS	109569	42359	108950	108950	74658	77181	107000
COD-WS	3765	1186	3691	3683	2470	2478	3765
HAD	205740	174543	235025	234872	212650	213222	196886
PLE-EC	40265	28429	46118	46091	36923	36042	41084
PLE-NS	1206551	1053710	1323950	1323950	1201144	1204459	1237188
POK	204624	134630	287171	287147	220952	225434	213159

	baseline	max	min	cod-ns	sq_E	val	Single-stock-advice
SOL-NS	89527	73003	105504	105504	90452	90082	89527
TUR	7775	6592	12155	12155	9397	9370	7753
WHG-NS	156231	133019	172422	172422	157133	157014	156981
WHG-WS	23783	22750	24015	23982	23660	23568	NA

Table A2.4. Predicted catches in 2020 (TAC year) for the all stocks for each scenario.

	baseline	cod-ns	max	min	sq_E	val	Single-stock-advice
COD-NS	12548	12411	81456	12411	46239	43663	13686
HAD	27192	9727	88655	9539	37688	36954	41818
PLE-EC	4648	2837	19364	2812	11225	12051	9073
PLE-NS	86684	42404	343788	42404	178619	174926	166499
POK	77931	22696	183288	22671	90851	86179	88093
SOL-EC	2552	539	4127	532	2314	2559	2846
SOL-NS	15117	4802	38326	4802	20281	20663	17545
WHG-NS	13600	6387	61364	6387	27279	27443	22082
TUR	3914	834	5964	834	3345	3369	4538
NEP5	1074	137	1586	137	622	763	1637
NEP6	2200	572	6642	572	2607	2704	2384
NEP7	13930	1187	13785	1187	5408	6847	14263
NEP8	2866	526	6105	526	2395	3099	3143
NEP9	1271	292	3391	292	1330	1748	1307
NEP10	46	6	68	6	27	33	48
NEP32	389	49	574	49	225	276	397
NEP33	898	114	1326	114	520	638	898
NEP34	552	70	815	70	320	392	590
NEPOTH-NS	376	48	555	48	218	267	376
COD-WS	0	434	2557	428	1441	1434	0

	baseline	cod-ns	max	min	sq_E	val	Single-stock-advice
WHG-WS	0	299	1378	270	580	662	0
ANF	21346	5350	53236	5247	21572	23695	22056
LEZ	7762	1396	8328	1282	3267	4156	8350
NEP11	3274	443	5141	443	2017	2854	3347
NEP12	6814	681	7521	675	2951	4253	7134
NEP13	5597	973	11299	973	4433	5784	5861
NEPOTH-WS	261	35	399	35	156	215	261

4.2.2. Special request scenarios

The scenarios in the special request only affect the "max" and "min" scenarios through changes in the target F in the TAC year. The predicted levels of catch are presented below for the "min" scenario under the 3 special request scenarios alongside a selection of other scenarios for comparison. Only WoS stocks were changed so all other stocks have the same results as the standard "min" run.

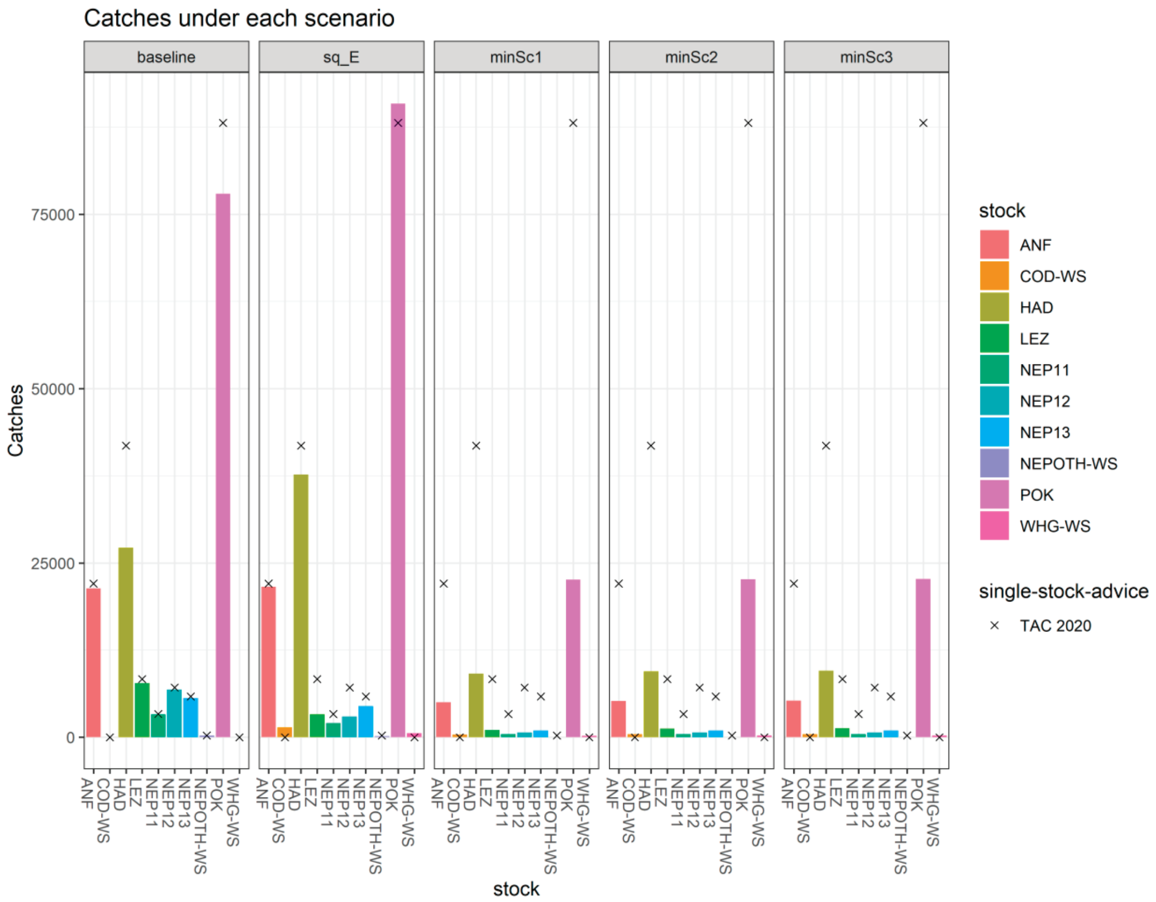


Figure A2.11. Predicted catches in 2020 for the "min" scenario under each special request scenario (min Sc1, min Sc2, min Sc3) compared to the baseline run, status quo effort scenario (sq_E). Black crosses mark the ICES advice TAC for 2020.

Table A2.5. Predicted catches in 2020 for the "min" scenario under each special request scenario (min Sc1, min Sc2, min Sc3) compared to the baseline run, status quo effort scenario (sq_E) and single stock advice.

	baseline	Single-stock-advice	sq_E	min Sc1	min Sc2	min Sc3
HAD	27192	41818	37688	9135	9457	9539
POK	77931	88093	90851	22617	22659	22671
SOL-EC	2552	2846	2314	532	532	532
COD-WS	0	0	1441	413	424	428
WHG-WS	0	0	580	210	258	270
ANF	21346	22056	21572	5027	5202	5247
LEZ	7762	8350	3267	1040	1233	1282
NEP11	3274	3347	2017	443	443	443
NEP12	6814	7134	2951	663	673	675
NEP13	5597	5861	4433	973	973	973
NEPOTH-WS	261	261	156	35	35	35

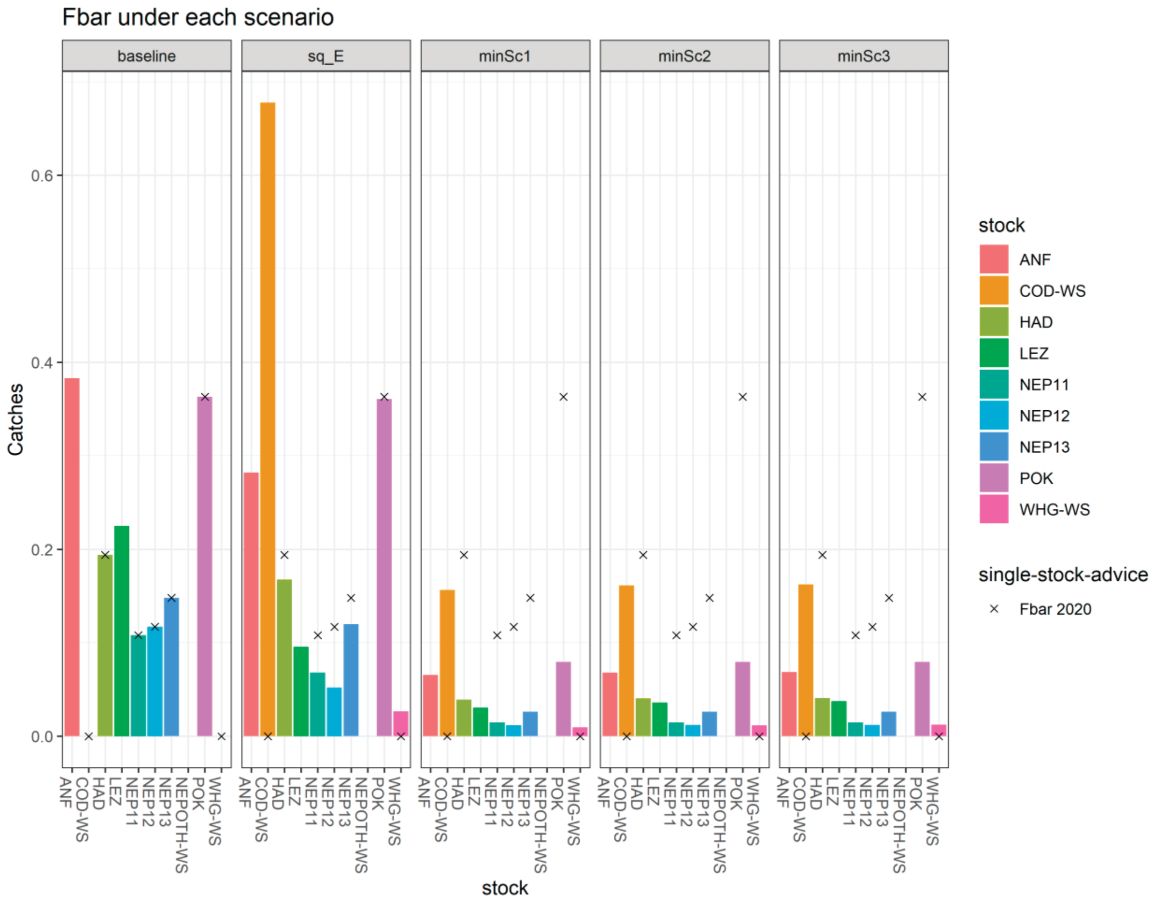


Figure A2.12. Fbar in 2020 for the "min" scenario under each special request scenario (min Sc1, min Sc2, min Sc3) compared to the baseline run, status quo effort scenario (sq_E). Black crosses mark the ICES advice Fbar for 2020.

Table A2.5. Fbar in 2020 for the "min" scenario under each special request scenario (min Sc1, min Sc2, min Sc3) compared to the baseline run, status quo effort scenario (sq_E) and single stock advice.

	baseline	Single-stock-advice	sq_E	min Sc1	min Sc2	min Sc3
COD-WS	0.00	0	0.68	0.156	0.161	0.162
WHG-WS	0.00	0	0.03	0.0096	0.0118	0.0124
HAD	0.194	0	0.167	0.04	0.04	0.04
POK	0.36	0.36	0.36	0.08	0.08	0.08
ANF	0.38	NA	0.28	0.07	0.07	0.07
LEZ	0.23	NA	0.096	0.03	0.04	0.04
NEP11	0.108	0.108	0.07	0.0149	0.0149	0.0149
NEP12	0.117	0.117	0.05	0.0117	0.0118	0.0119

NEP13	0.148	0.148	0.120	0.03	0.03	0.03

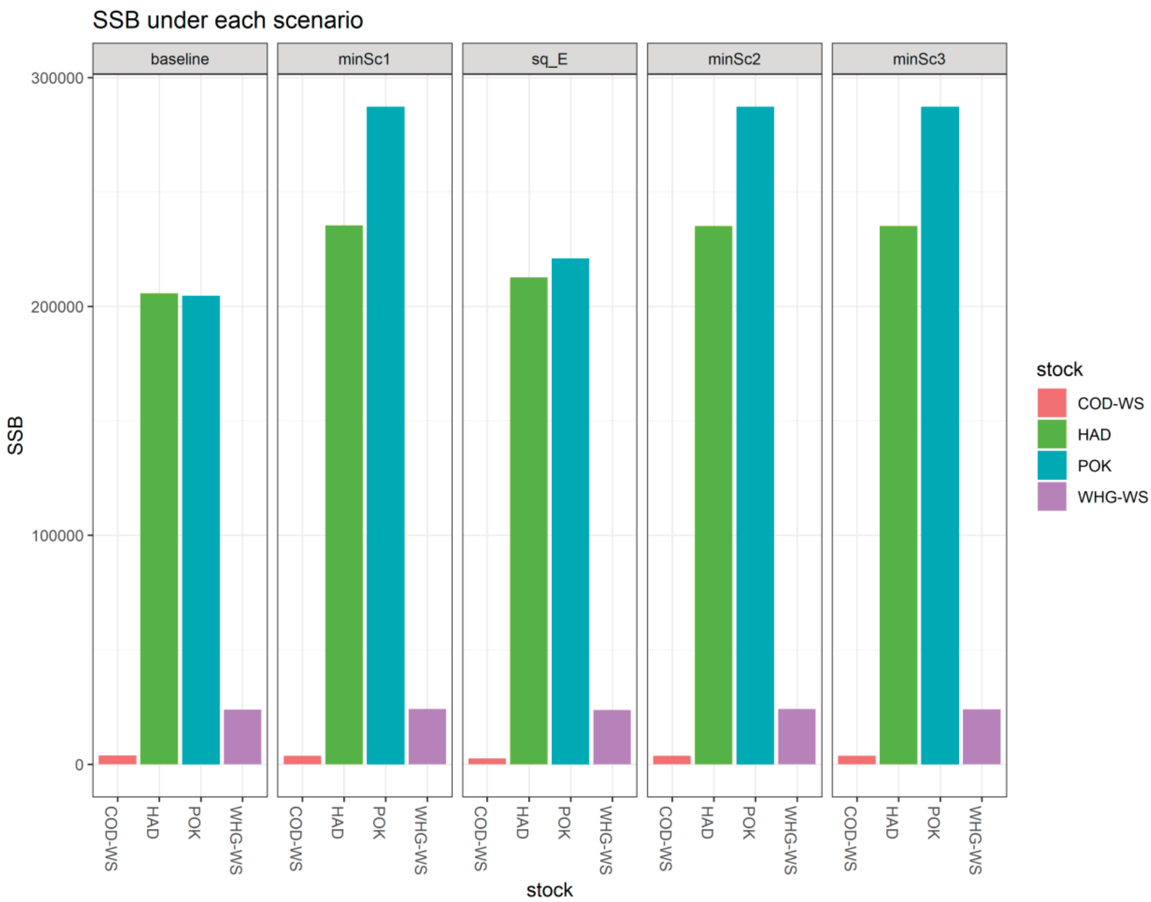


Figure A2.13. SSB in 2021 for the “min” scenario under each special request scenario (min Sc1, min Sc2, min Sc3) compared to the baseline run, status quo effort scenario (sq_E).

Table A2.5. SSB in 2021 for the “min” scenario under each special request scenario (min Sc1, min Sc2, min Sc3) compared to the baseline run, status quo effort scenario (sq_E) and single stock advice.

2021	baseline	Single-stock-advice	sq_E	min Sc1	min Sc2	min Sc3
COD-WS	3765	3765	2470	3709	3695	3691
WHG-WS	23783		23660	24085	24029	24015
HAD	205740	196886	212650	235353	235092	235025
POK	204624	213159	220952	287223	287182	287171

Annex 3: TAF outputs from data call

This annex provides an example of the newly implemented data quality checks implemented for one data submission. These extensive checks compare data submission to InterCatch with those submitted to WGMIXFISH accessions.

ICES WGMIXFISH data call quality check report for IE

22 July, 2020

Effort data

The tables and plots in this section summarise the effort data.

Use these tables and plots to check:

- Consistency of country code used over time
- Ideally, only one code should be used per country
- Number of records submitted over time
- Are these similar year-to-year or are they changing? Is there a good reason for this or has some data been missed or duplicated?
- Consistency of vessel lengths over time
- Are any codes similar enough to be grouped together? (e.g. “<10” and “<10m”)
- Consistency of metier codes over time and with ecoregion (i.e. North Sea, Celtic Sea etc.)
- Do the metier codes used make sense and are they consistent with the data call? Does the effort per metier over time make sense? Are these metiers consistent with the ecoregion?
- Consistency of area codes over time and with ecoregion
- Do the area codes used make sense? and are they consistent with the data call? Does the effort per area over time make sense? Are these areas consistent with the ecoregion? Are they at the requested level of aggregation (ICES division)?

Please pay particular attention to the latest submission and check it makes sense in the context of the time series.

Please address any issues in the latest submission before submitting to WGMIXFISH. Table 1: Effort: Number of records submitted by country code

	CelticSea	IberianWaters	IrishSea	NorthSea
IE	3475	19	741	682

Table 2: Effort: Number of records submitted by year

	CelticSea	IberianWaters	IrishSea	NorthSea
2010	320	1	68	55
2011	316	0	78	55
2012	375	0	86	59
2013	347	0	78	68
2014	362	0	72	70
2015	355	0	69	66
2016	360	5	71	71
2017	343	6	70	76
2018	356	3	72	79
2019	341	4	77	83

Effort: There are 2 duplicate records (across all years and ecoregions)

Table 3: Effort: Number of records submitted by vessel length

	CelticSea	IberianWaters	IrishSea	NorthSea
>=40m	149	3	14	42
10<24m	1861	8	465	387
24<40m	1465	8	262	253

Celtic Sea

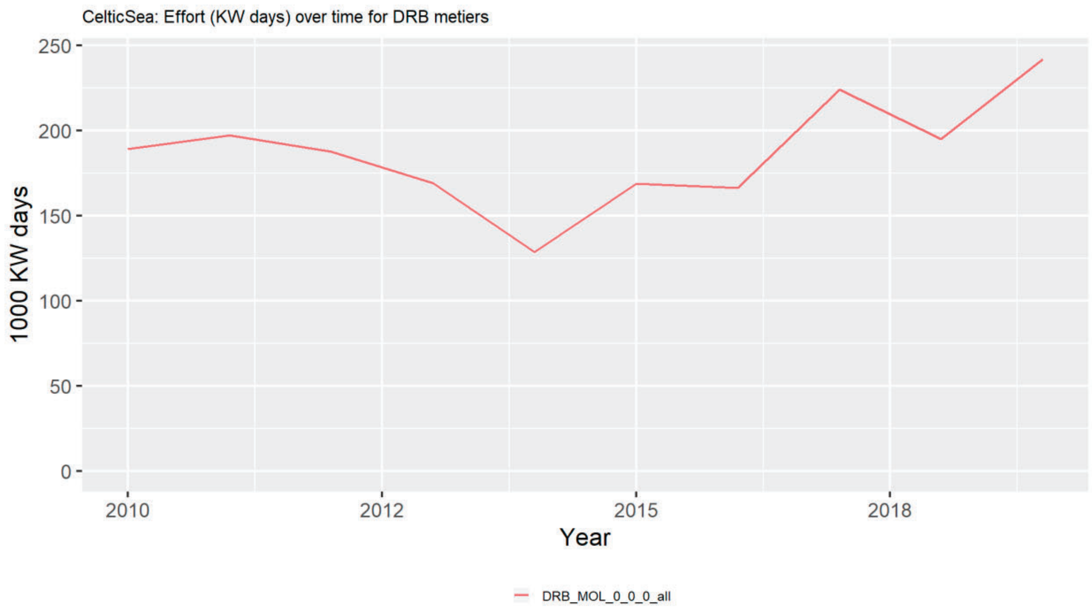
Table 4: Celtic Sea: Total effort by metiers by year (1000 kw days)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	189	197	188	169	129	169	167	224	195	242
FPO_CRU_0_0_0_all	377	316	299	296	279	244	311	275	308	299
GNS_DEF_>=220_0_0_all	22	18	13	6	7	2	0	5	1	4
GNS_DEF_120-219_0_0_all	582	502	574	530	581	554	622	615	592	632

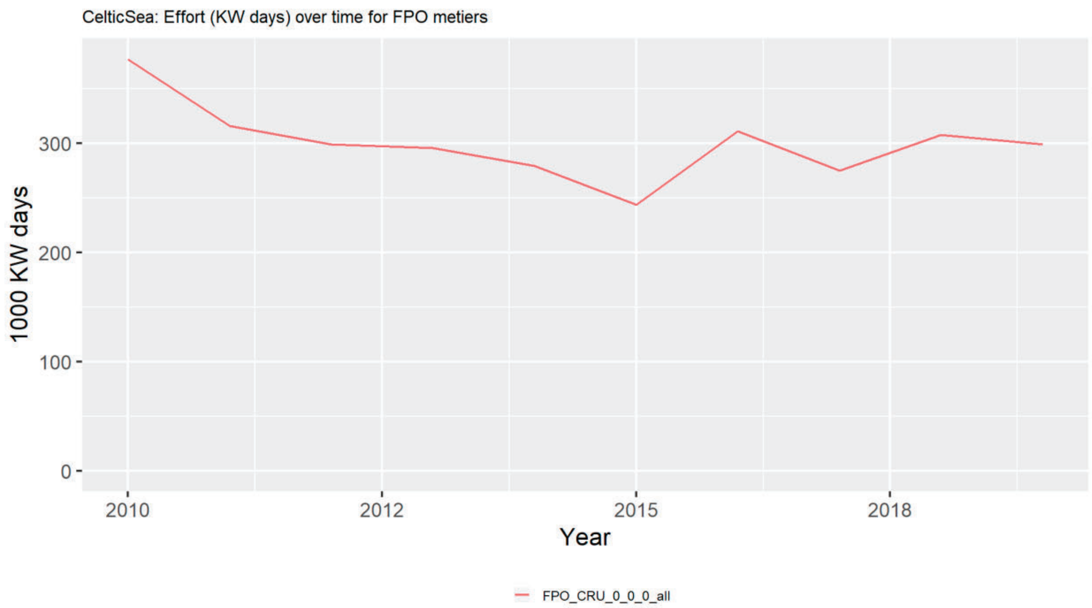
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
GTR_CRU_100-119_0_0_all	-	-	-	-	-	-	-	-	1	-
LLS_FIF_0_0_0_all	34	18	49	14	14	10	12	11	17	12
MIS_MIS_0_0_0_HC	-	1	17	17	13	2	2	-	0	0
OTB_CEP_0-0_0_0_all	-	-	-	-	-	-	-	1	1	2
OTB_CRU_100-119_0_0_all	450	361	532	334	884	1065	1082	841	1401	1787
OTB_CRU_70-99_0_0_all	2263	2168	2637	2798	2520	2500	3079	2919	2398	2175
OTB_DEF_>=120_0_0_all	-	-	-	-	-	-	-	-	-	2
OTB_DEF_100-119_0_0_all	3635	3556	3490	3643	3806	3496	3528	3645	3553	3488
OTB_DEF_70-99_0_0_all	1810	1669	1584	1577	1610	1833	1974	2037	1885	1238
OTB_DWS_100-119_0_0_all	-	-	-	-	-	-	0	-	-	0
OTM_SPF_16-31_0_0_all	-	-	-	-	-	-	-	-	0	-
PTM_LPF_100-119_0_0_all	318	399	1013	431	437	408	259	17	148	29
PTM_SPF_32-69_0_0_all	4003	1965	2841	3089	2881	2139	1940	1222	1235	1052
SSC_DEF_100-119_0_0_all	479	723	734	807	802	709	770	648	705	892
TBB_DEF_70-99_0_0_all	948	880	1086	1134	1025	1060	1161	1043	1122	1084

Table 5: Celtic Sea: Total effort by area by year (1000 kw days)

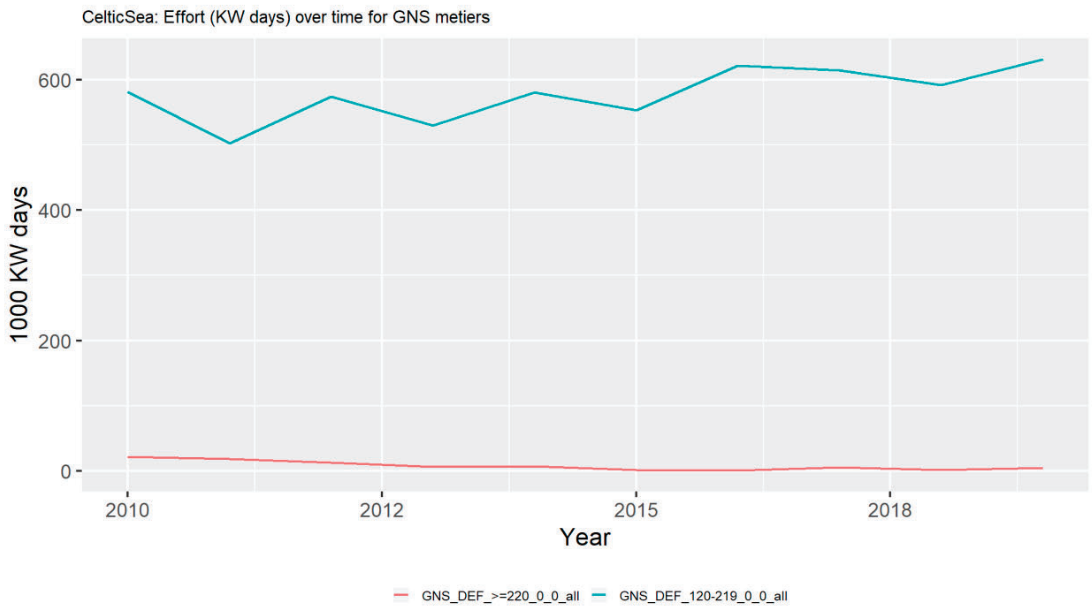
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
27.7.b	2364	1930	2269	2807	2594	1911	2051	1488	1530	1398
27.7.c	767	441	507	466	585	572	732	757	1122	720
27.7.e	53	23	13	18	4	30	32	303	388	183
27.7.f	28	84	14	16	11	16	34	27	31	11
27.7.g	5588	5393	6060	6053	6099	6338	7083	6511	5519	5571
27.7.h	651	562	627	744	1153	1009	896	734	806	1114
27.7.j	4645	2871	3911	3290	3014	2746	2406	2265	2480	2349
27.7.k	1013	1469	1655	1453	1527	1569	1675	1418	1688	1593

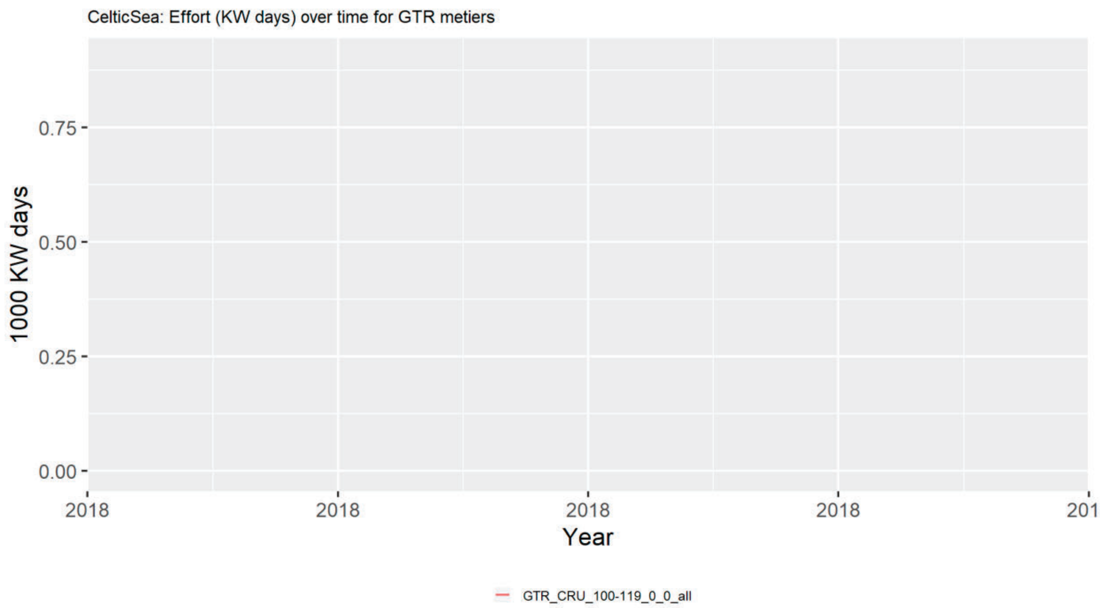


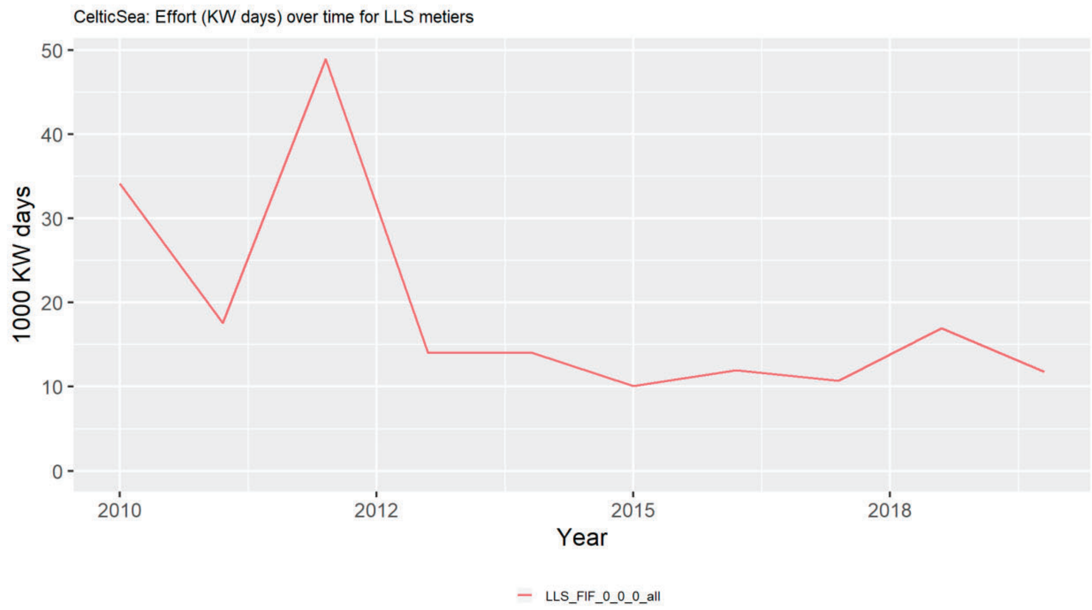
CelticSea: Effort (KW days) over time for DRB metiers
1000 KW days
250
200
150
100
50
0
2010
2012
2015
2018
Year
DRB_MOL_0_0_0_all

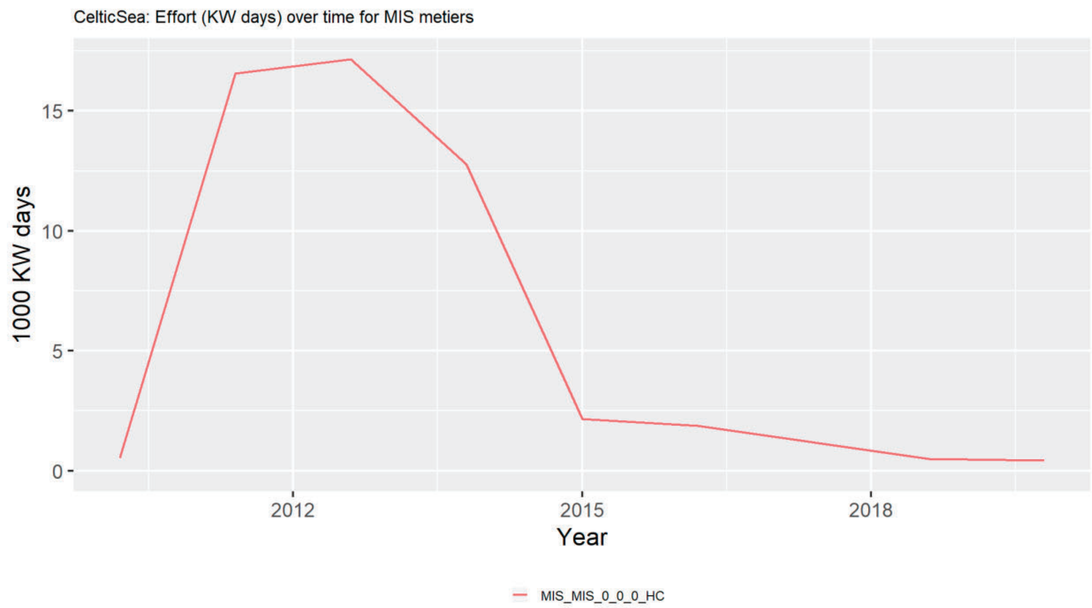


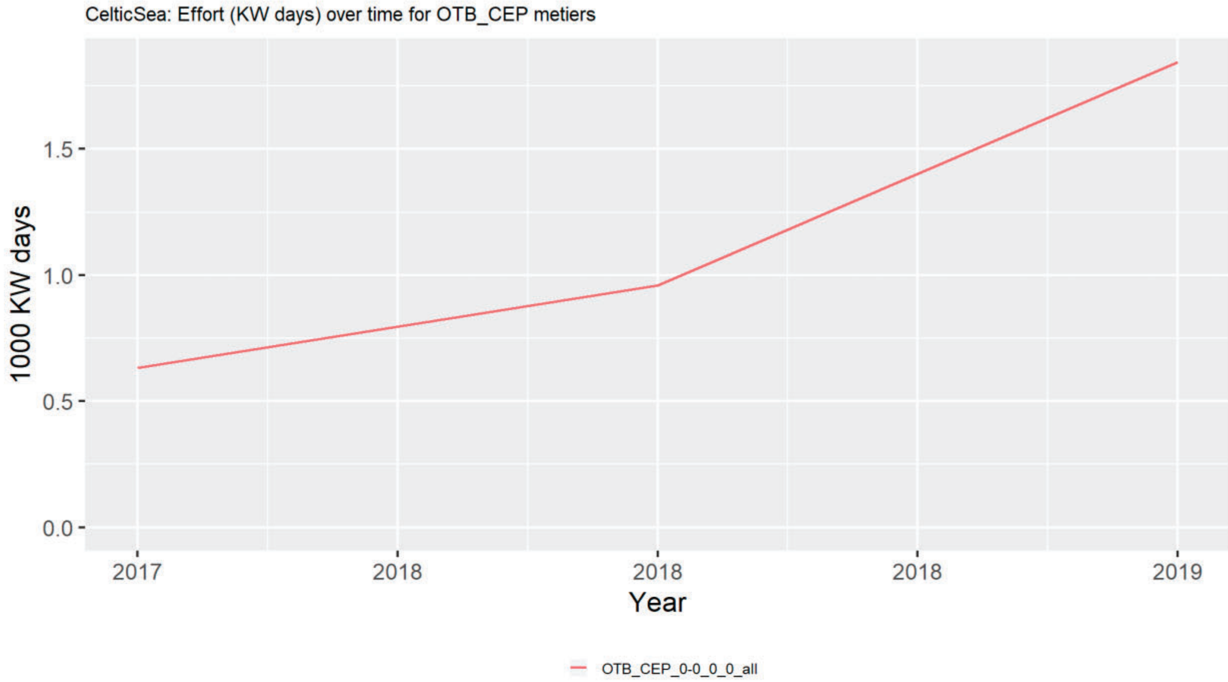
CelticSea: Effort (KW days) over time for FPO metiers
1000 KW days
300
200
100
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all

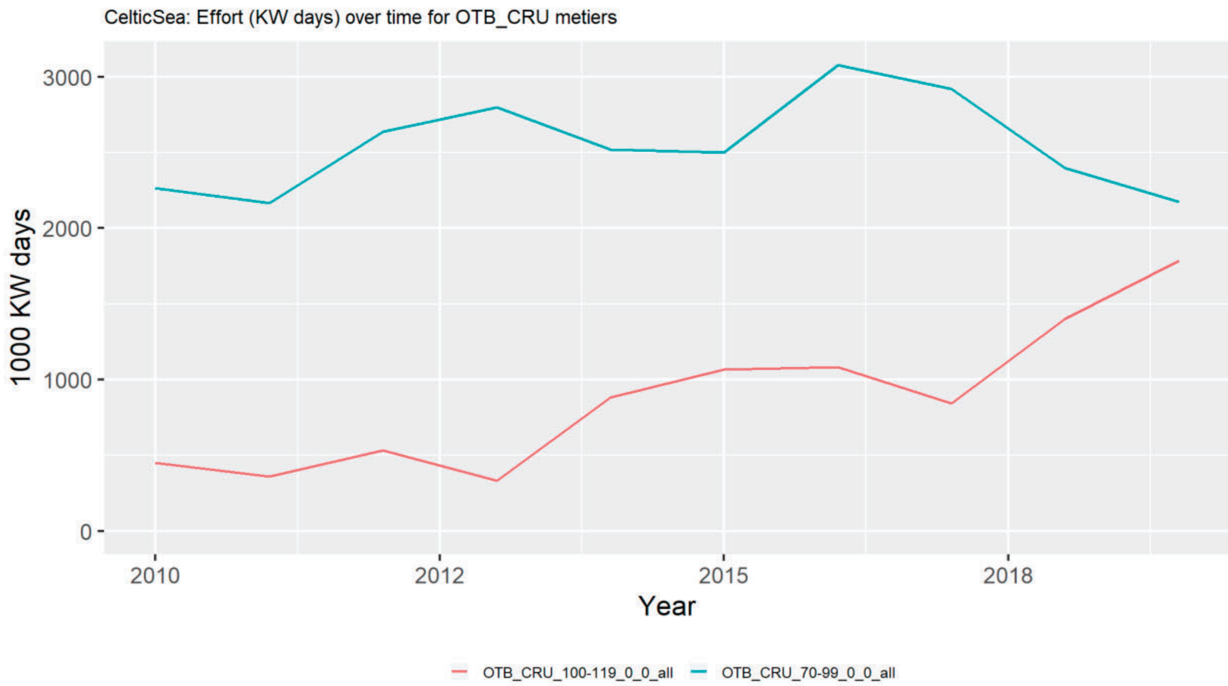

CelticSea: Effort (KW days) over time for GNS metiers
1000 KW days
600
400
200
0
2010
2012
2015
2018
Year
GNS_DEF_>=220_0_0_all
GNS_DEF_120-219_0_0_all

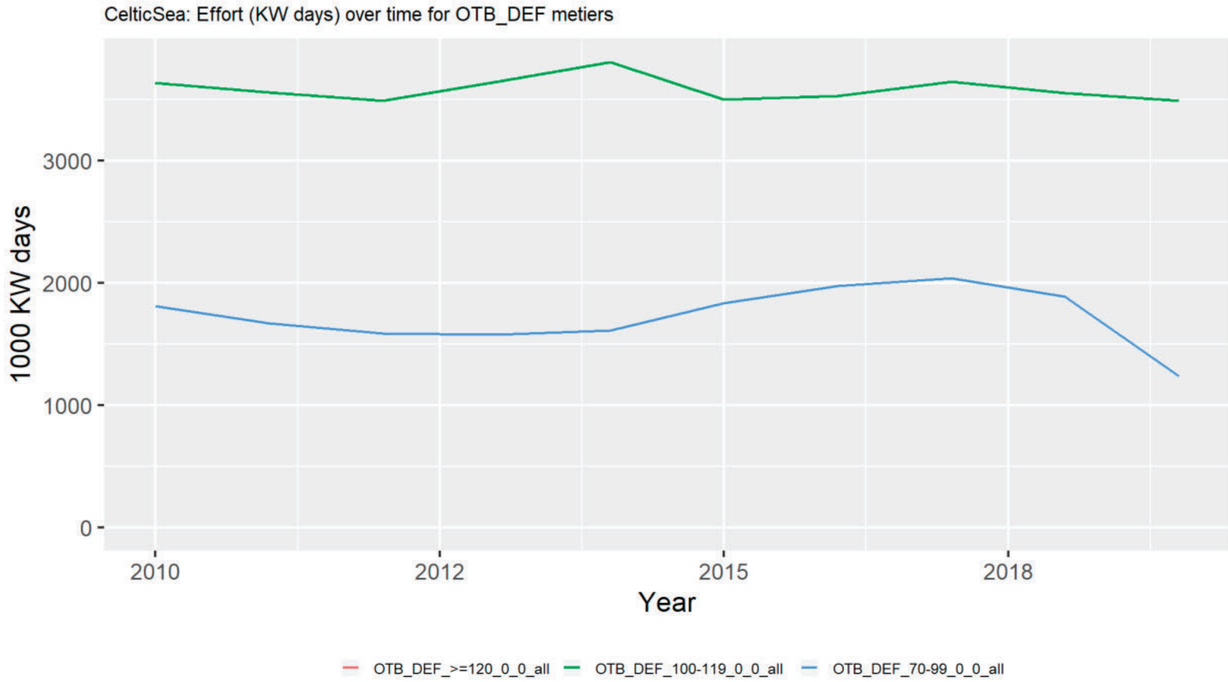

CelticSea: Effort (KW days) over time for GTR metiers
1000 KW days
0.75
0.50
0.25
0.00
2018
2018
2018
2018
201
Year
GTR_CRU_100-119_0_0_all

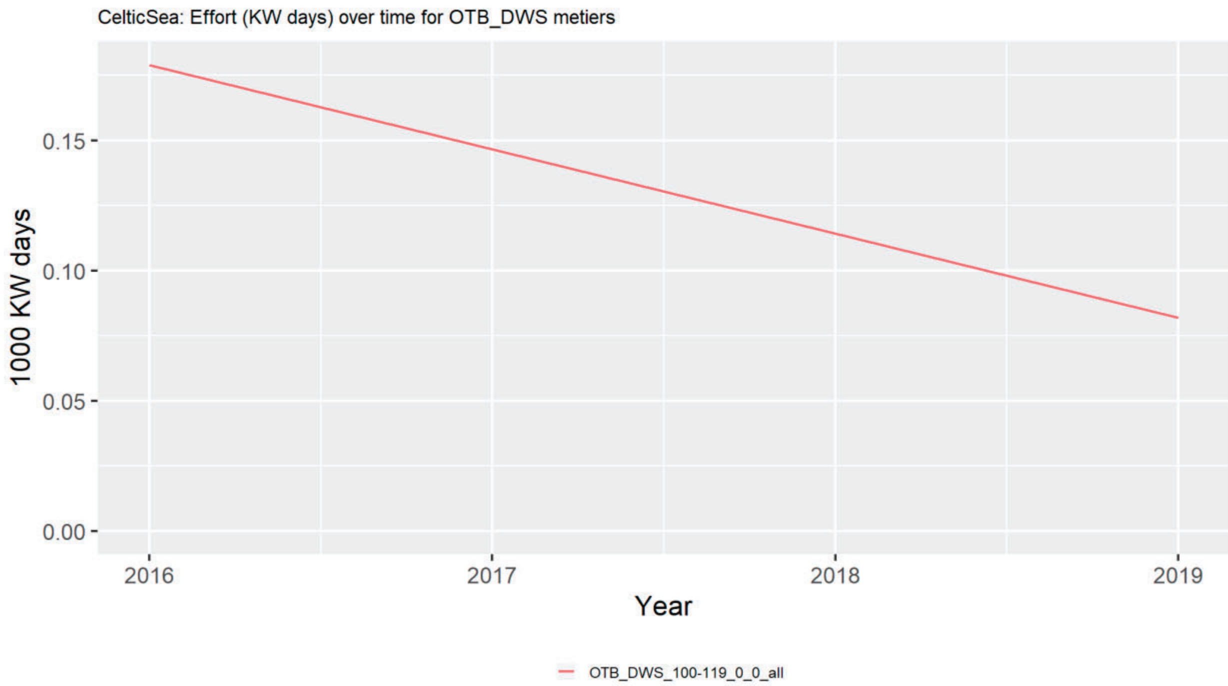

CelticSea: Effort (KW days) over time for LLS metiers
1000 KW days
50
40
30
20
10
0
2010
2012
2015
2018
Year
LLS_FIF_0_0_0_all

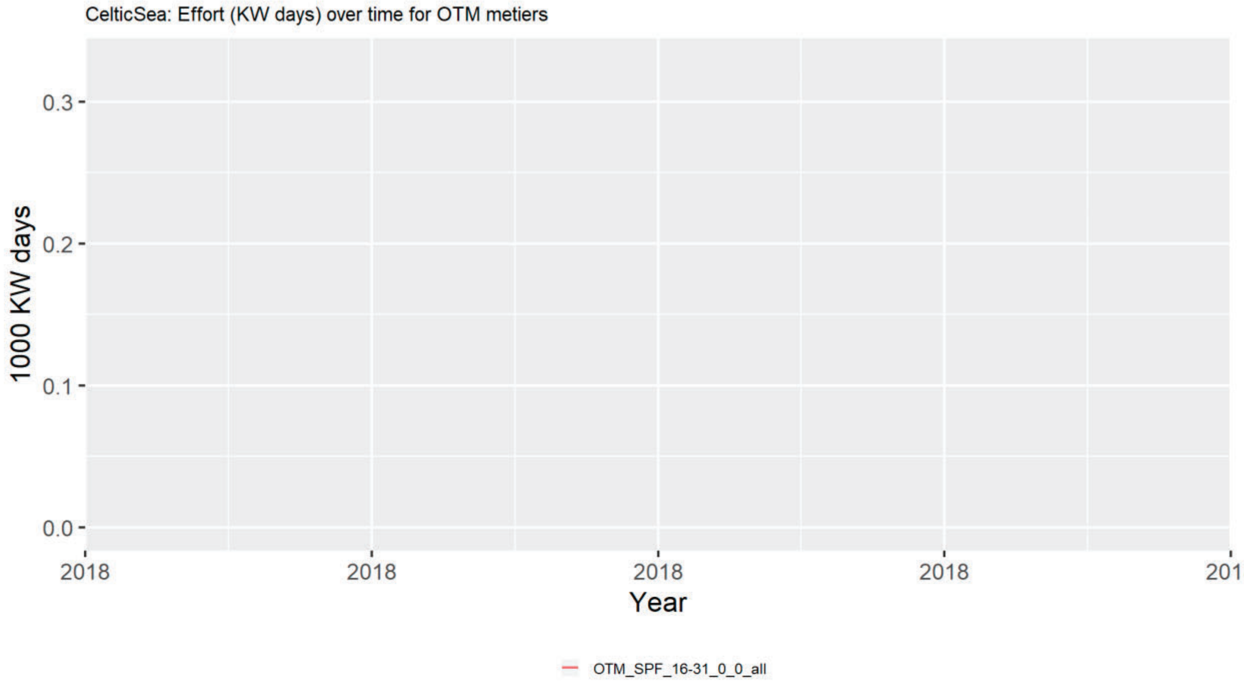

CelticSea: Effort (KW days) over time for MIS metiers
1000 KW days
15
10
5
0
2012
2015
2018
Year
MIS_MIS_0_0_0_HC

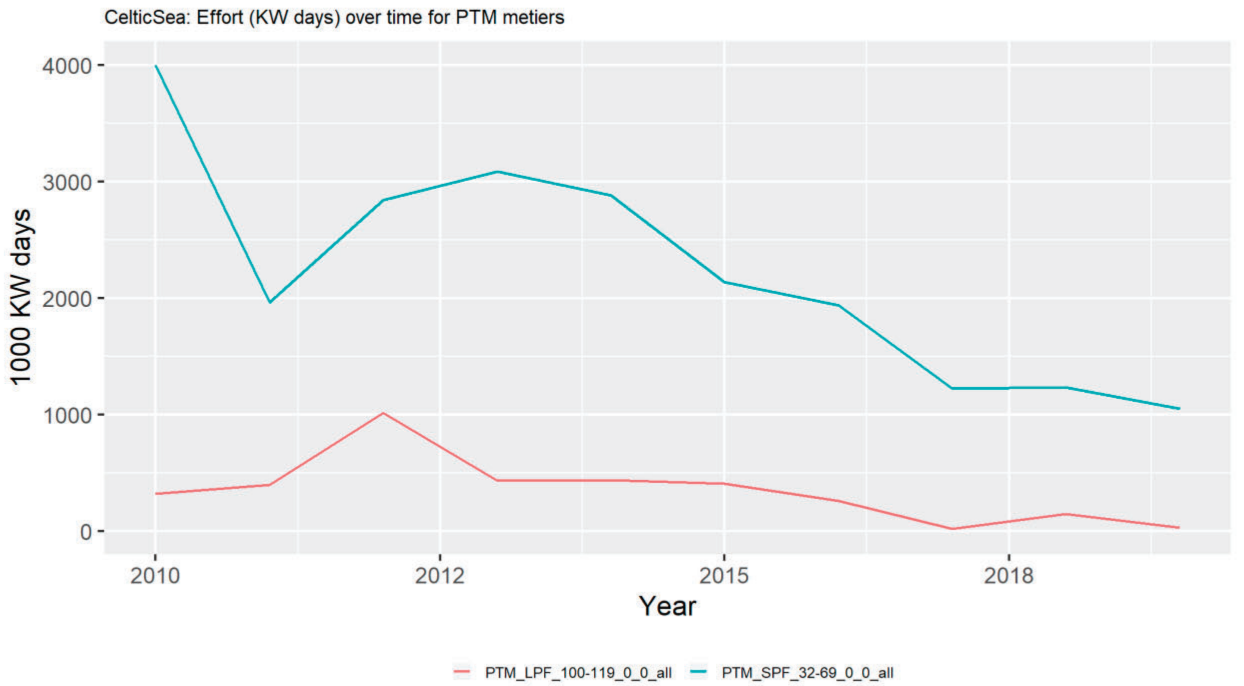

CelticSea: Effort (KW days) over time for OTB_CEP metiers
1000 KW days
0.0
0.5
1.0
1.5
2017
2018
2018
2018
2019
Year
OTB_CEP_0-0_0_0_all

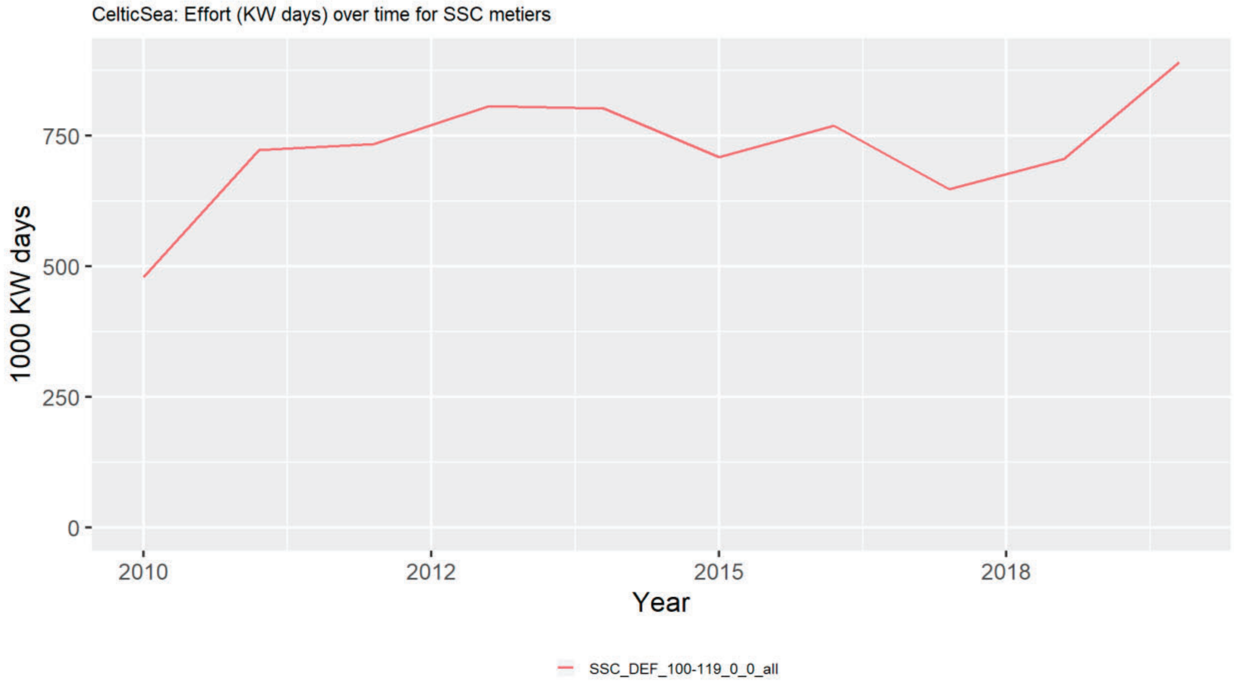

CelticSea: Effort (KW days) over time for OTB_CRU metiers
1000 KW days
0
1000
2000
3000
2010
2012
2015
2018
Year
OTB_CRU_100-119_0_0_all
OTB_CRU_70-99_0_0_all

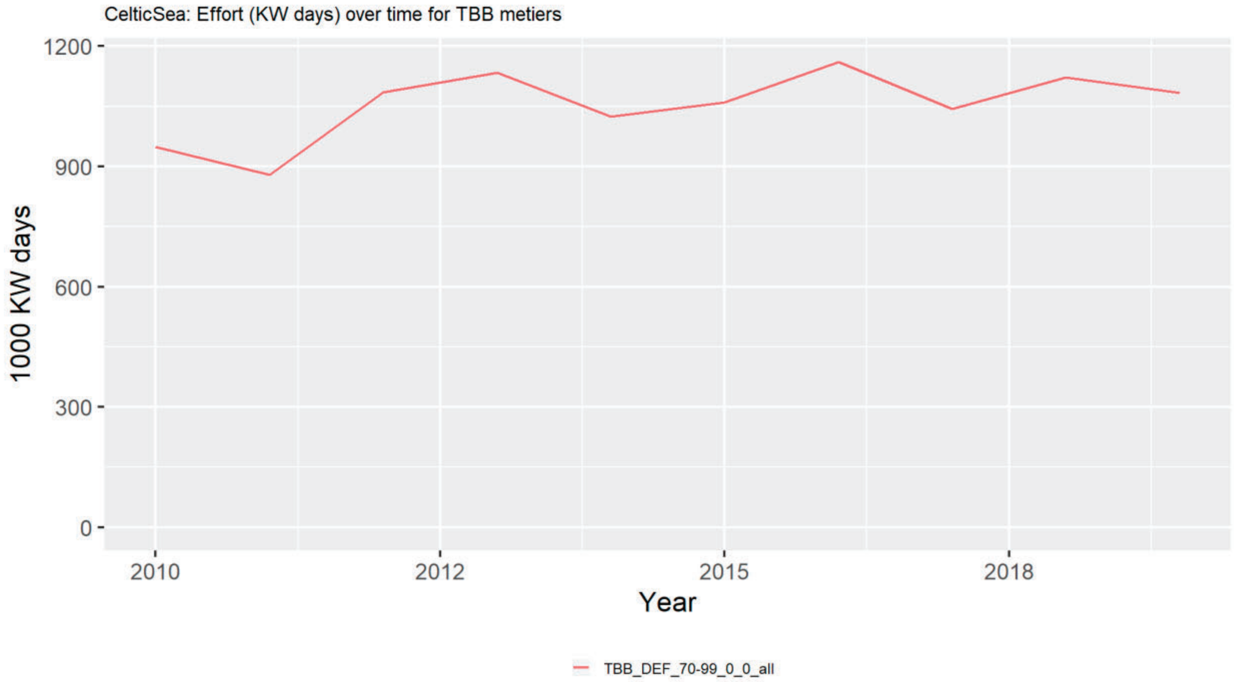

CelticSea: Effort (KW days) over time for OTB_DEF metiers
1000 KW days
3000
2000
1000
0
2010
2012
2015
2018
Year
OTB_DEF_>=120_0_0_all
OTB_DEF_100-119_0_0_all
OTB_DEF_70-99_0_0_all

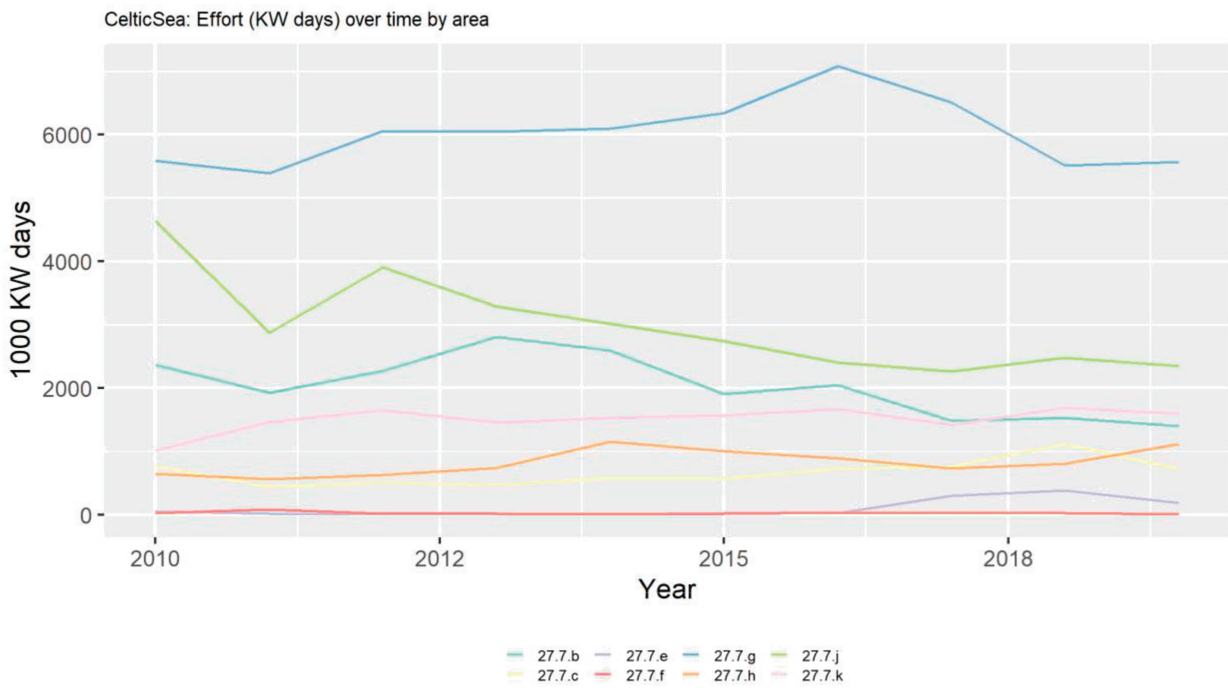

CelticSea: Effort (KW days) over time for OTB_DWS metiers
1000 KW days
0.15
0.10
0.05
0.00
2016
2017
2018
2019
Year
OTB_DWS_100-119_0_0_all


CelticSea: Effort (KW days) over time for OTM metiers
1000 KW days
0.3
0.2
0.1
0.0
2018
2018
2018
2018
201
Year
OTM_SPF_16-31_0_0_all


CelticSea: Effort (KW days) over time for PTM metiers
1000 KW days
4000
3000
2000
1000
0
2010
2012
2015
2018
Year
PTM_LPF_100-119_0_0_all
PTM_SPF_32-69_0_0_all


CelticSea: Effort (KW days) over time for SSC metiers
1000 KW days
750
500
250
0
2010
2012
2015
2018
Year
SSC_DEF_100-119_0_0_all


CelticSea: Effort (KW days) over time for TBB metiers
1200
900
600
300
0
1000 KW days
2010
2012
2015
2018
Year
TBB_DEF_70-99_0_0_all



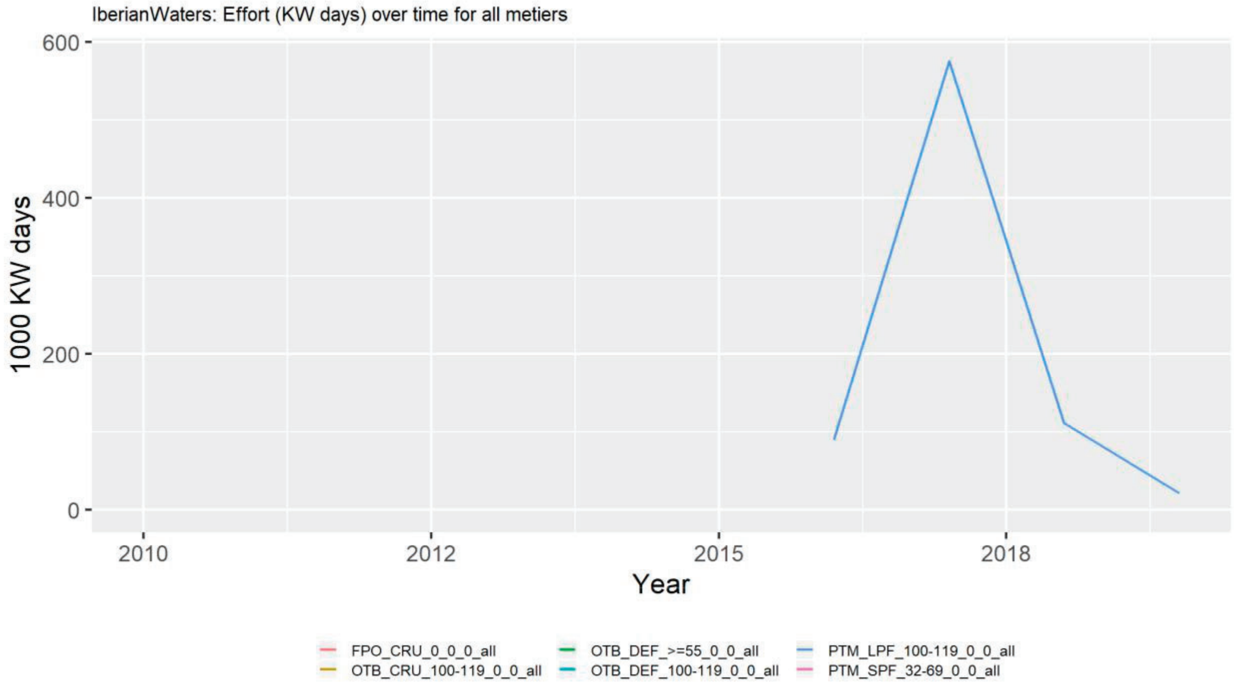
Iberian Waters

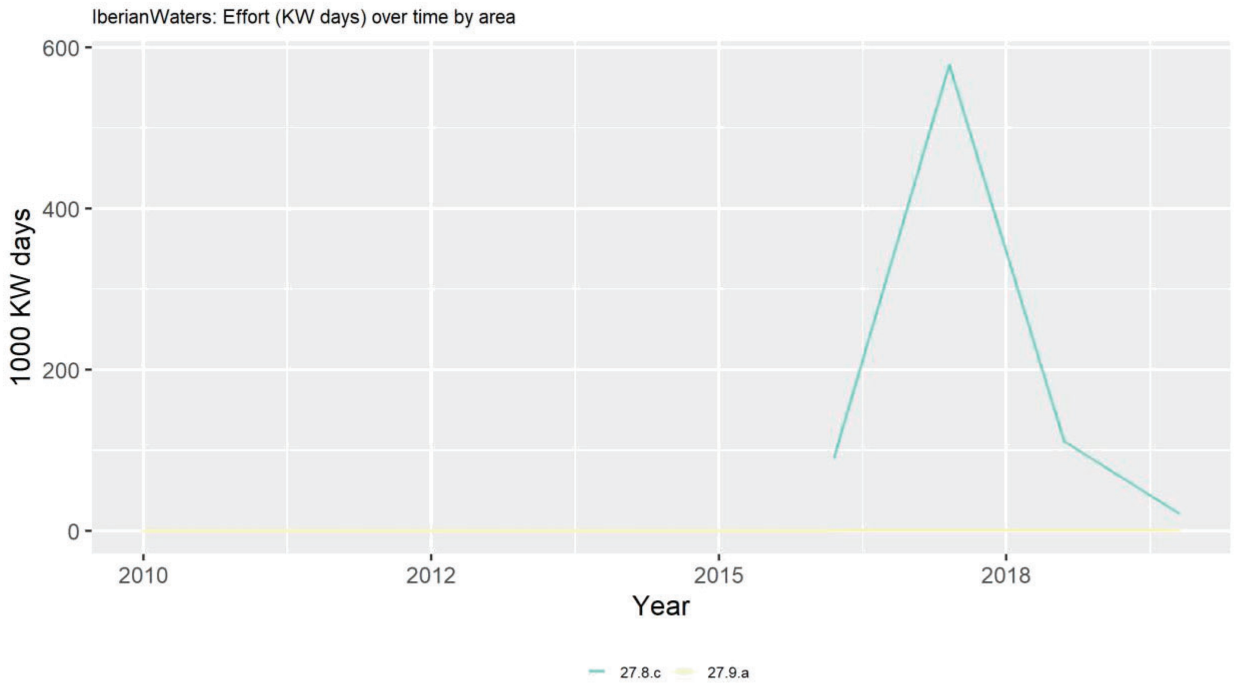
Table 6: Iberian Waters: Total effort by metiers by year (1000 kw days)

	2010	2016	2017	2018	2019
FPO_CRU_0_0_0_all	-	0	-	-	-
OTB_CRU_100-119_0_0_all	-	0	-	-	-
OTB_DEF_>=55_0_0_all	0	-	-	-	-
OTB_DEF_100-119_0_0_all	-	-	-	-	0
PTM_LPF_100-119_0_0_all	-	90	576	111	21
PTM_SPF_32-69_0_0_all	-	-	3	-	-

Table 7: Iberian Waters: Total effort by area by year (1000 kw days)

	2010	2016	2017	2018	2019
27.8.c	-	90	579	111	21
27.9.a	0	0	-	-	0


IberianWaters: Effort (KW days) over time for all metiers
1000 KW days
600
400
200
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all
OTB_CRU_100-119_0_0_all
OTB_DEF_>=55_0_0_all
OTB_DEF_100-119_0_0_all
PTM_LPF_100-119_0_0_all
PTM_SPF_32-69_0_0_all


IberianWaters: Effort (KW days) over time by area
1000 KW days
600
400
200
0
2010
2012
2015
2018
Year
27.8.c
27.9.a

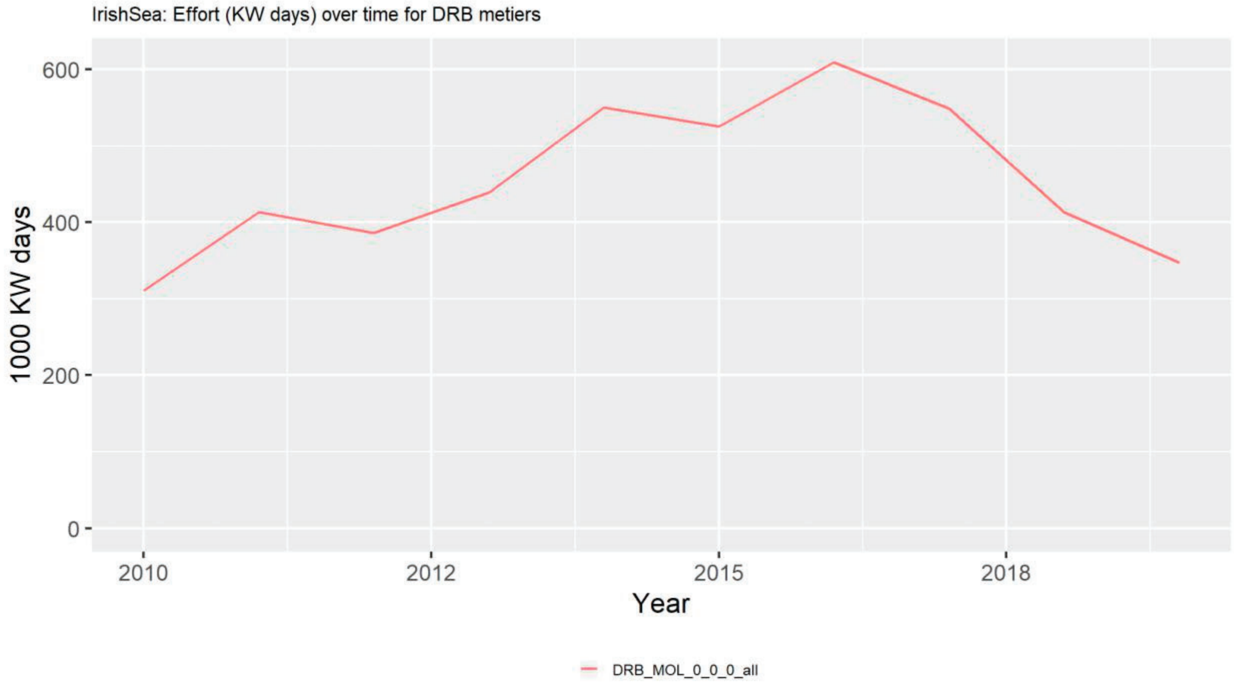
Irish Sea

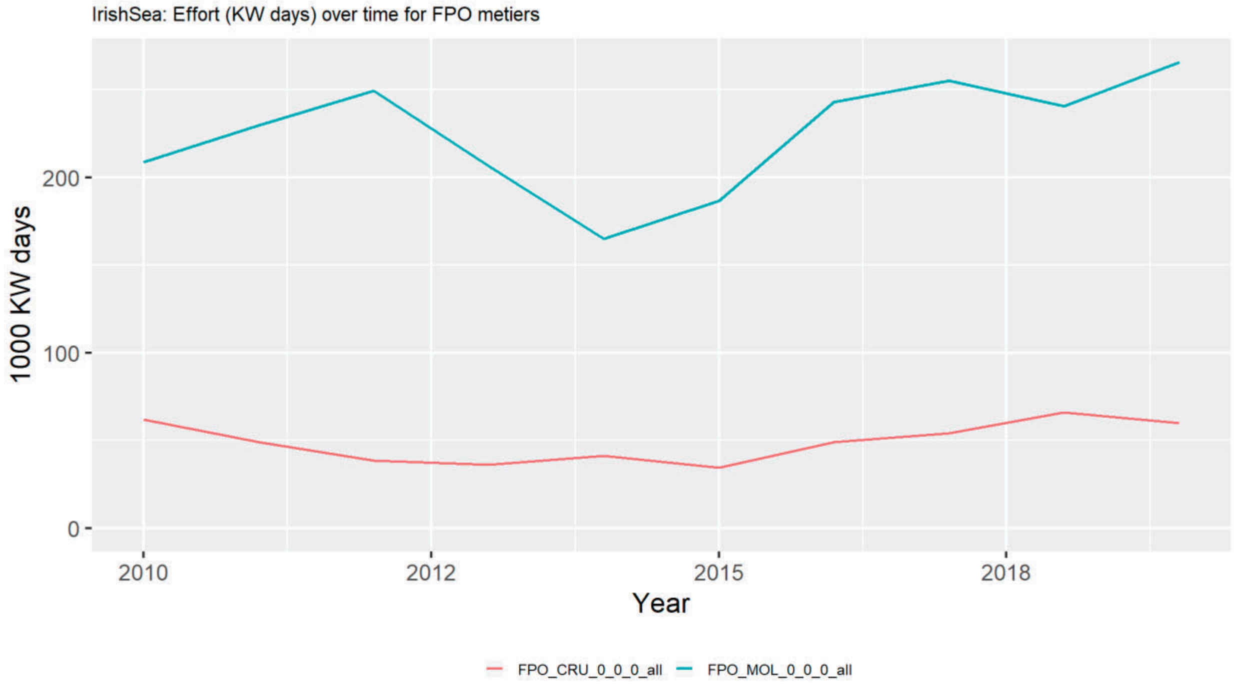
Table 8: Irish Sea: Total effort by metiers by year (1000 kw days)

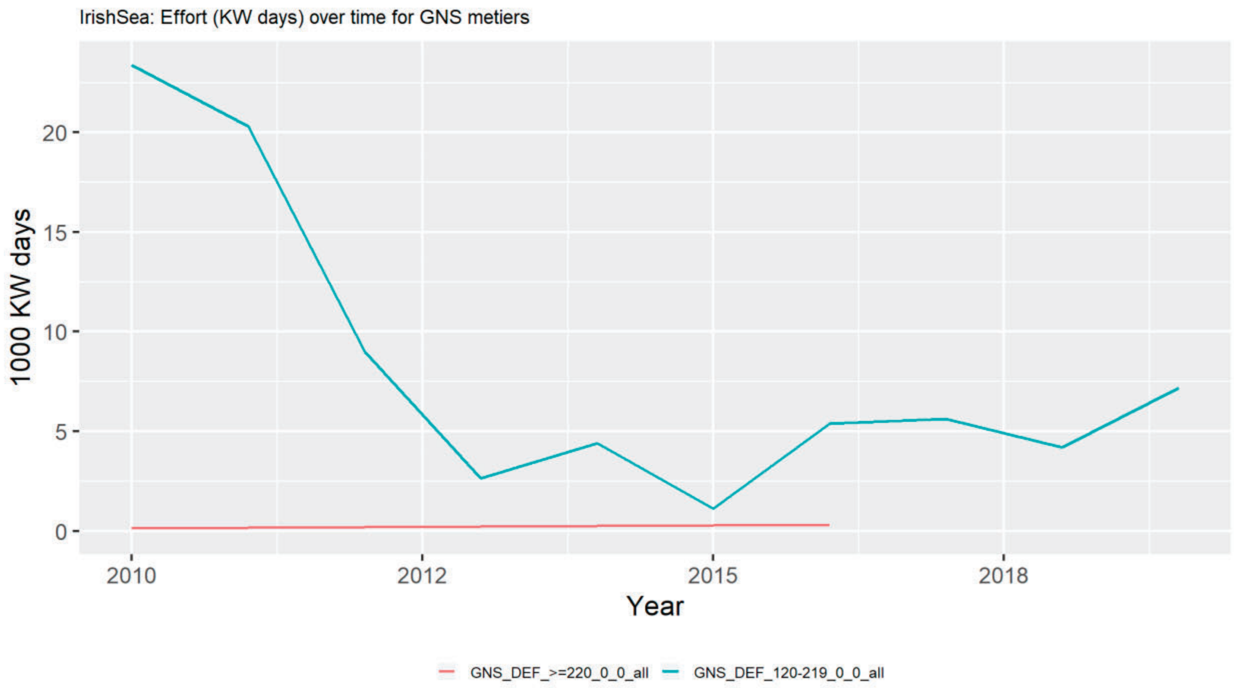
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	311	413	387	440	550	526	610	549	413	347
FPO_CRU_0_0_0_all	62	49	38	36	41	35	49	54	66	60
FPO_MOL_0_0_0_all	209	230	249	206	165	187	243	255	241	266
GNS_DEF_>=220_0_0_all	0	-	-	-	-	-	0	-	-	-
GNS_DEF_120-219_0_0_all	23	20	9	3	4	1	5	6	4	7
LLS_FIF_0_0_0_all	1	0	4	-	0	0	-	-	-	0
MIS_MIS_0_0_0_HC	-	-	-	-	0	-	-	-	-	1
OTB_CRU_100-119_0_0_all	-	-	-	0	-	-	-	-	-	-
OTB_CRU_70-99_0_0_all	845	988	1181	825	1027	860	664	473	606	795
OTB_DEF_100-119_0_0_all	162	126	118	152	123	124	147	211	211	274
OTB_DEF_70-99_0_0_all	7	15	14	25	18	25	12	7	6	11
PTM_LPF_100-119_0_0_all	-	-	4	-	-	-	-	-	-	-
PTM_SPF_32-69_0_0_all	15	38	79	51	26	43	48	47	58	75
SSC_DEF_100-119_0_0_all	3	10	32	25	18	24	19	31	21	27
TBB_DEF_70-99_0_0_all	218	212	179	142	159	208	190	171	207	272

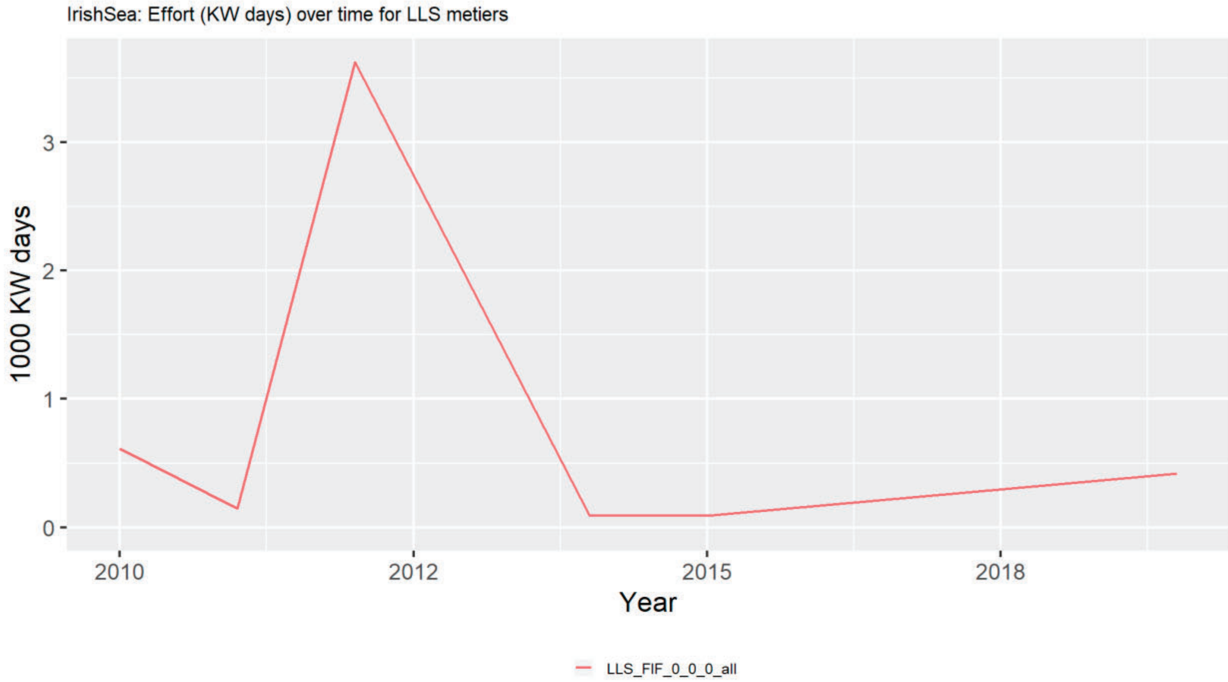
Table 9: Irish Sea: Total effort by area by year (1000 kw days)

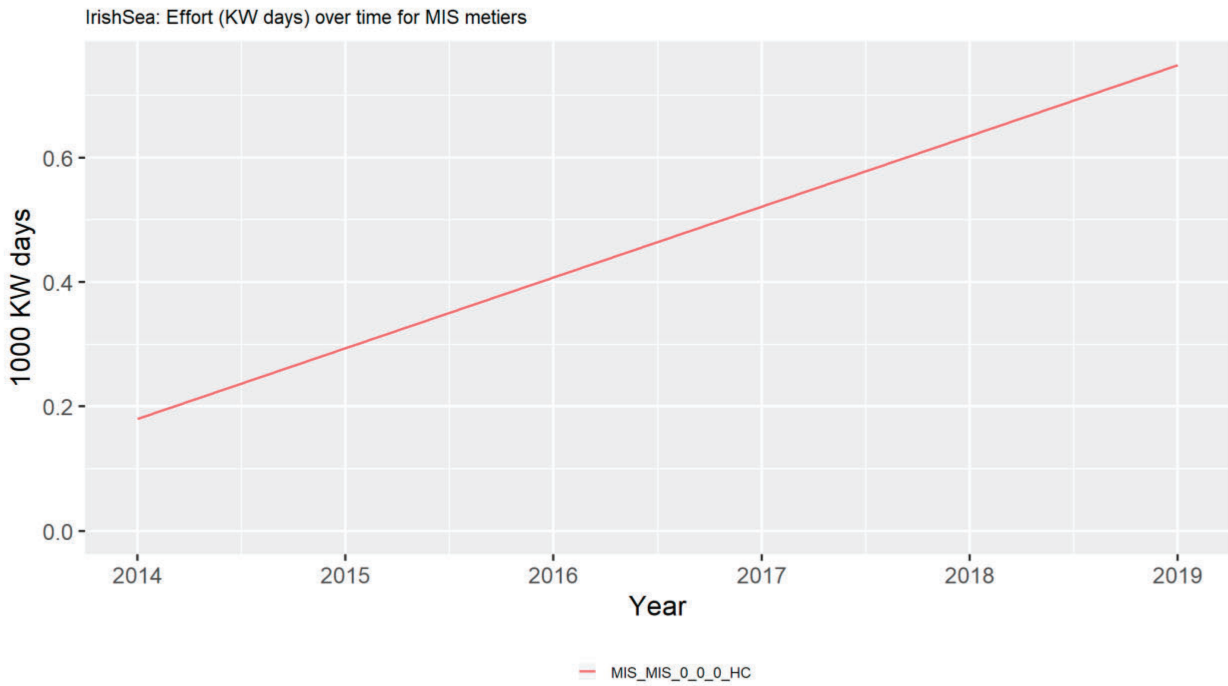
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
27.7.a	1856	2102	2294	1905	2133	2033	1988	1805	1834	2135

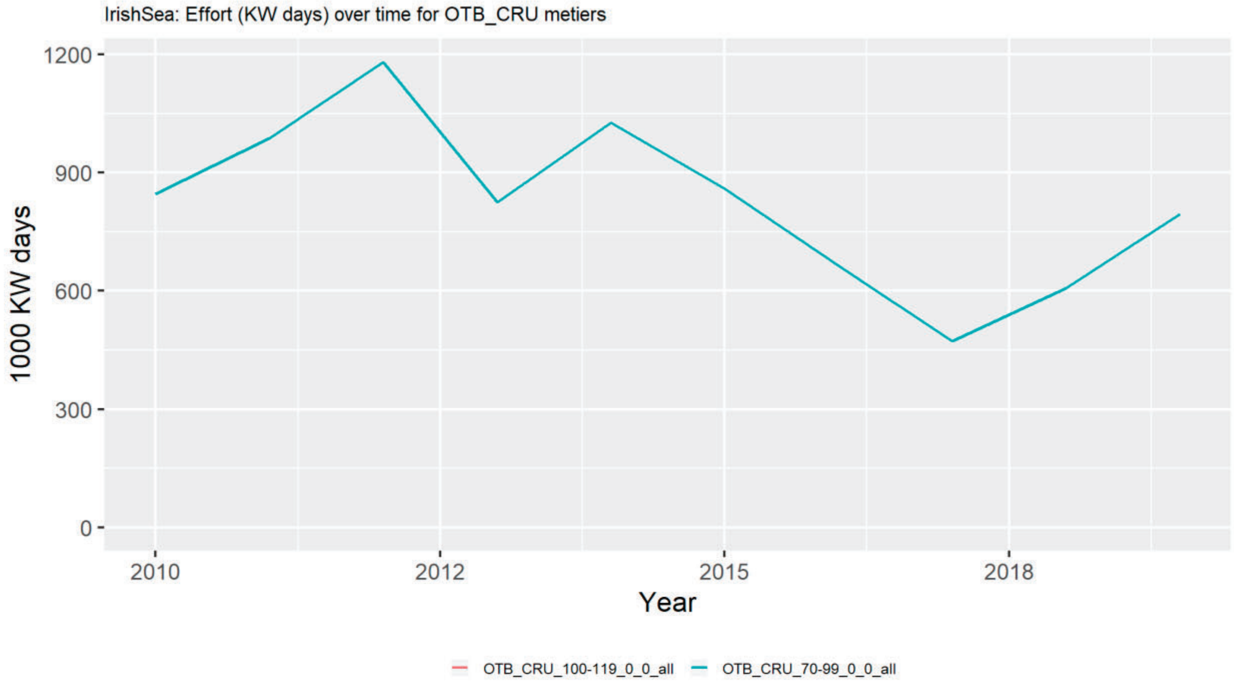

IrishSea: Effort (KW days) over time for DRB metiers
1000 KW days
600
400
200
0
2010
2012
2015
2018
Year
DRB_MOL_0_0_0_all

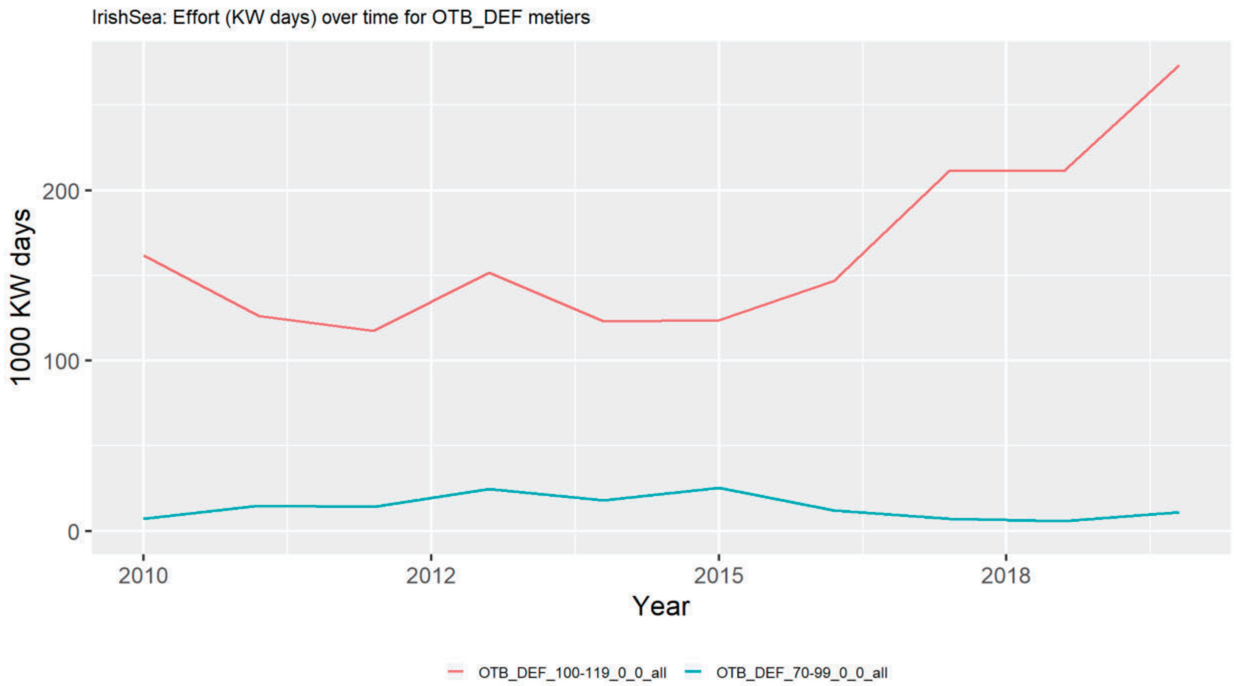

IrishSea: Effort (KW days) over time for FPO metiers
1000 KW days
200
100
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all
FPO_MOL_0_0_0_all

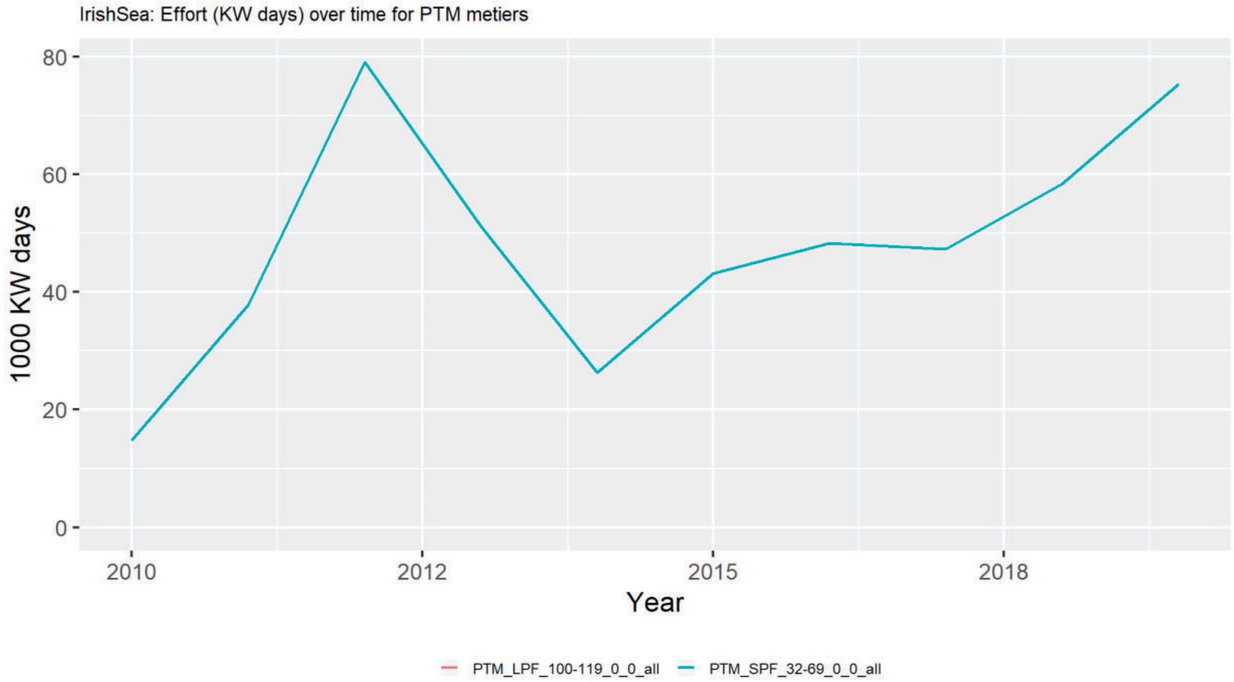

IrishSea: Effort (KW days) over time for GNS metiers
1000 KW days
20
15
10
5
0
2010
2012
2015
2018
Year
GNS_DEF_>=220_0_0_all
GNS_DEF_120-219_0_0_all

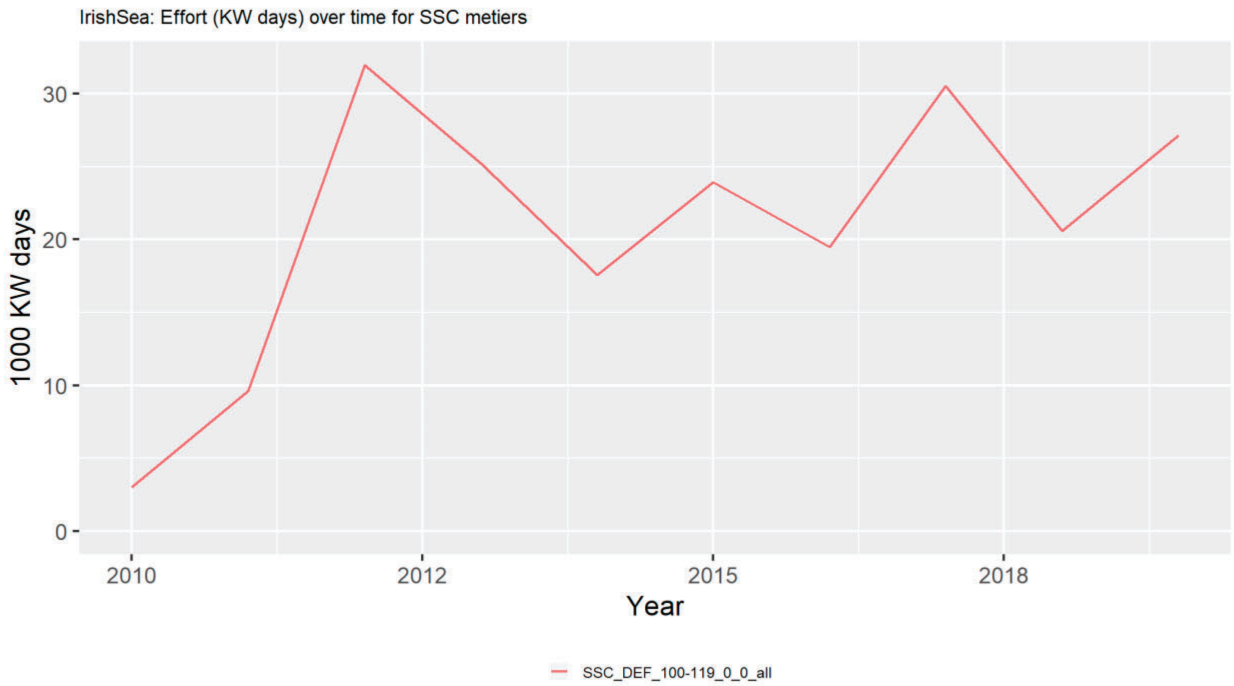

IrishSea: Effort (KW days) over time for LLS metiers
1000 KW days
0
1
2
3
2010
2012
2015
2018
Year
LLS_FIF_0_0_0_all

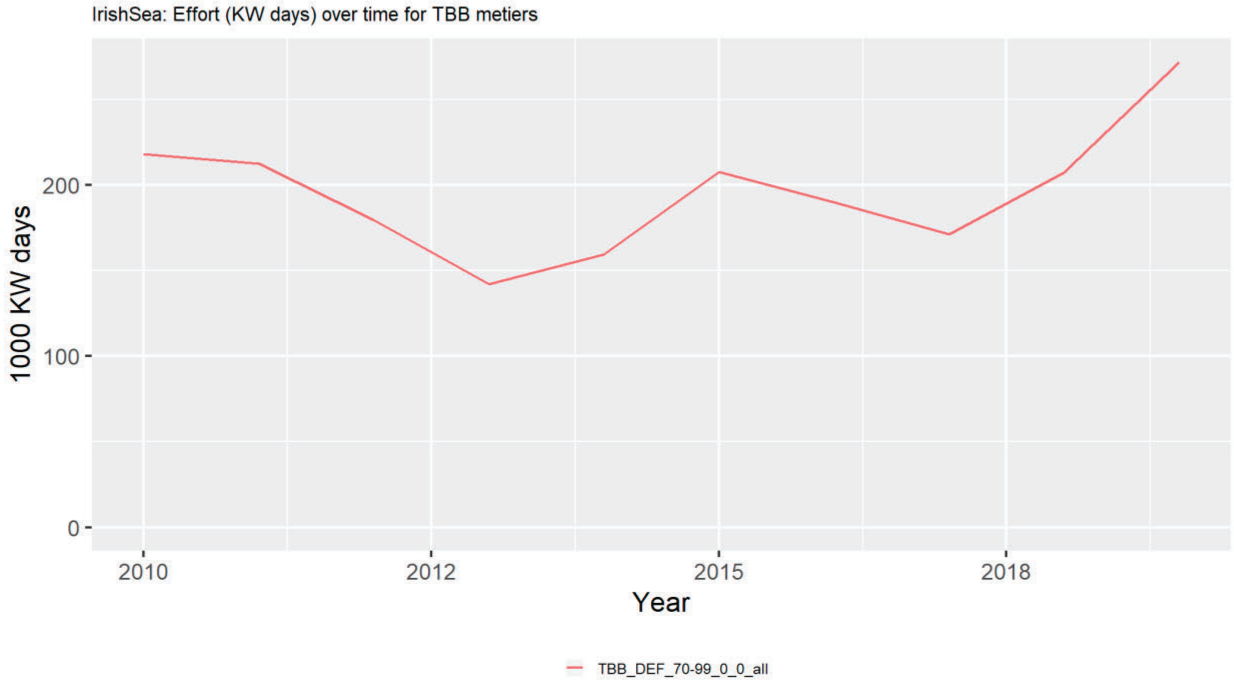

IrishSea: Effort (KW days) over time for MIS metiers
1000 KW days
0.0
0.2
0.4
0.6
2014
2015
2016
2017
2018
2019
Year
MIS_MIS_0_0_0_HC

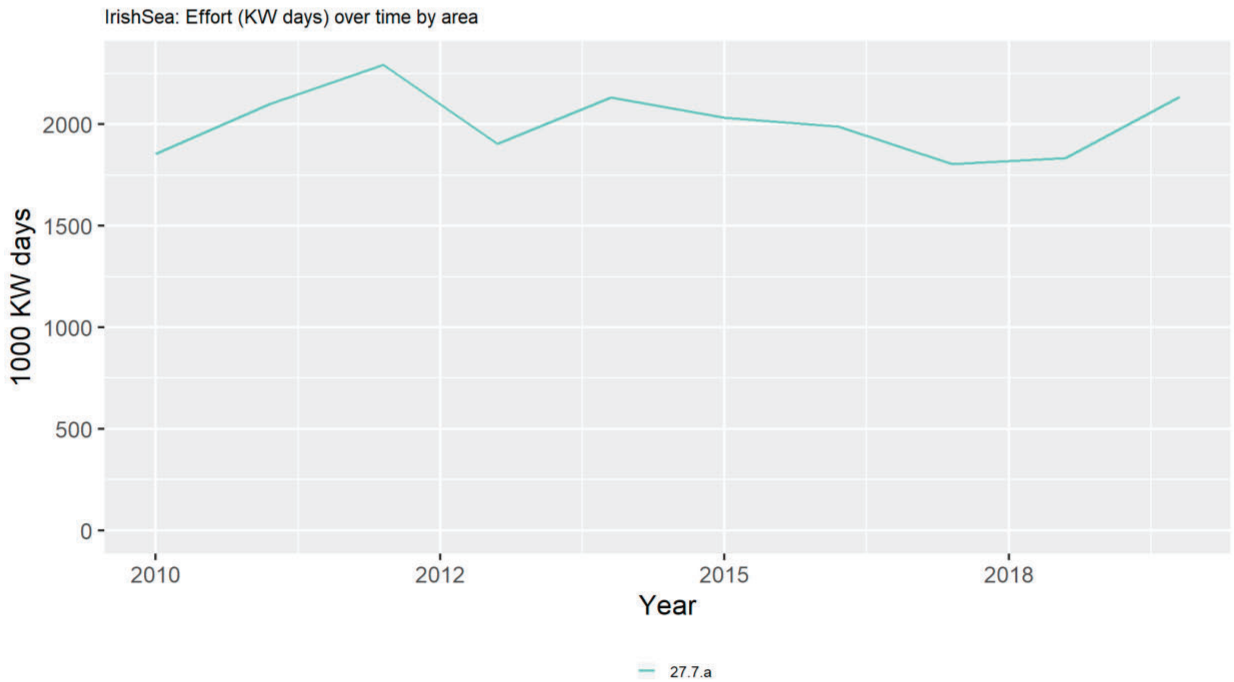

IrishSea: Effort (KW days) over time for OTB_CRU metiers
1200
900
600
300
0
1000 KW days
2010
2012
2015
2018
Year
OTB_CRU_100-119_0_0_all
OTB_CRU_70-99_0_0_all


IrishSea: Effort (KW days) over time for OTB_DEF metiers
200
100
0
1000 KW days
2010
2012
2015
2018
Year
OTB_DEF_100-119_0_0_all
OTB_DEF_70-99_0_0_all


IrishSea: Effort (KW days) over time for PTM metiers
1000 KW days
0
20
40
60
80
2010
2012
2015
2018
Year
PTM_LPF_100-119_0_0_all
PTM_SPF_32-69_0_0_all


IrishSea: Effort (KW days) over time for SSC metiers
1000 KW days
0
10
20
30
2010
2012
2015
2018
Year
SSC_DEF_100-119_0_0_all


IrishSea: Effort (KW days) over time for TBB metiers
1000 KW days
0
100
200
2010
2012
2015
2018
Year
TBB_DEF_70-99_0_0_all


IrishSea: Effort (KW days) over time by area
1000 KW days
0
500
1000
1500
2000
2010
2012
2015
2018
Year
27.7.a

North Sea

Table 10: North Sea: Total effort by métiers by year (1000 kw days)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	-	2	45	64	52	35	54	80	91	150
FPO_CRU_0_0_0_all	692	529	515	446	435	503	578	583	612	620
FPO_MOL_0_0_0_all	10	-	-	35	26	32	40	15	14	24
GNS_DEF_>=220_0_0_all	-	-	0	-	-	-	-	-	-	0
GNS_DEF_120-219_0_0_all	0	3	0	11	5	8	7	8	4	3
LLS_FIF_0_0_0_all	1	7	3	2	2	1	2	0	1	1
MIS_MIS_0_0_0_HC	-	-	1	-	2	1	-	0	-	1
OTB_CRU_70-99_0_0_all	0	1	0	0	1	-	-	0	1	0
OTB_DEF_>=120_0_0_all	-	-	-	-	-	-	-	-	1	-
OTB_DEF_100-119_0_0_all	757	595	497	498	485	546	675	646	642	697
OTB_DEF_70-99_0_0_all	2	5	4	1	2	4	11	8	7	8
OTB_MCF_>=120_0_0_all	-	-	-	-	-	-	-	2	4	-
PTM_LPF_100-119_0_0_all	-	-	-	-	-	-	2	-	-	-
PTM_SPF_32-69_0_0_all	1733	2231	2613	2112	2224	1753	2030	2297	1809	2165
SSC_DEF_100-119_0_0_all	-	-	4	5	11	20	26	6	7	29
TBB_DEF_70-99_0_0_all	-	-	-	-	-	-	-	0	-	0

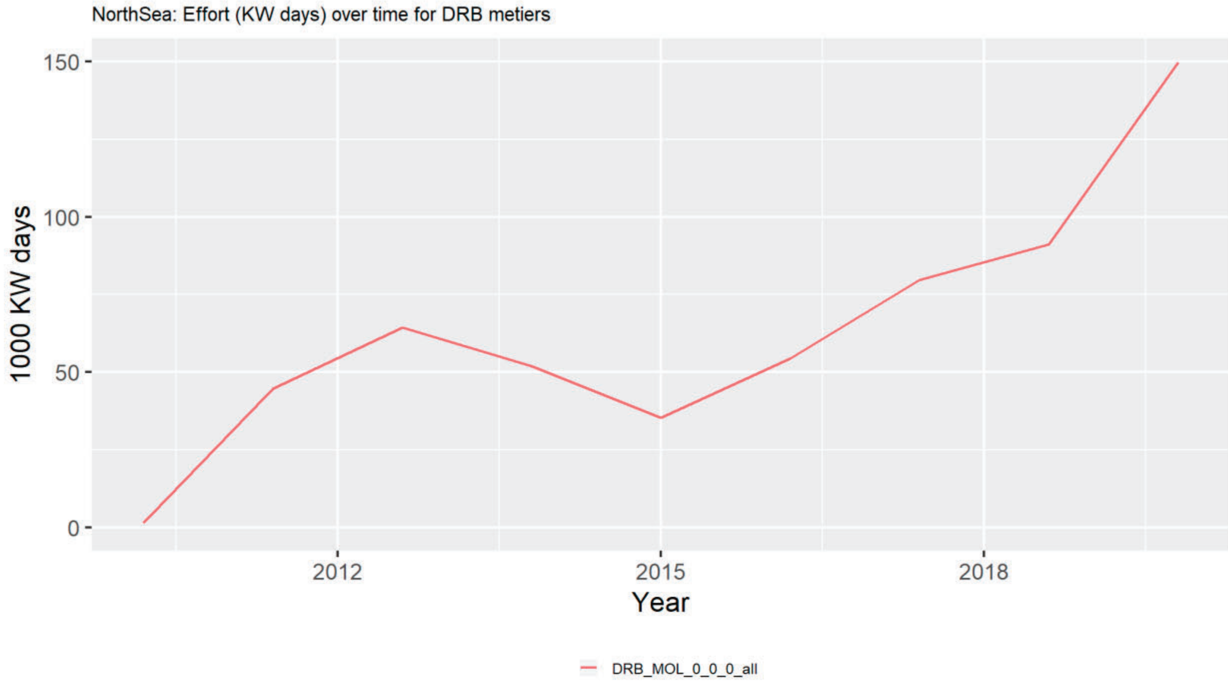
Table 11: North Sea: Total effort by metiers for which an FDF flag is submitted (1000 kw days)

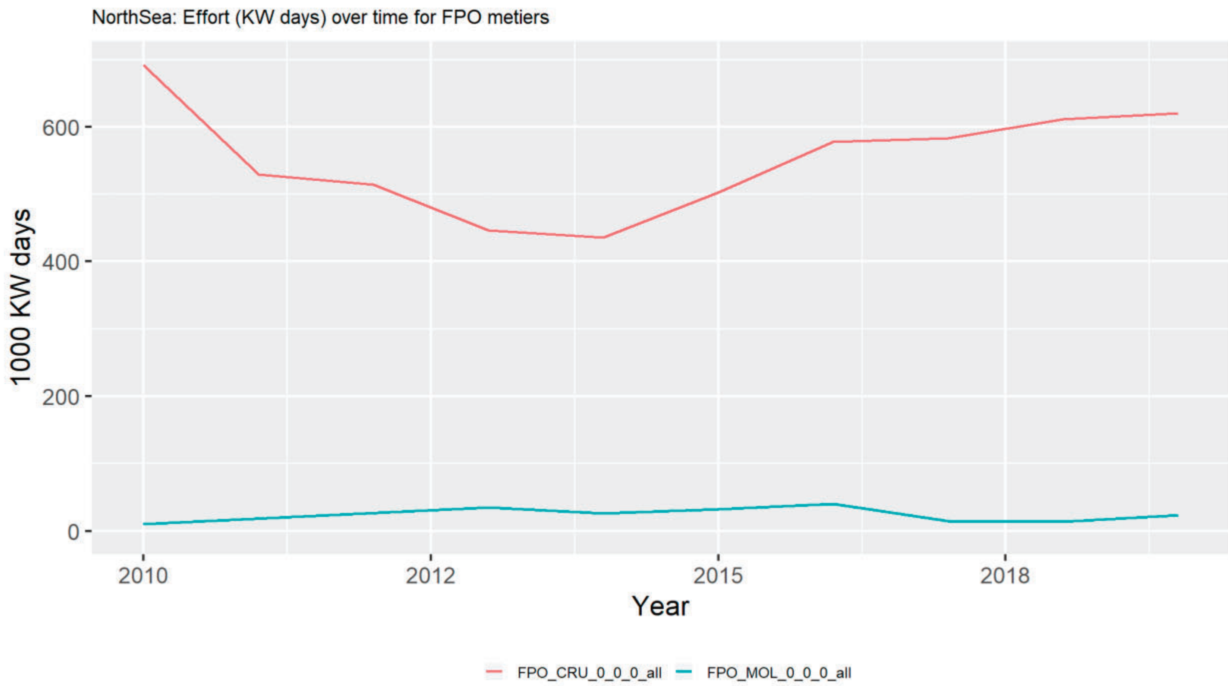
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	-	2	45	64	52	35	54	80	91	150
FPO_CRU_0_0_0_all	692	529	515	446	435	503	578	583	612	620
FPO_MOL_0_0_0_all	10	-	-	35	26	32	40	15	14	24
GNS_DEF_>=220_0_0_all	-	-	0	-	-	-	-	-	-	0
GNS_DEF_120-219_0_0_all	0	3	0	11	5	8	7	8	4	3
LLS_FIF_0_0_0_all	1	7	3	2	2	1	2	0	1	1
MIS_MIS_0_0_0_HC	-	-	1	-	2	1	-	0	-	1
OTB_CRU_70-99_0_0_all	0	1	0	0	1	-	-	0	1	0

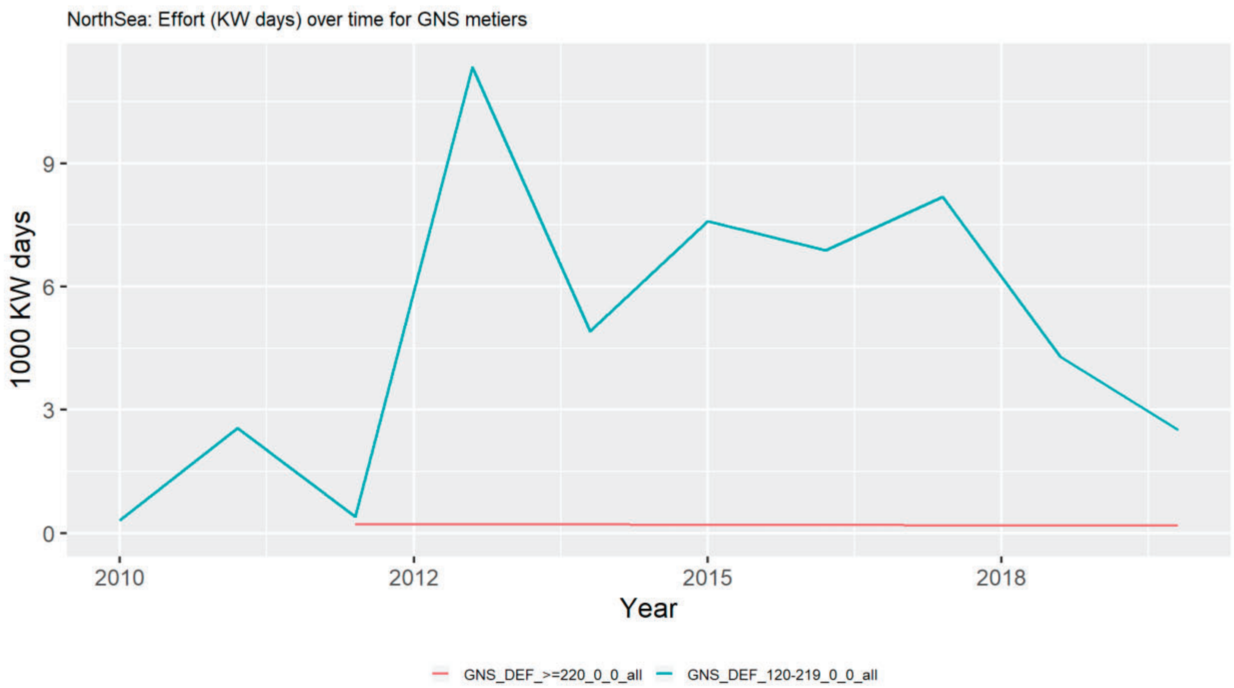
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
OTB_DEF_>=120_0_0_all	-	-	-	-	-	-	-	-	1	-
OTB_DEF_100-119_0_0_all	757	595	497	498	485	546	675	646	642	697
OTB_DEF_70-99_0_0_all	2	5	4	1	2	4	11	8	7	8
OTB_MCF_>=120_0_0_all	-	-	-	-	-	-	-	2	4	-
PTM_LPF_100-119_0_0_all	-	-	-	-	-	-	2	-	-	-
PTM_SPF_32-69_0_0_all	1733	2231	2613	2112	2224	1753	2030	2297	1809	2165
SSC_DEF_100-119_0_0_all	-	-	4	5	11	20	26	6	7	29
TBB_DEF_70-99_0_0_all	-	-	-	-	-	-	-	0	-	0

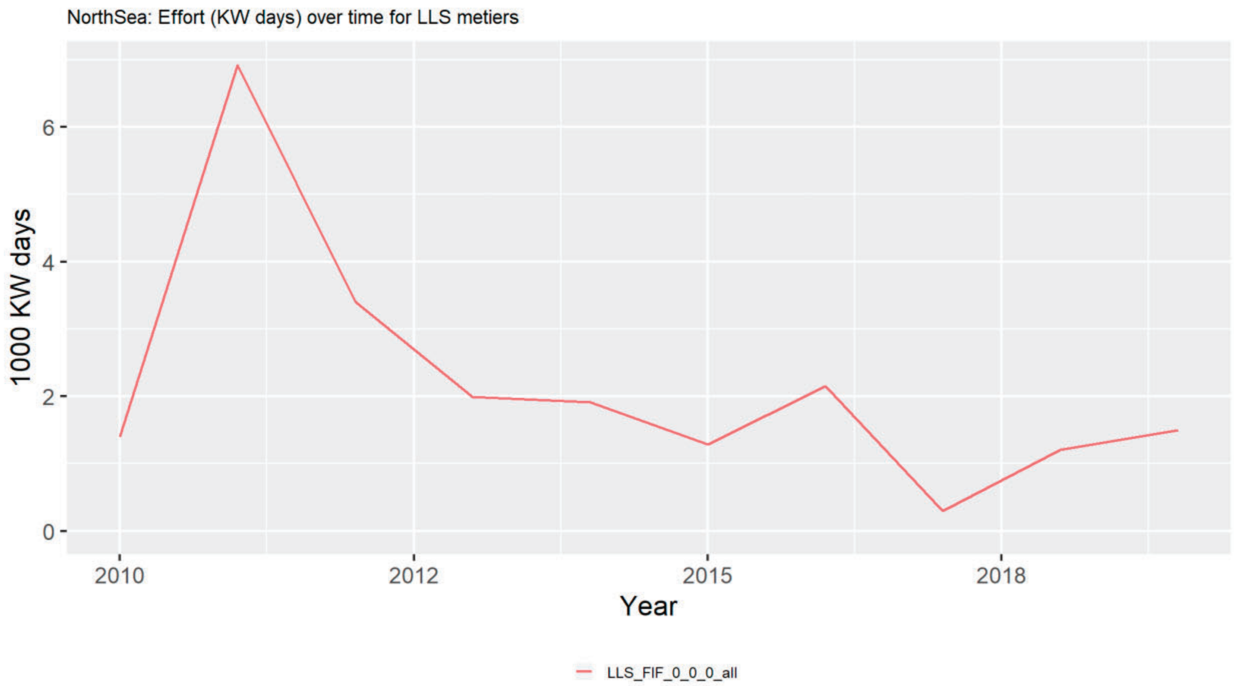
Table 12: North Sea: Total effort by area by year (1000 kw days)

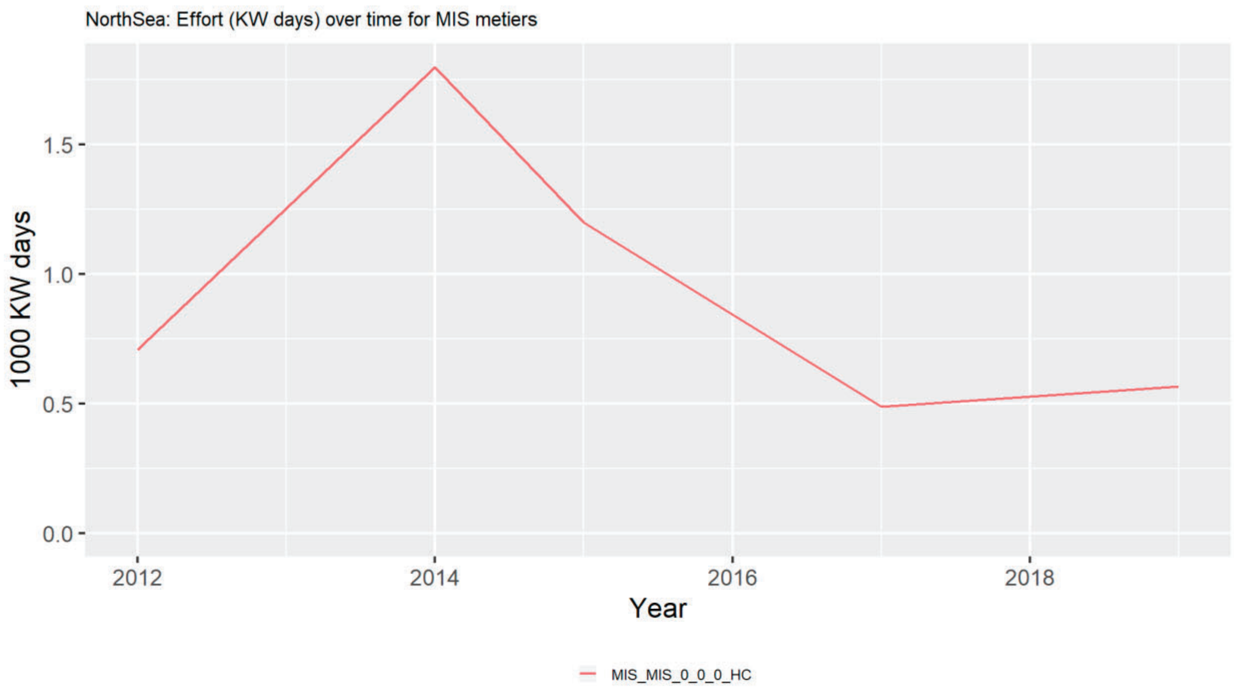
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
27.3.a	-	-	-	-	-	-	-	0	-	-
27.4.a	379	506	530	463	872	707	465	632	493	47
27.4.b	191	171	219	166	202	197	188	194	182	268
27.4.c	-	-	-	1	1	-	0	0	1	1
27.6.a	2626	2695	2900	2480	2118	1966	2719	2740	2432	3237
27.7.d	-	1	33	65	52	34	54	79	87	145

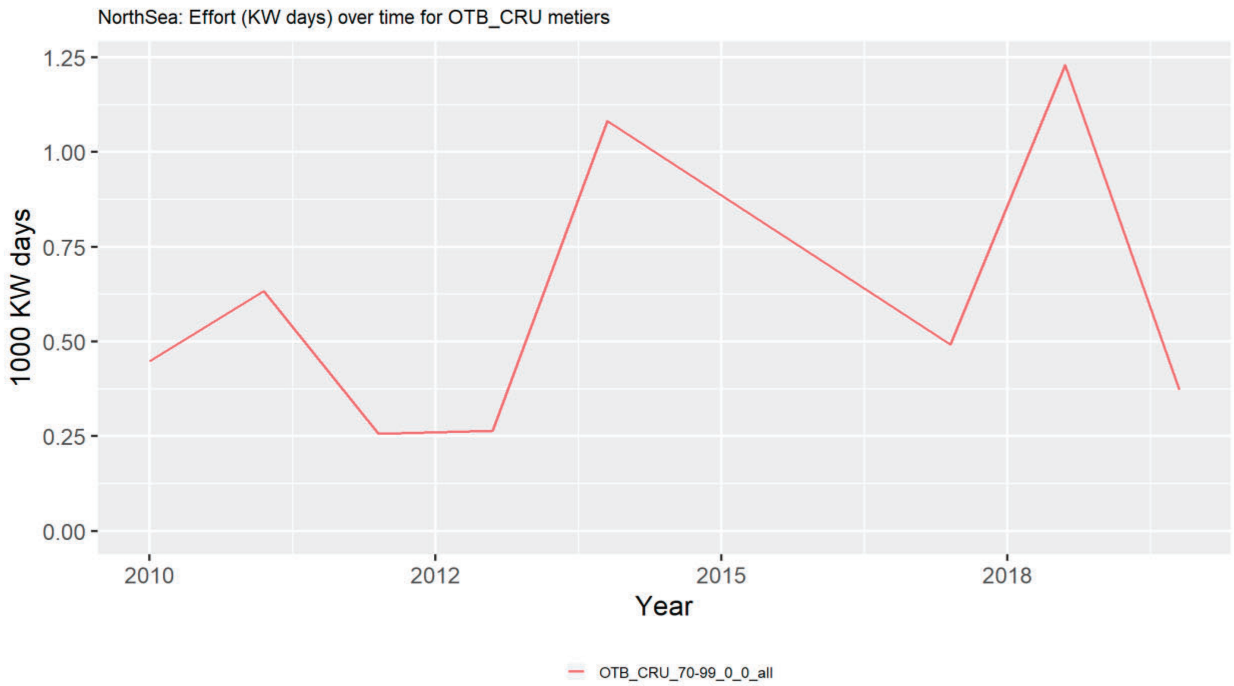

NorthSea: Effort (KW days) over time for DRB metiers
1000 KW days
150
100
50
0
2012
2015
2018
Year
DRB_MOL_0_0_0_all

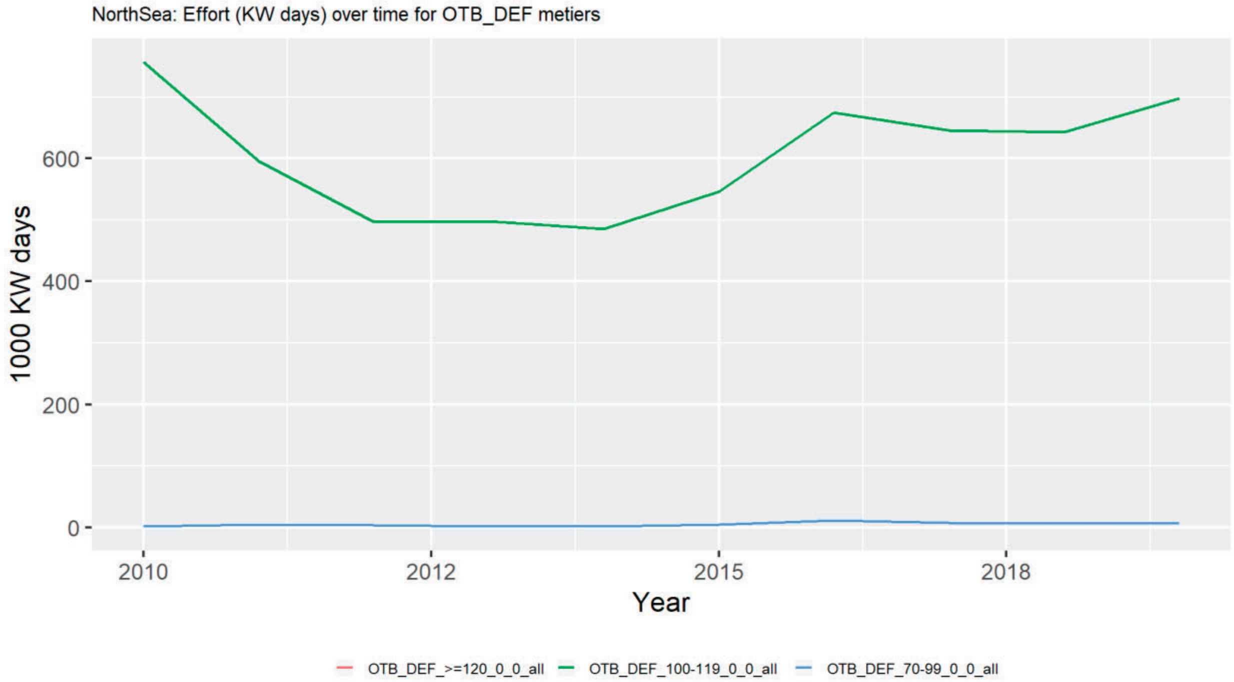

NorthSea: Effort (KW days) over time for FPO metiers
1000 KW days
600
400
200
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all
FPO_MOL_0_0_0_all

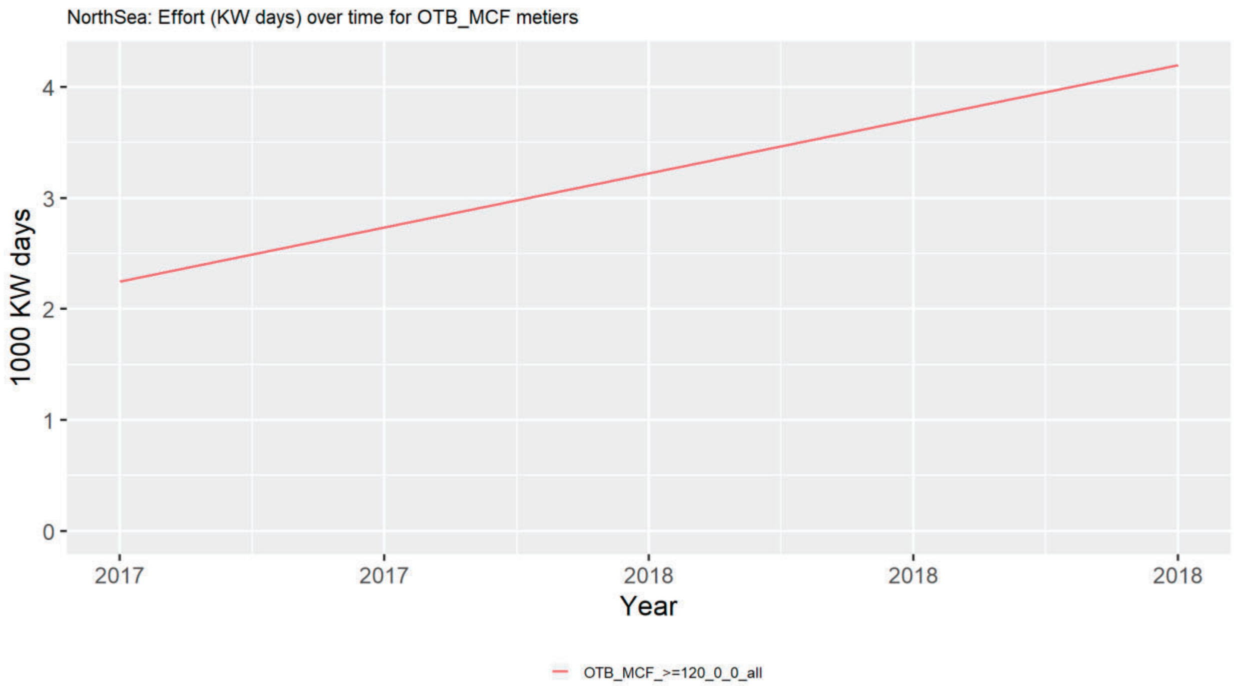

NorthSea: Effort (KW days) over time for GNS metiers
1000 KW days
0
3
6
9
2010
2012
2015
2018
Year
GNS_DEF_>=220_0_0_all
GNS_DEF_120-219_0_0_all

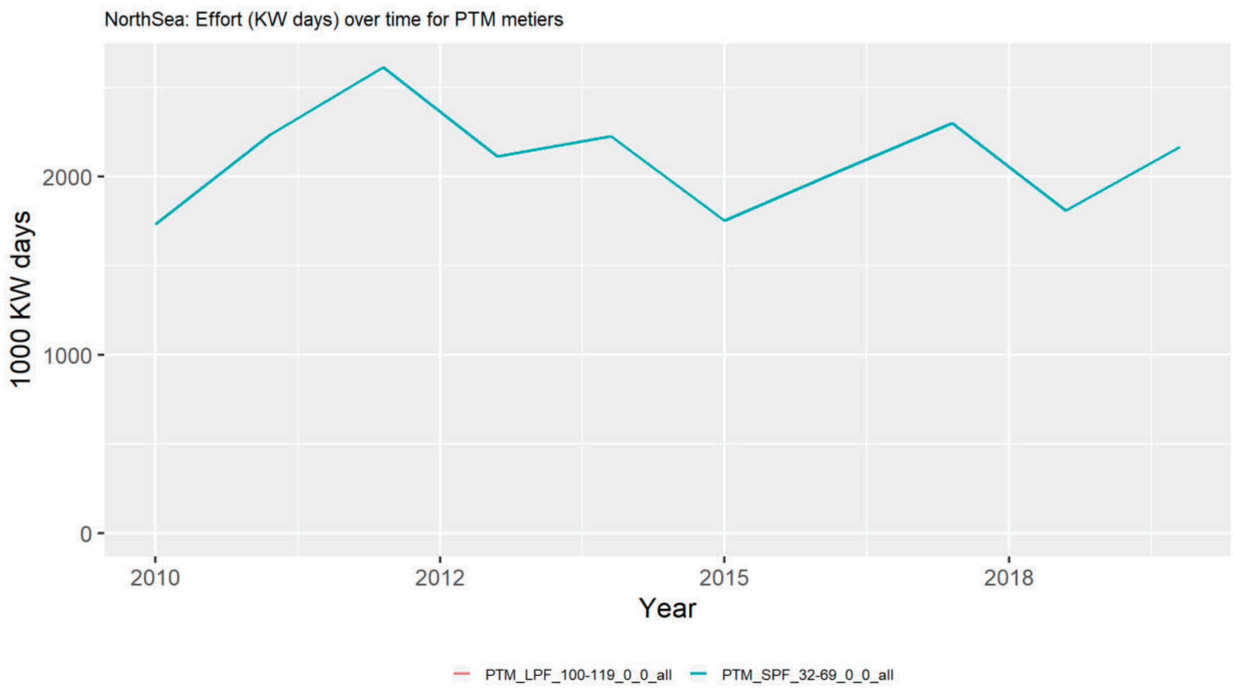

NorthSea: Effort (KW days) over time for LLS metiers
1000 KW days
0
2
4
6
2010
2012
2015
2018
Year
LLS_FIF_0_0_0_all

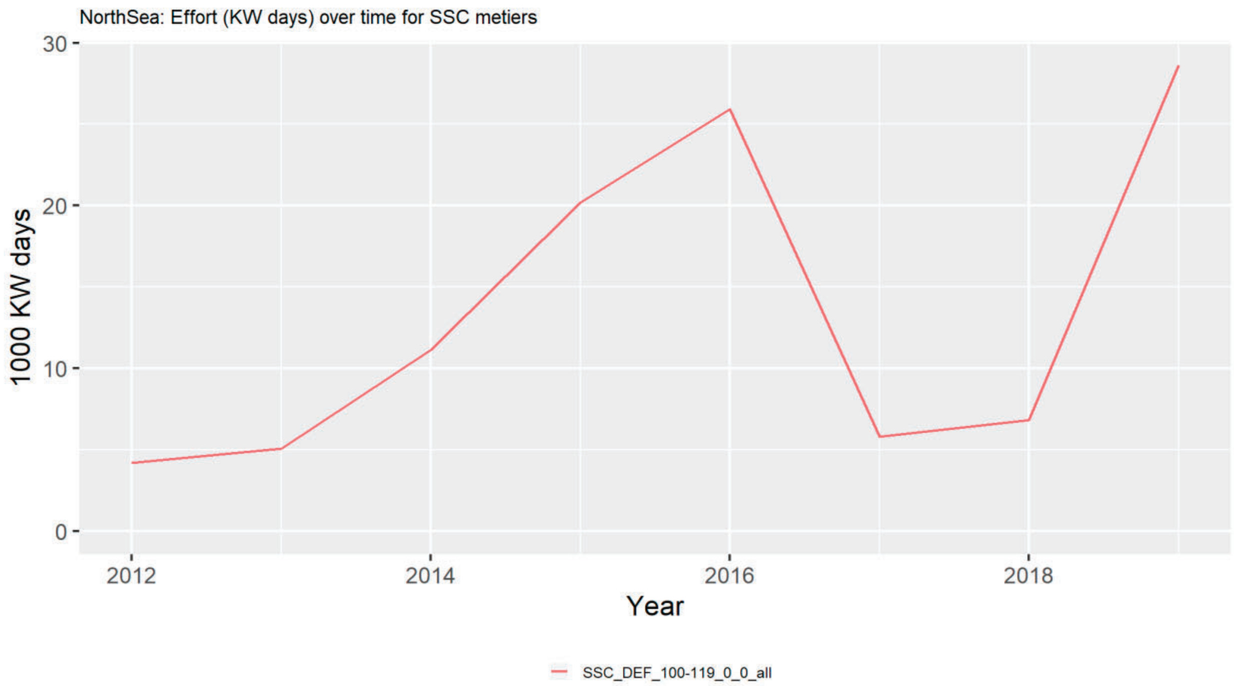

NorthSea: Effort (KW days) over time for MIS metiers
1000 KW days
0.0
0.5
1.0
1.5
2012
2014
2016
2018
Year
MIS_MIS_0_0_0_HC

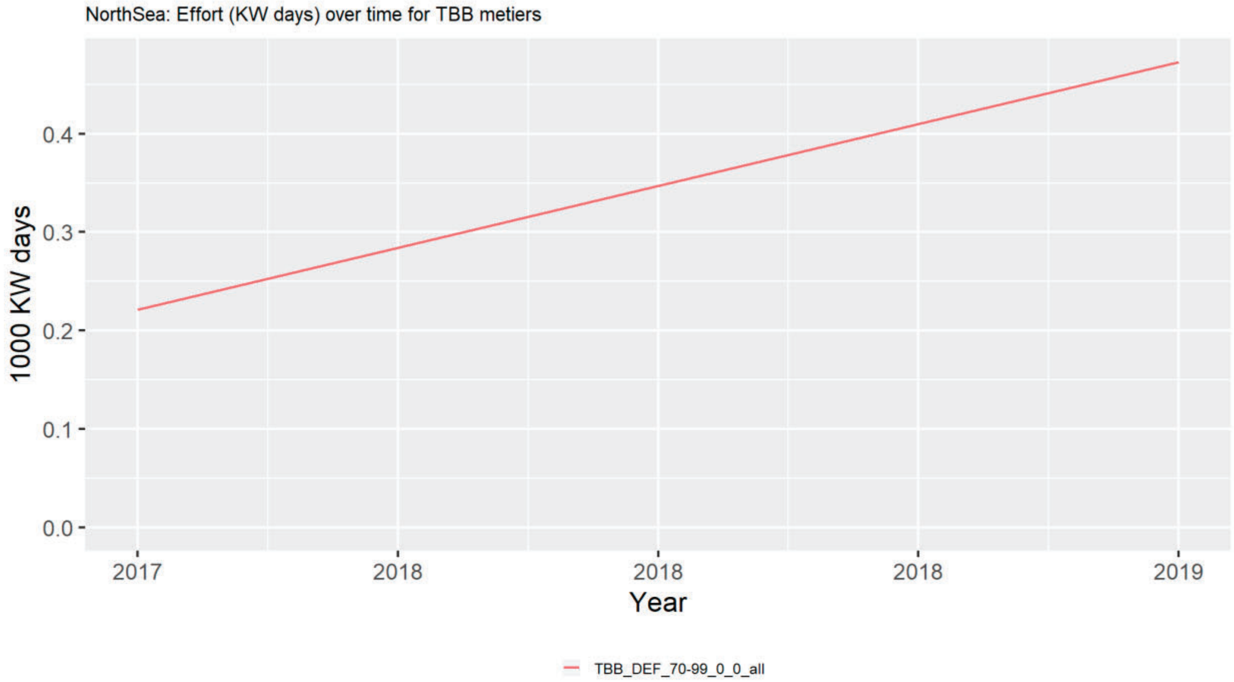

NorthSea: Effort (KW days) over time for OTB_CRU metiers
1000 KW days
0.00
0.25
0.50
0.75
1.00
1.25
2010
2012
2015
2018
Year
OTB_CRU_70-99_0_0_all

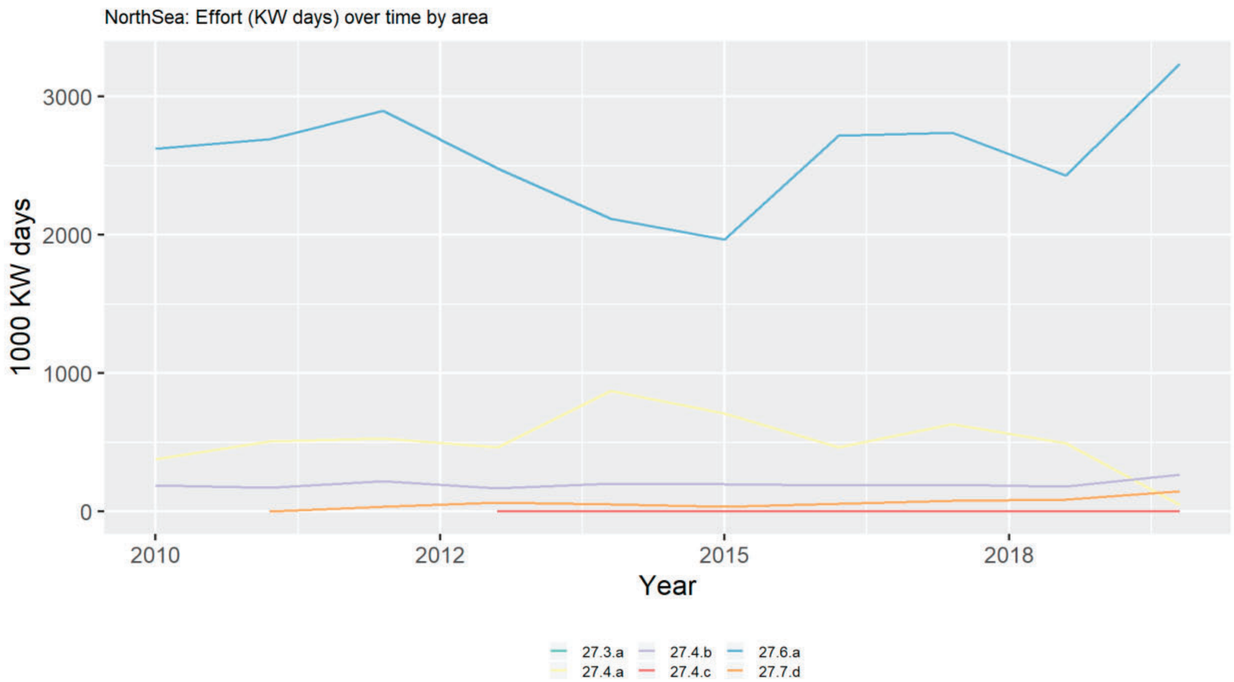

NorthSea: Effort (KW days) over time for OTB_DEF metiers
1000 KW days
600
400
200
0
2010
2012
2015
2018
Year
OTB_DEF_>=120_0_0_all
OTB_DEF_100-119_0_0_all
OTB_DEF_70-99_0_0_all


NorthSea: Effort (KW days) over time for OTB_MCF metiers
1000 KW days
4
3
2
1
0
2017
2017
2018
2018
2018
Year
OTB_MCF_>=120_0_0_all


NorthSea: Effort (KW days) over time for PTM metiers
1000 KW days
2000
1000
0
2010
2012
2015
2018
Year
PTM_LPF_100-119_0_0_all
PTM_SPF_32-69_0_0_all


NorthSea: Effort (KW days) over time for SSC metiers
1000 KW days
30
20
10
0
2012
2014
2016
2018
Year
SSC_DEF_100-119_0_0_all


NorthSea: Effort (KW days) over time for TBB metiers
1000 KW days
0.0
0.1
0.2
0.3
0.4
2017
2018
2018
2018
2019
Year
TBB_DEF_70-99_0_0_all


NorthSea: Effort (KW days) over time by area
1000 KW days
0
1000
2000
3000
2010
2012
2015
2018
Year
27.3.a
27.4.a
27.4.b
27.4.c
27.6.a
27.7.d

Catch data

The tables and plots in this section summarise the catch data.

Use these tables and plots to check:

- Consistency of country code used over time
- Ideally, only one code should be used per country
- Number of records submitted over time
- Are these similar year-to-year or are they changing? Is there a good reason for this or has some data been missed or duplicated?
- Consistency of vessel lengths over time
- Are any codes similar enough to be grouped together? (e.g. "<10" and "<10m")
- Consistency of metier codes over time and with ecoregion (i.e. North Sea, Celtic Sea etc.)
- Do the metier codes used make sense and are they consistent with the data call? Do the landings per metier over time make sense? Are these metiers consistent with the ecoregion?
- Consistency of area codes over time and with ecoregion
- Do the area codes used make sense and are they consistent with the data call? Do the landings per area over time make sense? Are these areas consistent with the ecoregion?
- Consistency of species codes over time and with ecoregion
- Do the species codes used make sense and are they consistent with the data call? Do the landings per species over time make sense? Are these species consistent with the ecoregion? Are they at the requested level of aggregation (ICES division)?

Please pay particular attention to the latest submission and check it makes sense in the context of the time series.

Please address any issues in the latest submission before submitting to WGMIXFISH.

Table 13: Catch: Number of records submitted by country code

	CelticSea	IberianWaters	IrishSea	NorthSea
IE	41352	41	6575	4187

Table 14: Catch: Number of records submitted by year

	CelticSea	IberianWaters	IrishSea	NorthSea
2010	4086	2	719	393
2011	4018	1	689	366
2012	4243	0	668	341

	CelticSea	IberianWaters	IrishSea	NorthSea
2013	4177	0	631	396
2014	4246	0	633	419
2015	4181	0	653	466
2016	4190	14	657	465
2017	4126	14	641	438
2018	4147	5	607	471
2019	3938	5	677	432

Catch: There are 1 duplicate records (across all years and ecoregions)

Table 15: Catch: Number of records submitted by vessel length

	CelticSea	IberianWaters	IrishSea	NorthSea
<10m	255	0	99	49
>=40m	343	8	10	186
10<24m	23120	16	4240	2183
24<40m	17634	17	2226	1769

Celtic Sea

Table 16: Celtic Sea: Total landings by metiers by year (tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	1022	834	870	759	510	628	620	1164	988	1128
FPO_CRU_0_0_0_all	1634	1281	1414	1285	1315	1219	1643	1272	1327	1434
GNS_DEF_>=220_0_0_all	7	6	5	4	6	3	-	2	-	-
GNS_DEF_120-219_0_0_all	1814	1865	2319	2489	2643	1972	2315	2355	1838	2325
GTR_CRU_100-119_0_0_all	-	-	-	-	-	-	-	-	0	-
LHP_DEF_0_0_0_all	0	-	-	-	-	-	-	-	-	-
LLS_FIF_0_0_0_all	127	76	132	55	51	40	40	64	126	93
MIS_MIS_0_0_0_HC	191	94	377	589	453	468	91	48	-	-
OTB_CEP_0-0_0_0_all	-	-	-	-	-	-	-	1	13	1
OTB_CRU_100-119_0_0_all	890	756	1007	756	1830	2121	2317	1737	2546	3524

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
OTB_CRU_70-99_0_0_all	4735	3734	5388	5459	4804	4415	5862	5433	3828	3063
OTB_DEF_>=120_0_0_all	-	-	-	-	-	-	-	-	-	2
OTB_DEF_100-119_0_0_all	7396	8156	9634	9162	8780	7871	8610	8566	7551	6841
OTB_DEF_70-99_0_0_all	4699	4356	4589	4771	4256	4836	5949	5405	4368	2444
OTB_DWS_100-119_0_0_all	-	-	-	-	-	-	0	-	-	0
OTM_SPF_16-31_0_0_all	-	-	-	-	-	-	-	-	9	-
PTM_SPF_32-69_0_0_all	139186	61516	106979	103418	104245	92914	70440	48380	59477	44201
SSC_DEF_100-119_0_0_all	2672	3937	5130	4759	4203	3464	3520	3041	2706	3081
TBB_DEF_70-99_0_0_all	1725	1730	2382	2387	2282	2337	2589	2252	2305	2158

Table 17: Celtic Sea: Total landings by area by year (tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
27.7	-	127	16	-	-	-	-	-	-	-
27.7.b	24505	19528	28516	38720	33688	36533	22844	14314	18960	21170
27.7.c	9963	3114	2475	7260	8101	12041	22464	22434	30922	7419
27.7.e	1254	122	48	14	41	373	86	487	609	494
27.7.f	99	345	33	70	36	96	147	112	102	34
27.7.g	25655	28098	36600	33561	33582	33313	32998	26871	18163	16245
27.7.h	9513	9451	11267	12289	19610	10021	7975	4239	3945	8248
27.7.j	92951	23811	58210	40506	34995	28200	13539	9992	12132	13049
27.7.k	2159	3746	3060	3472	5324	1713	3945	1274	2249	3636

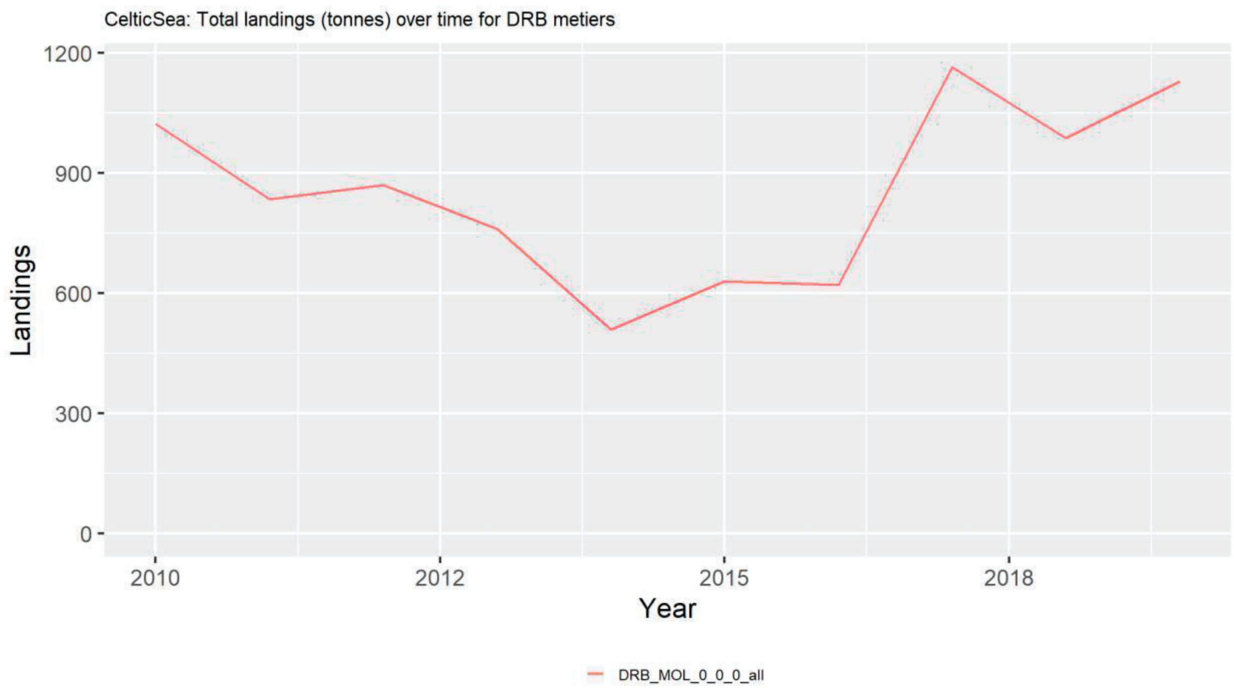
Table 18: Celtic Sea: Total landings by species by year (tonnes)

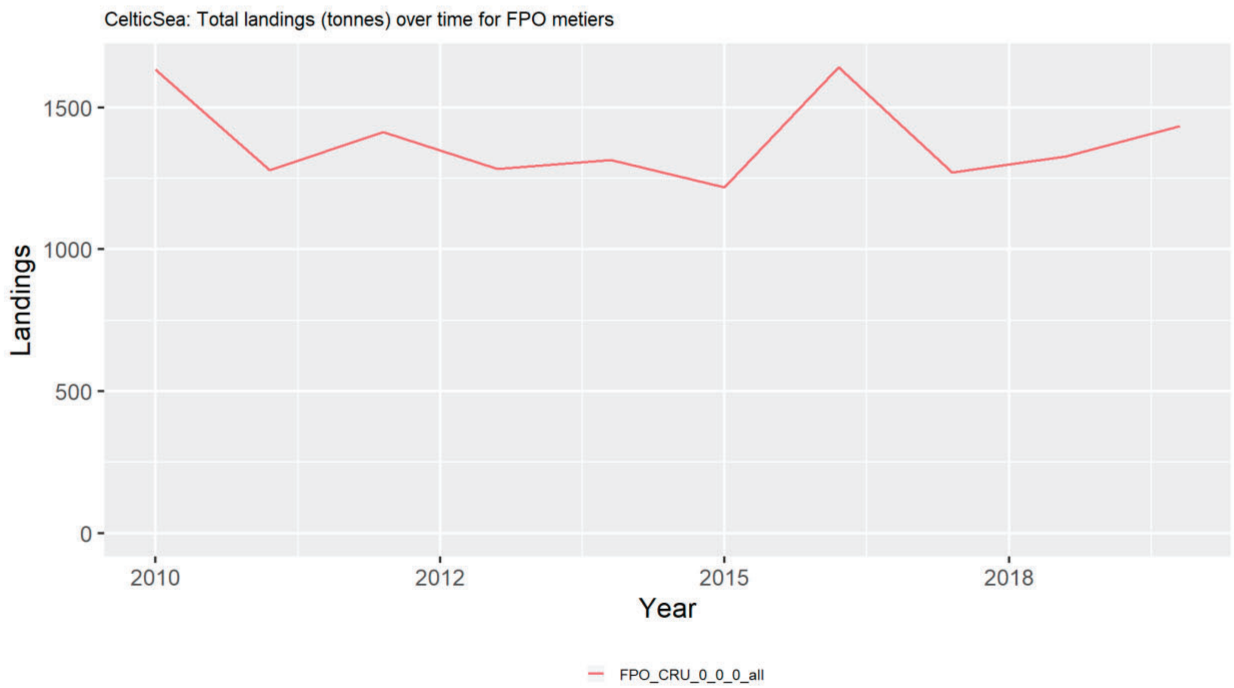
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ANF	3610	3319	3117	2843	3178	3055	3579	3316	3149	3435
COD	828	759	1413	1383	1190	1093	784	617	704	494
COE	38	42	35	33	51	29	33	32	33	57
DAB	0	0	4	8	9	8	1	0	0	5
FLE	1	1	1	2	2	2	1	1	0	0
GUG	-	-	-	-	-	-	-	-	-	2
GUR	-	20	25	14	2	1	2	2	11	8
HAD	2448	2987	3724	2387	1799	1419	1437	1268	1172	1142
HAL	0	0	0	-	-	-	-	-	1	0
HER	7885	11502	14923	13053	15553	14933	12853	8291	3183	1287
HKE	1535	1641	1608	1564	2373	2501	3124	3151	3122	3699
HOM	3242	1461	1628	147	-	-	-	-	-	-
LEM	238	315	404	393	432	447	427	405	376	357
LEZ	2345	2225	3078	3037	2387	2450	2603	2504	2179	2452
LIN	398	529	556	541	496	411	541	424	301	207
MAC	10809	8722	13179	12122	22148	30583	6557	2867	11326	12792
NEP.FU.15	-	-	-	1	-	-	-	2	-	-
NEP.FU.16	596	685	643	651	825	762	1133	764	2100	1149

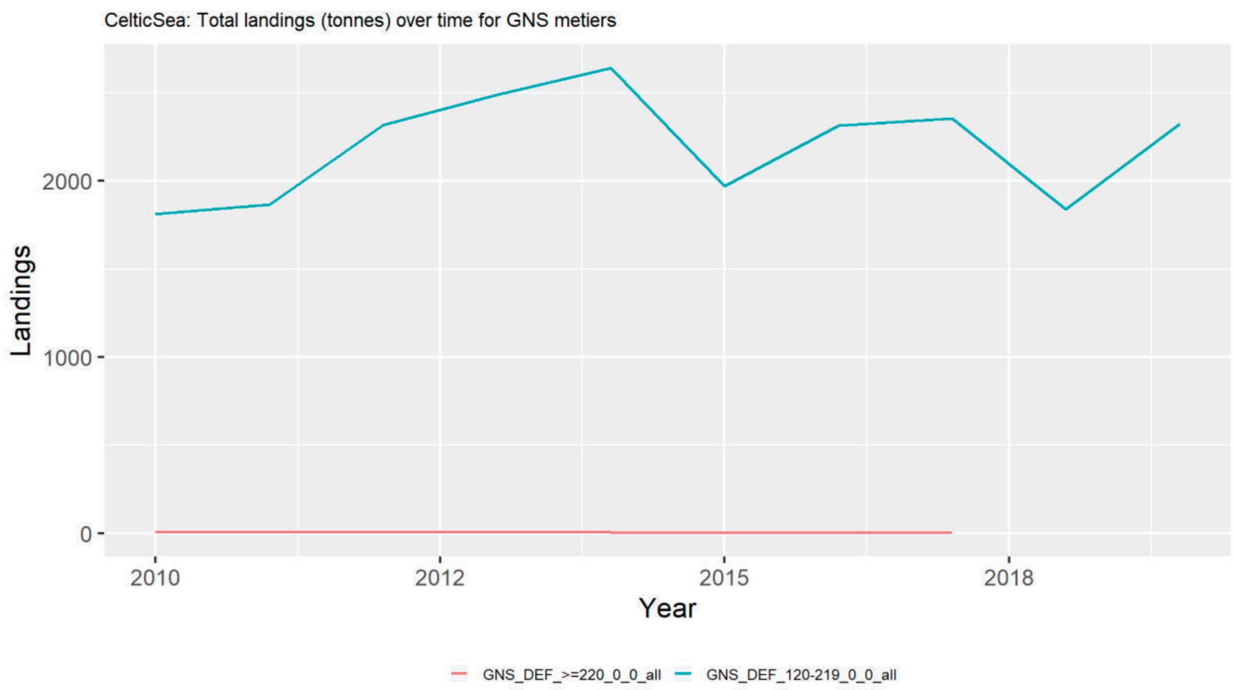
(continued...)

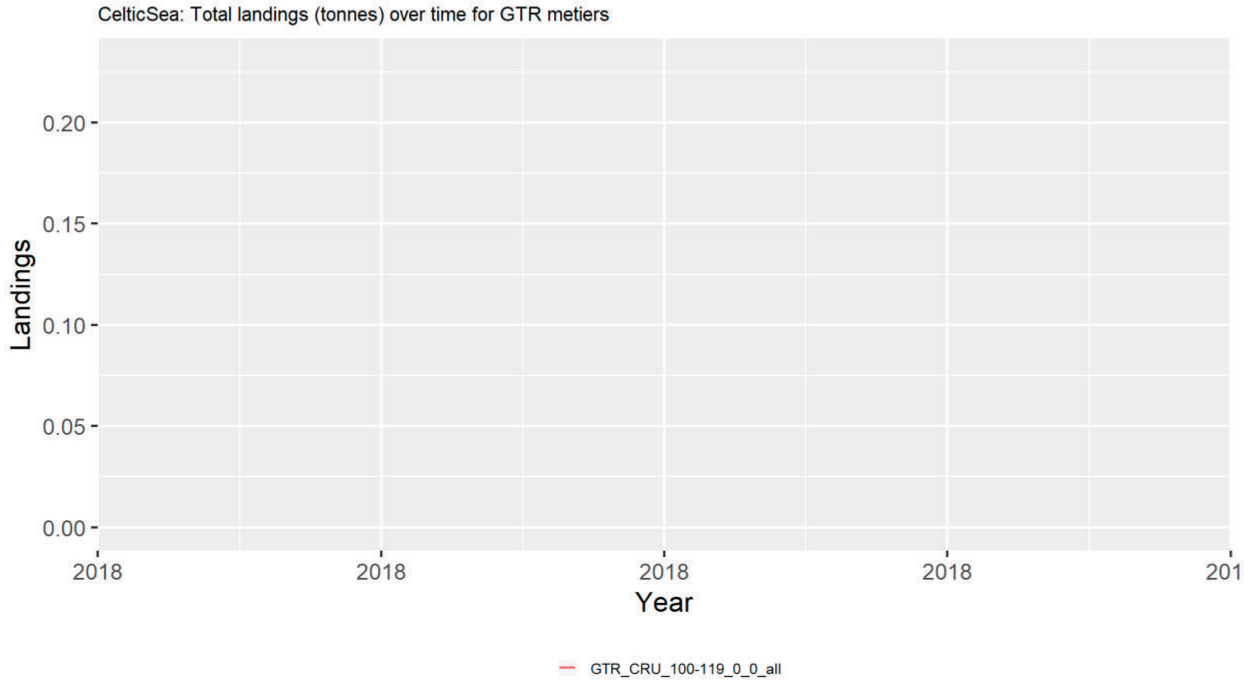
Table 18: Celtic Sea: Total landings by species by year (tonnes) *(continued)*

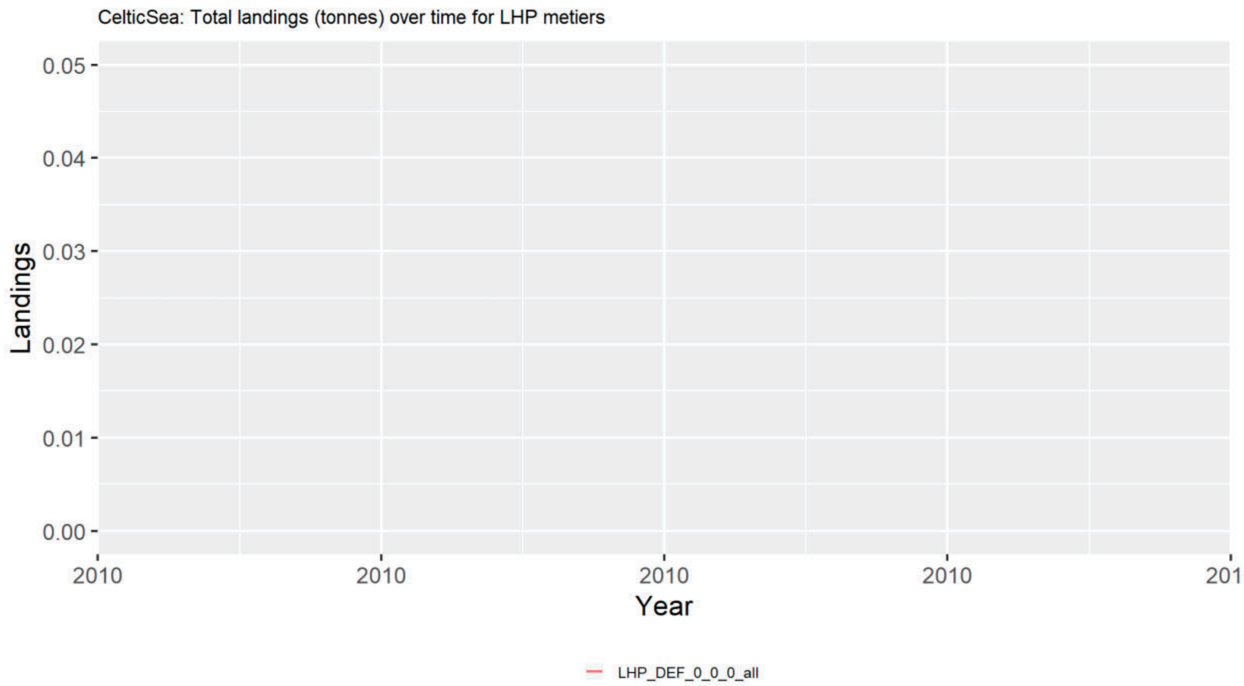
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NEP.FU.17	937	658	1243	1390	820	528	946	805	451	154
NEP.FU.19	615	589	783	747	452	515	659	672	159	180
NEP.FU.2021	715	635	787	875	1366	1672	1593	1100	1219	2129
NEP.FU.22	2234	1545	2538	2061	2416	2203	2955	2858	1566	1737
NEP.OUT.7	50	102	129	117	102	235	386	470	92	105
NOP	-	-	-	-	-	-	-	-	-	0
OTH	113783	40585	76831	71734	55886	30945	26610	15163	15936	18472
PLE	156	155	194	148	148	100	102	117	93	107
POK	302	681	969	1357	1034	655	702	578	336	144
POL	910	931	1125	1224	1074	1030	905	645	463	428
RJA	466	551	575	451	495	489	562	615	554	541
RJU	-	-	-	-	-	-	-	-	3	-
SDV	42	25	40	38	31	18	35	16	22	31
SOL	132	116	154	158	137	135	157	137	105	121
SPR	2436	1767	2655	1885	2311	3572	3248	2629	2459	6991
TUR	134	144	185	159	150	141	204	211	173	163
WHB	4563	568	1360	7891	11169	15503	23648	23235	30600	8768
WHG	4295	4692	5814	6860	6857	6431	7710	6310	4595	2645
WIT	356	390	504	618	483	425	502	515	599	495

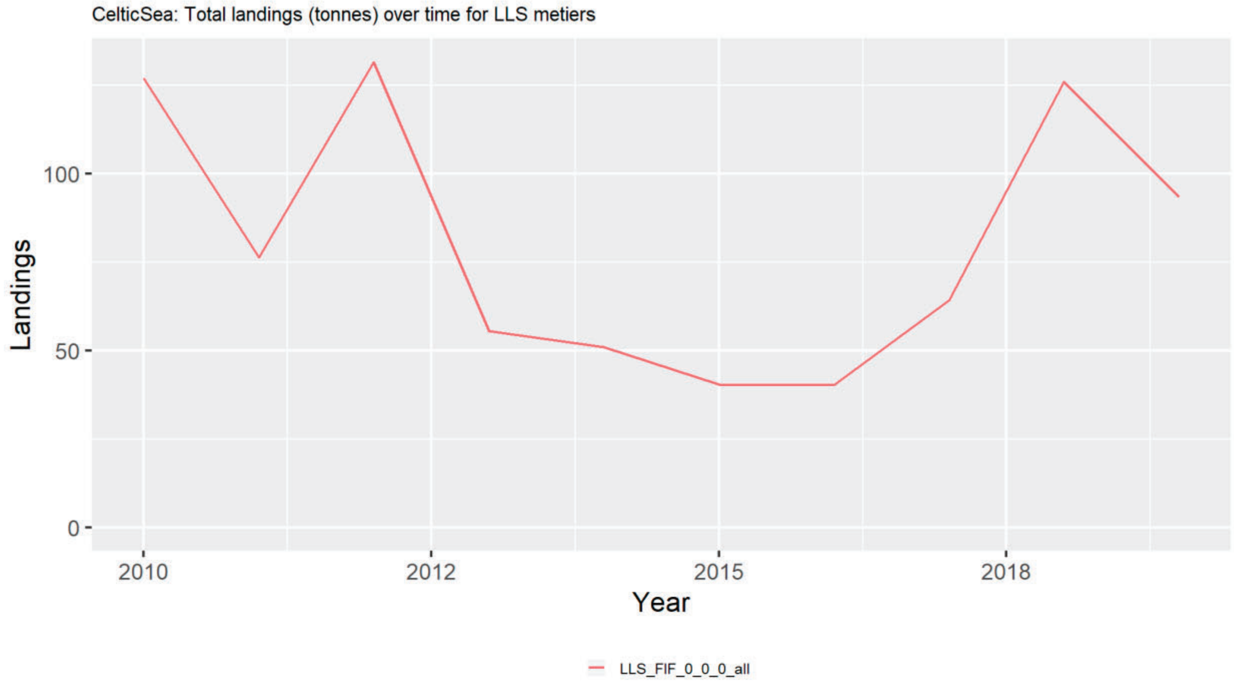

CelticSea: Total landings (tonnes) over time for DRB metiers
1200
900
600
300
0
Landings
2010
2012
2015
2018
Year
DRB_MOL_0_0_0_all

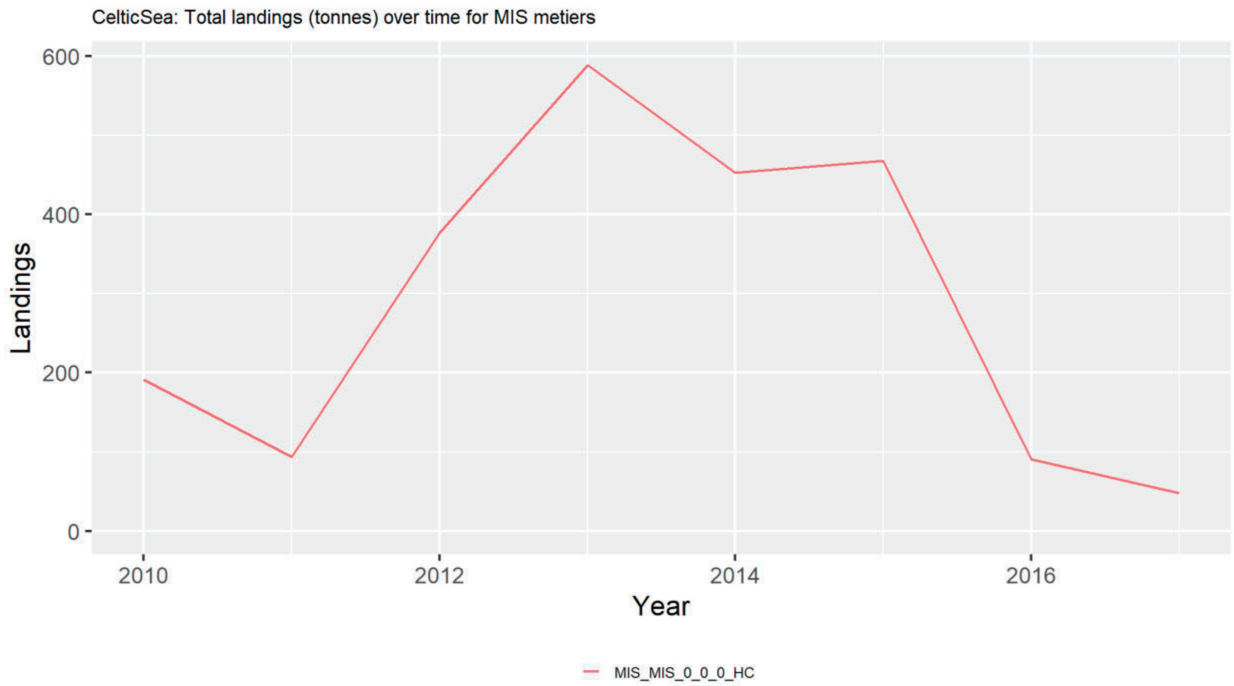

CelticSea: Total landings (tonnes) over time for FPO metiers
Landings
1500
1000
500
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all

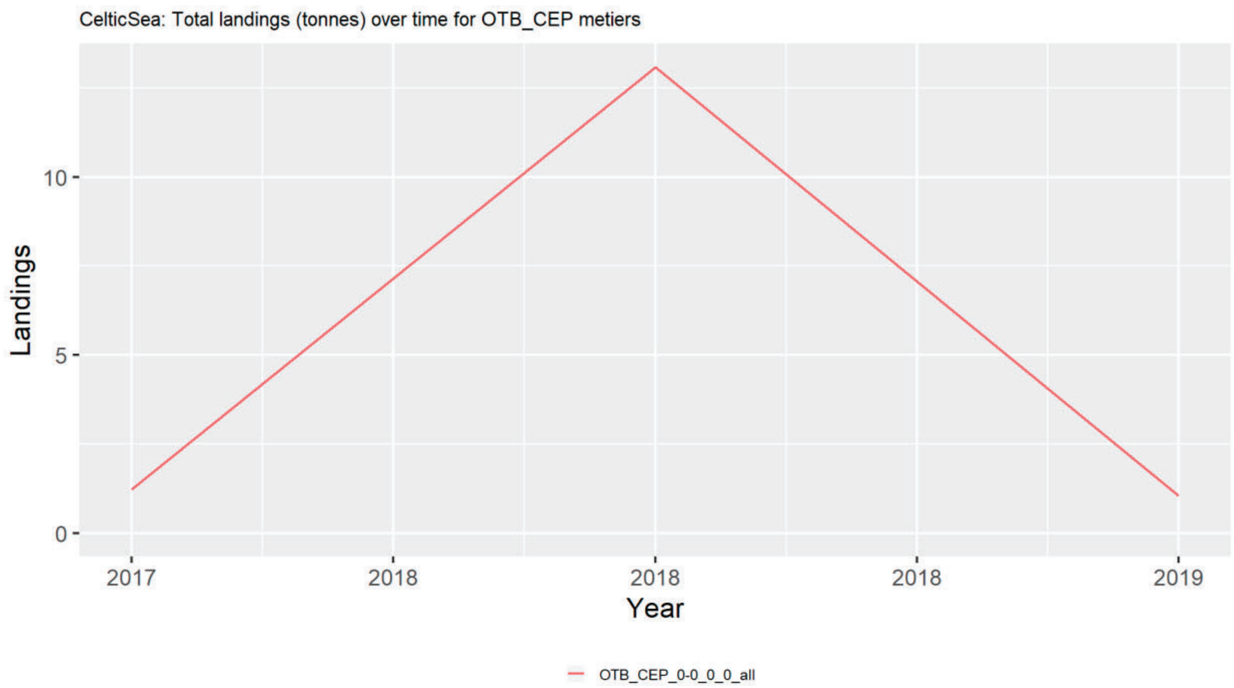

CelticSea: Total landings (tonnes) over time for GNS metiers
Landings
2000
1000
0
2010
2012
2015
2018
Year
GNS_DEF_>=220_0_0_all
GNS_DEF_120-219_0_0_all

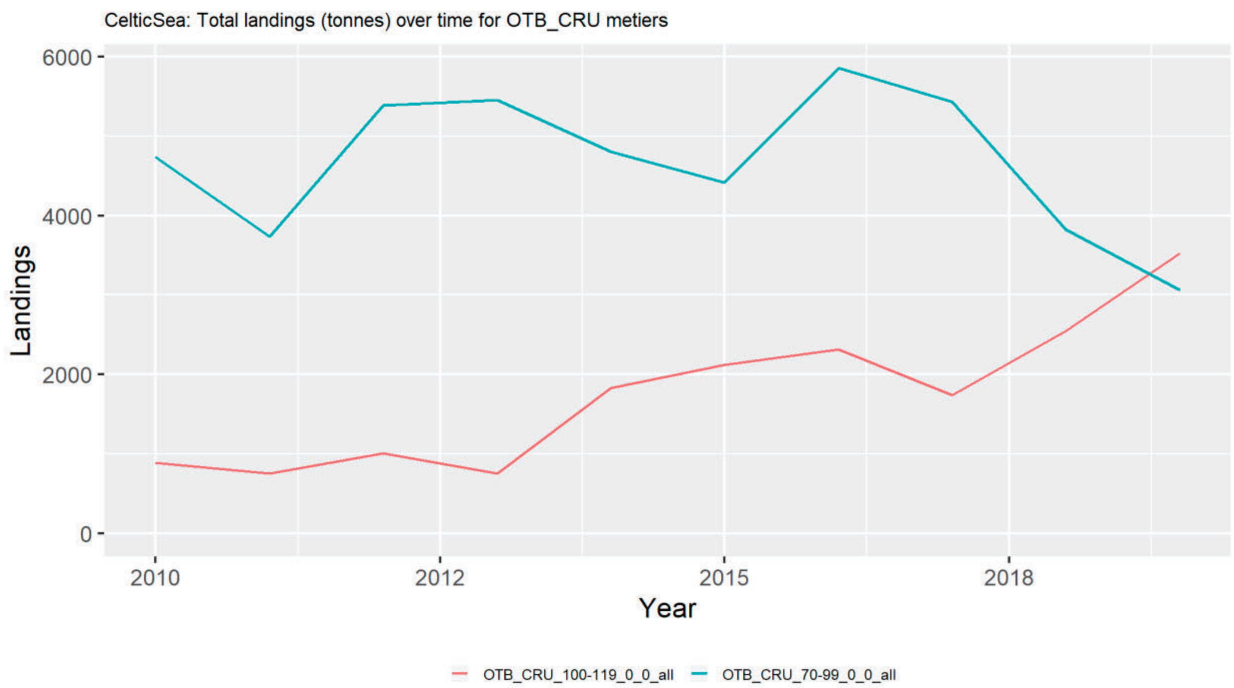

CelticSea: Total landings (tonnes) over time for GTR metiers
Landings
0.20
0.15
0.10
0.05
0.00
2018
2018
2018
2018
201
Year
GTR_CRU_100-119_0_0_all

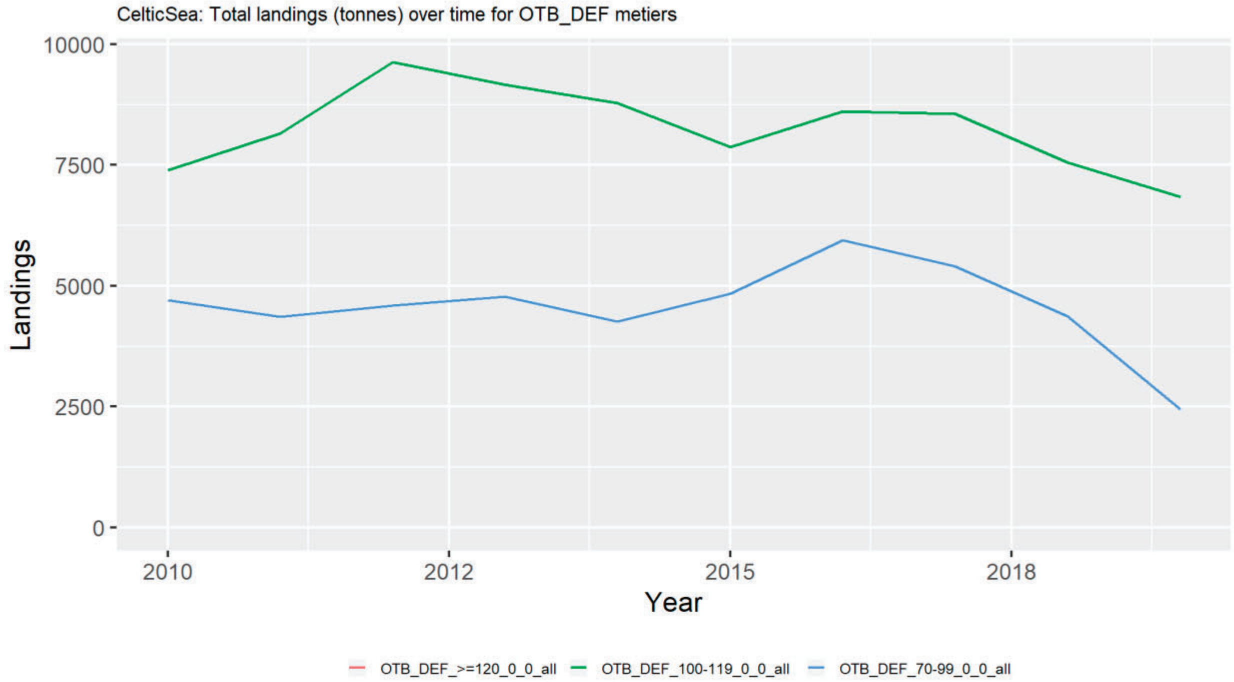

CelticSea: Total landings (tonnes) over time for LHP metiers
Landings
0.05
0.04
0.03
0.02
0.01
0.00
2010
2010
2010
2010
201
Year
LHP_DEF_0_0_0_all

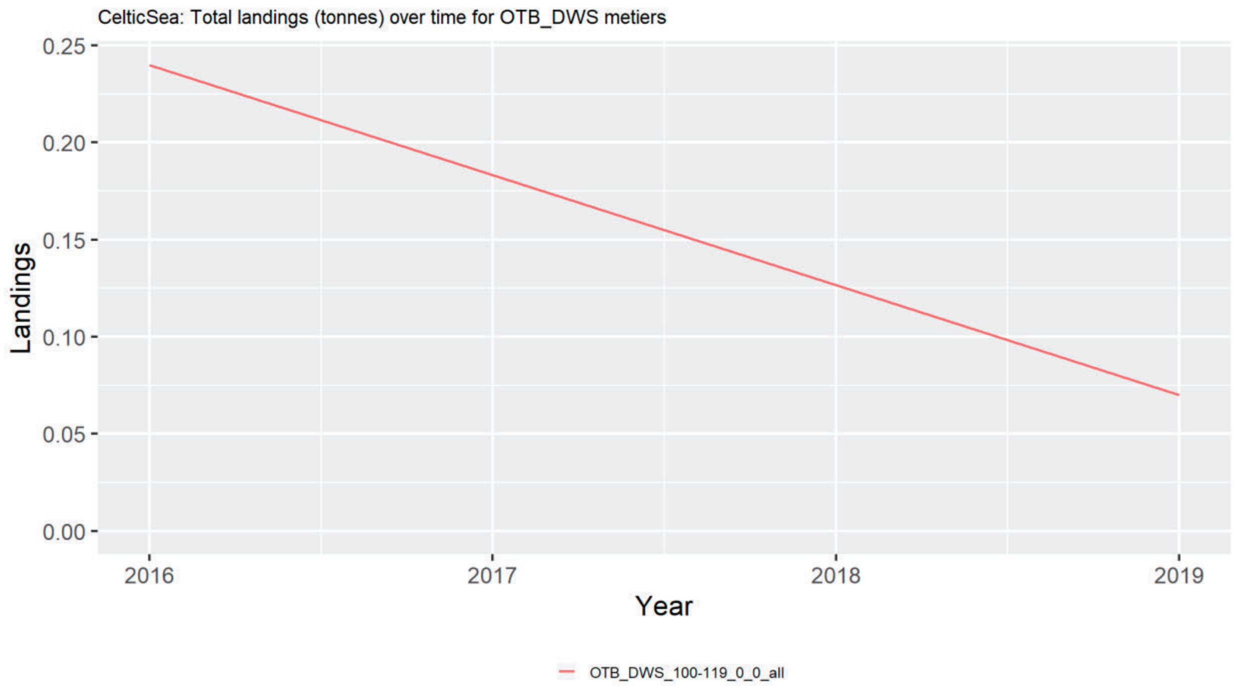

CelticSea: Total landings (tonnes) over time for LLS metiers
Landings
100
50
0
2010
2012
2015
2018
Year
LLS_FIF_0_0_0_all

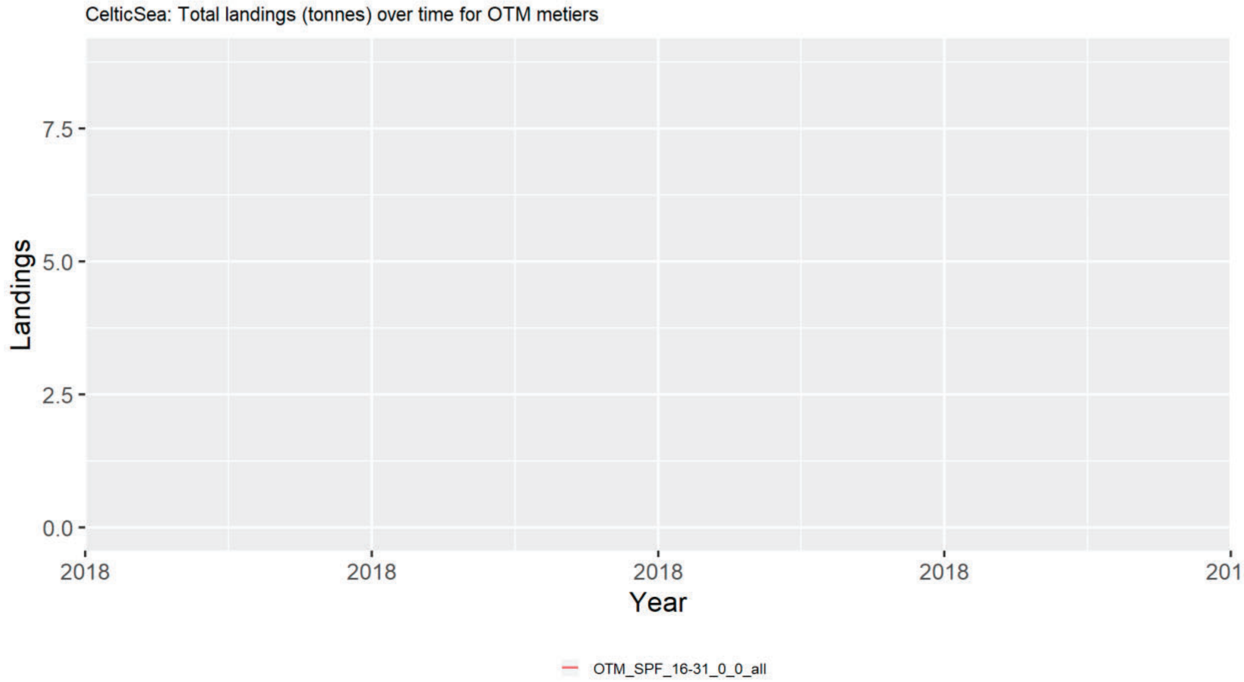

CelticSea: Total landings (tonnes) over time for MIS metiers
Landings
600
400
200
0
2010
2012
2014
2016
Year
MIS_MIS_0_0_0_HC

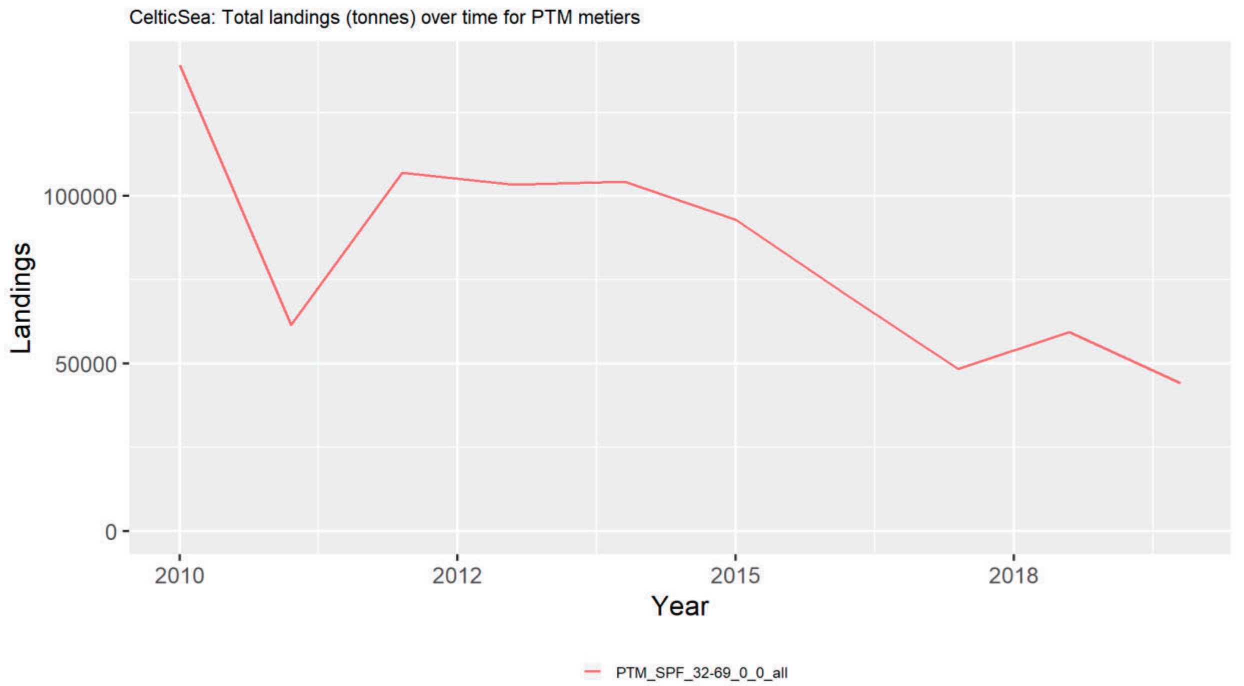

CelticSea: Total landings (tonnes) over time for OTB_CEP metiers
Landings
10
5
0
2017
2018
2018
2018
2019
Year
OTB_CEP_0-0_0_0_all

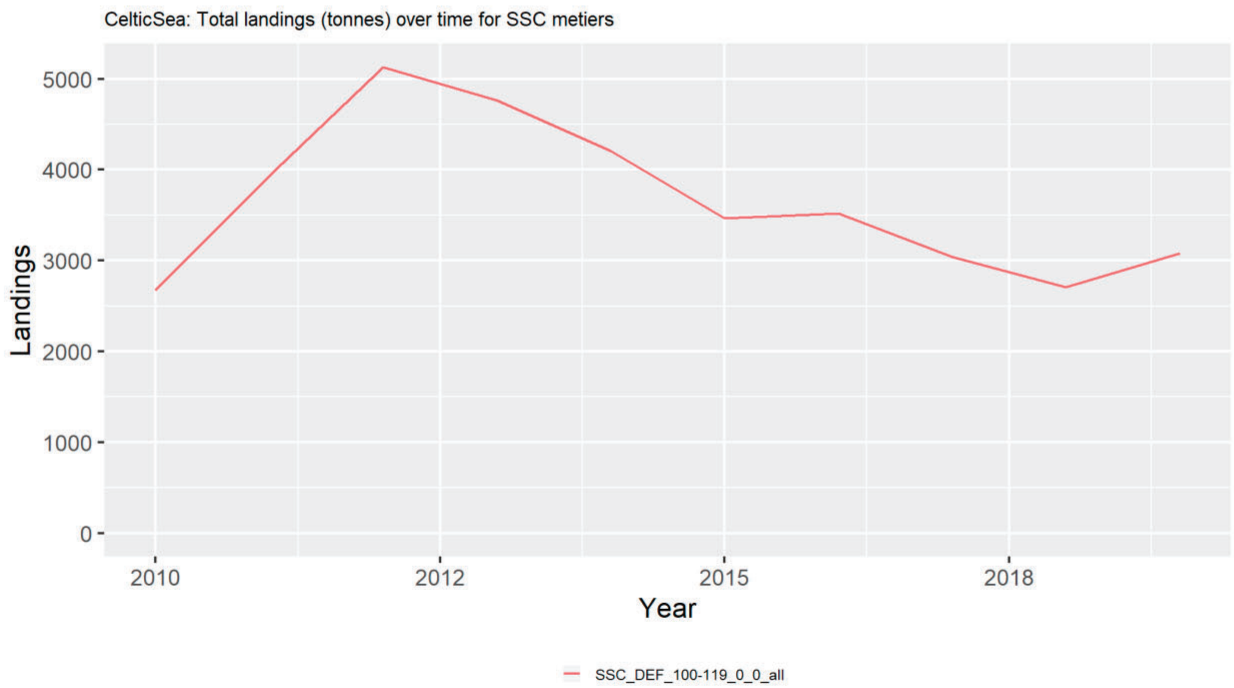

CelticSea: Total landings (tonnes) over time for OTB_CRU metiers
Landings
6000
4000
2000
0
2010
2012
2015
2018
Year
OTB_CRU_100-119_0_0_all
OTB_CRU_70-99_0_0_all

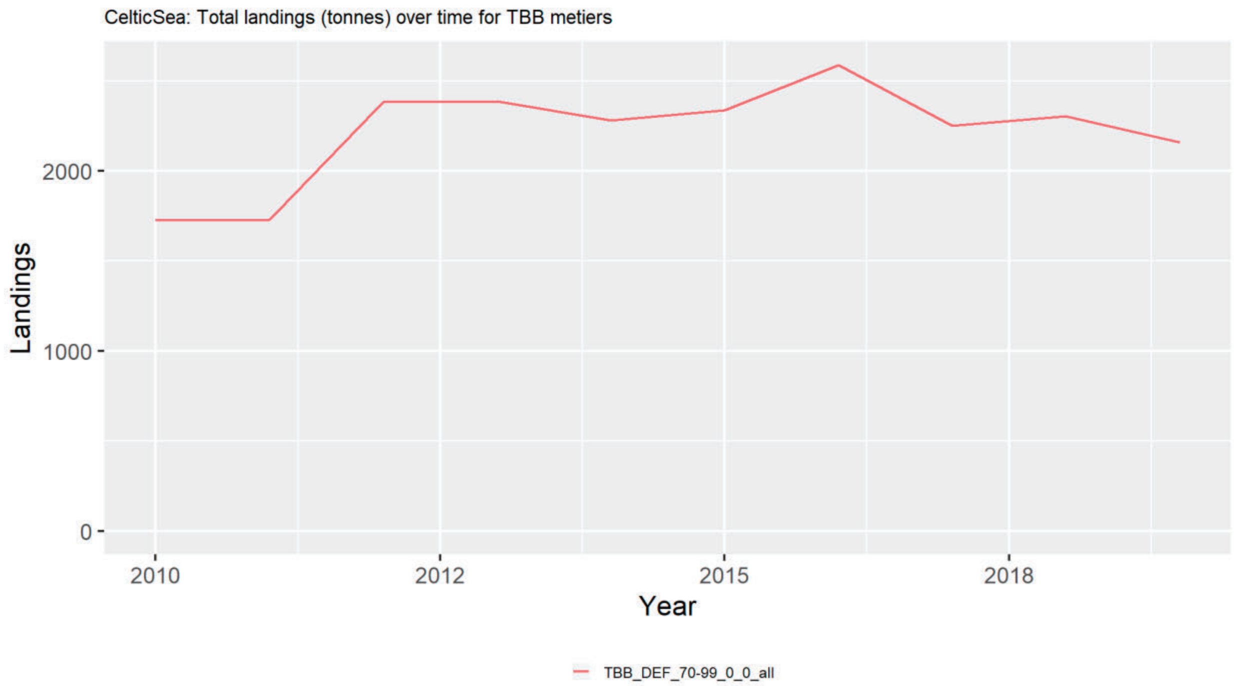

CelticSea: Total landings (tonnes) over time for OTB_DEF metiers
10000
7500
5000
2500
0
Landings
2010
2012
2015
2018
Year
OTB_DEF_>=120_0_0_all
OTB_DEF_100-119_0_0_all
OTB_DEF_70-99_0_0_all

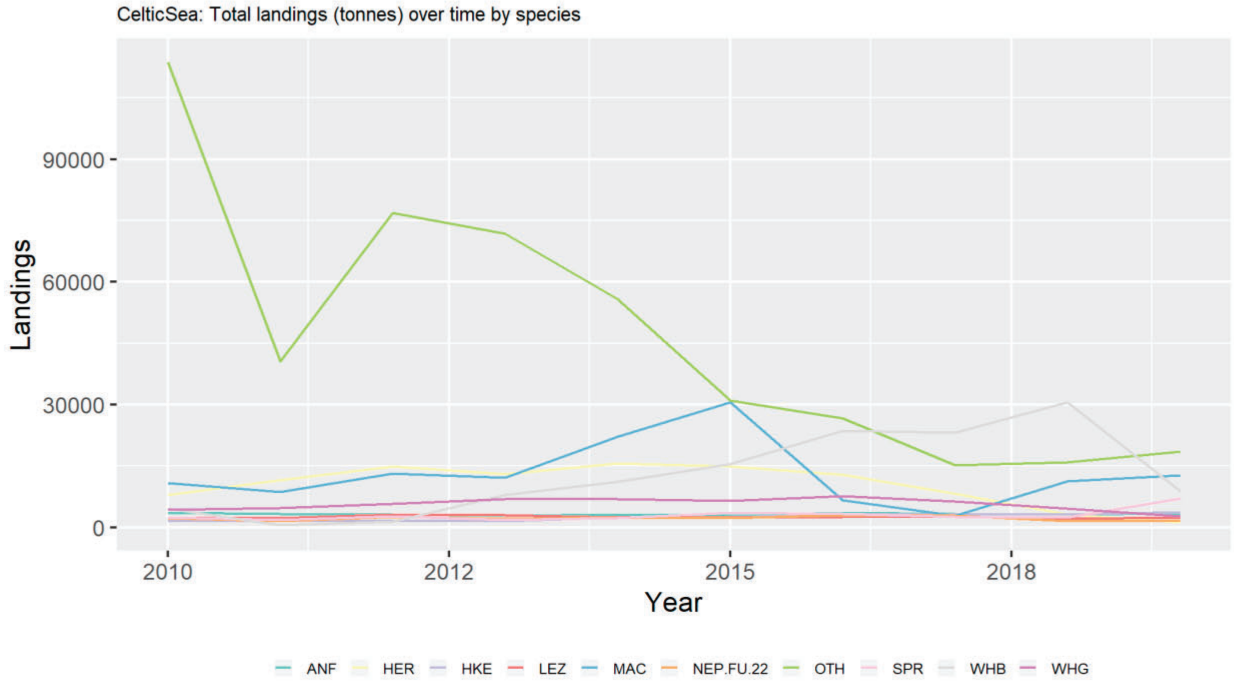

CelticSea: Total landings (tonnes) over time for OTB_DWS metiers
0.25
0.20
0.15
0.10
0.05
0.00
Landings
2016
2017
2018
2019
Year
OTB_DWS_100-119_0_0_all

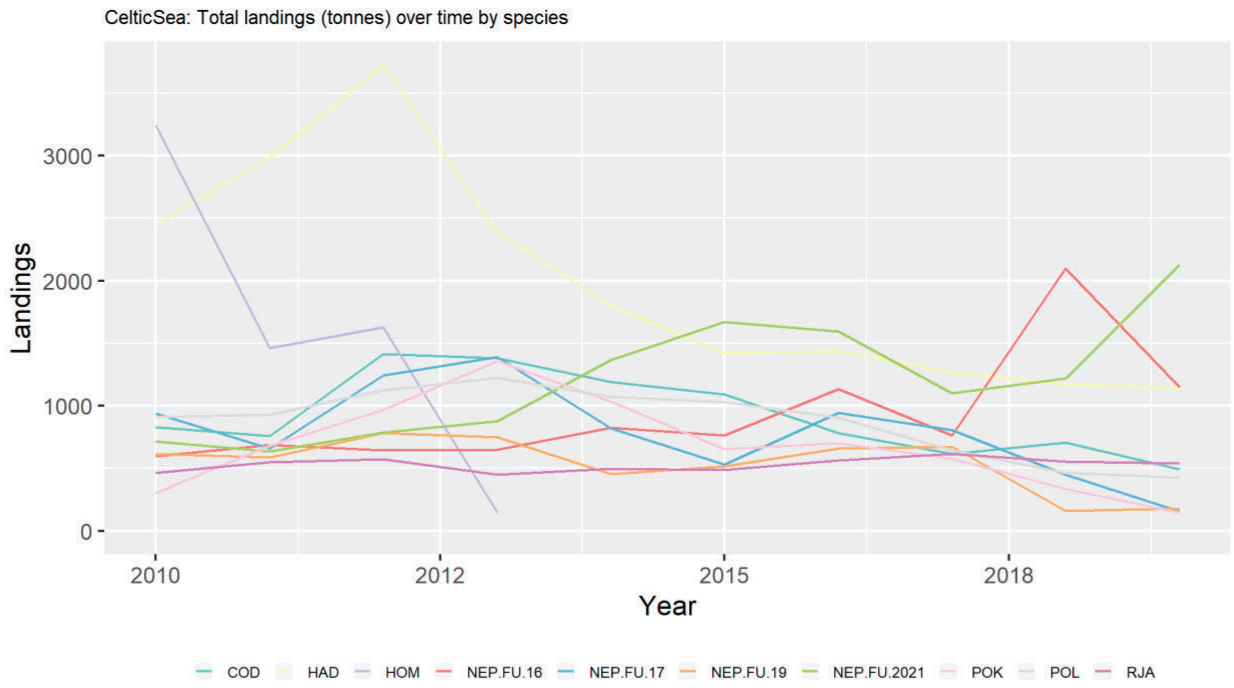

CelticSea: Total landings (tonnes) over time for OTM metiers
Landings
7.5
5.0
2.5
0.0
2018
2018
2018
2018
201
Year
OTM_SPF_16-31_0_0_all

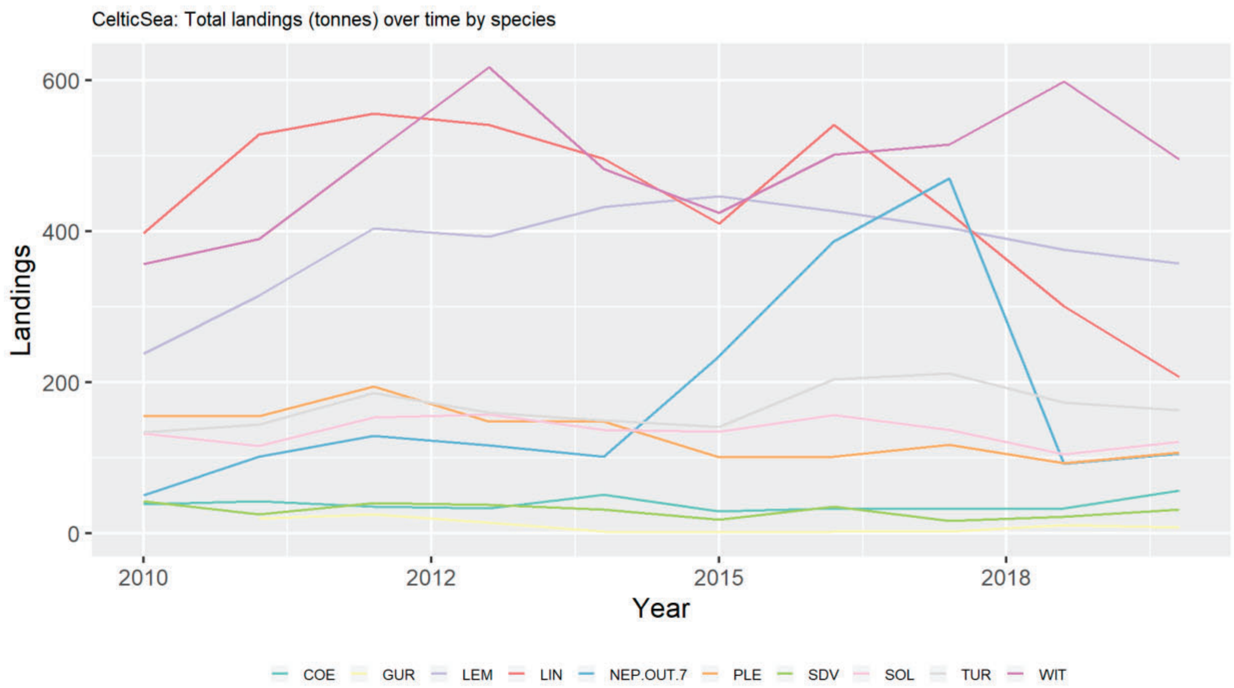

CelticSea: Total landings (tonnes) over time for PTM metiers
Landings
100000
50000
0
2010
2012
2015
2018
Year
PTM_SPF_32-69_0_0_all

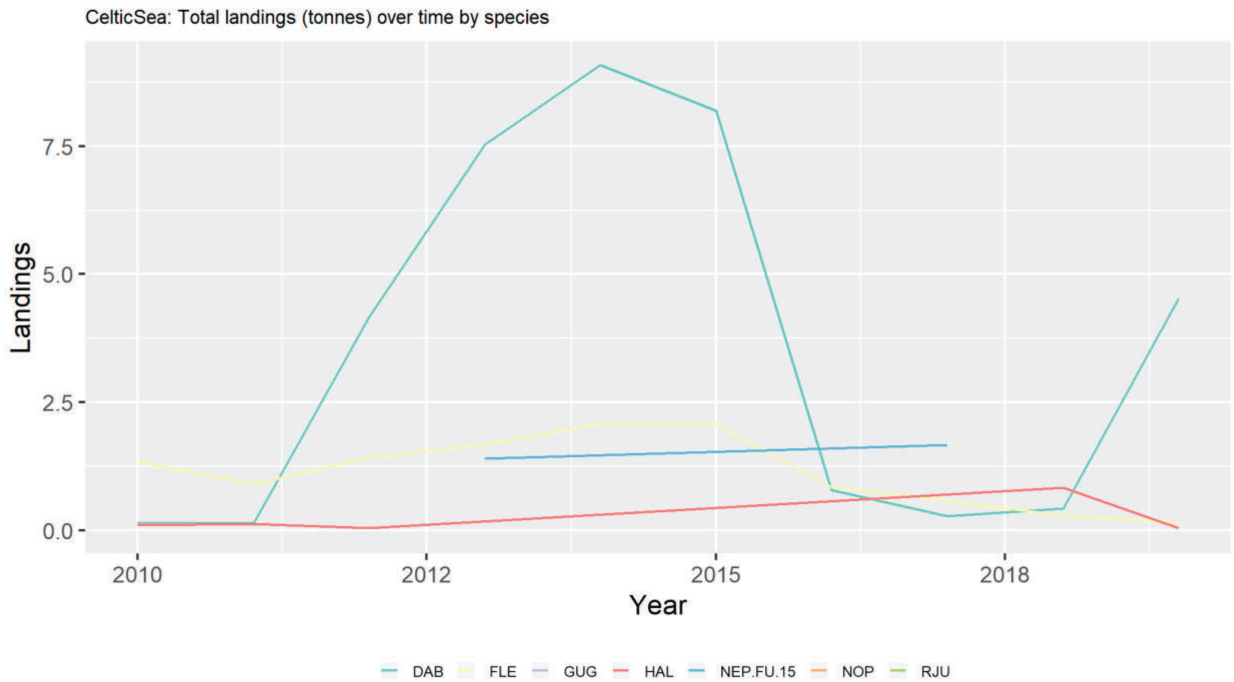

CelticSea: Total landings (tonnes) over time for SSC metiers
Landings
5000
4000
3000
2000
1000
0
2010
2012
2015
2018
Year
SSC_DEF_100-119_0_0_all


CelticSea: Total landings (tonnes) over time for TBB metiers
Landings
2000
1000
0
2010
2012
2015
2018
Year
TBB_DEF_70-99_0_0_all


CelticSea: Total landings (tonnes) over time by species
Landings
90000
60000
30000
0
2010
2012
2015
2018
Year
ANF
HER
HKE
LEZ
MAC
NEP.FU.22
OTH
SPR
WHB
WHG


CelticSea: Total landings (tonnes) over time by species
Landings
3000
2000
1000
0
2010
2012
2015
2018
Year
COD
HAD
HOM
NEP.FU.16
NEP.FU.17
NEP.FU.19
NEP.FU.2021
POK
POL
RJA


CelticSea: Total landings (tonnes) over time by species
Landings
600
400
200
0
2010
2012
2015
2018
Year
COE
GUR
LEM
LIN
NEP.OUT.7
PLE
SDV
SOL
TUR
WIT


CelticSea: Total landings (tonnes) over time by species
Landings
7.5
5.0
2.5
0.0
2010
2012
2015
2018
Year
DAB
FLE
GUG
HAL
NEP.FU.15
NOP
RJU

Iberian Waters

Table 19: Iberian Waters: Total landings by metiers by year (tonnes)

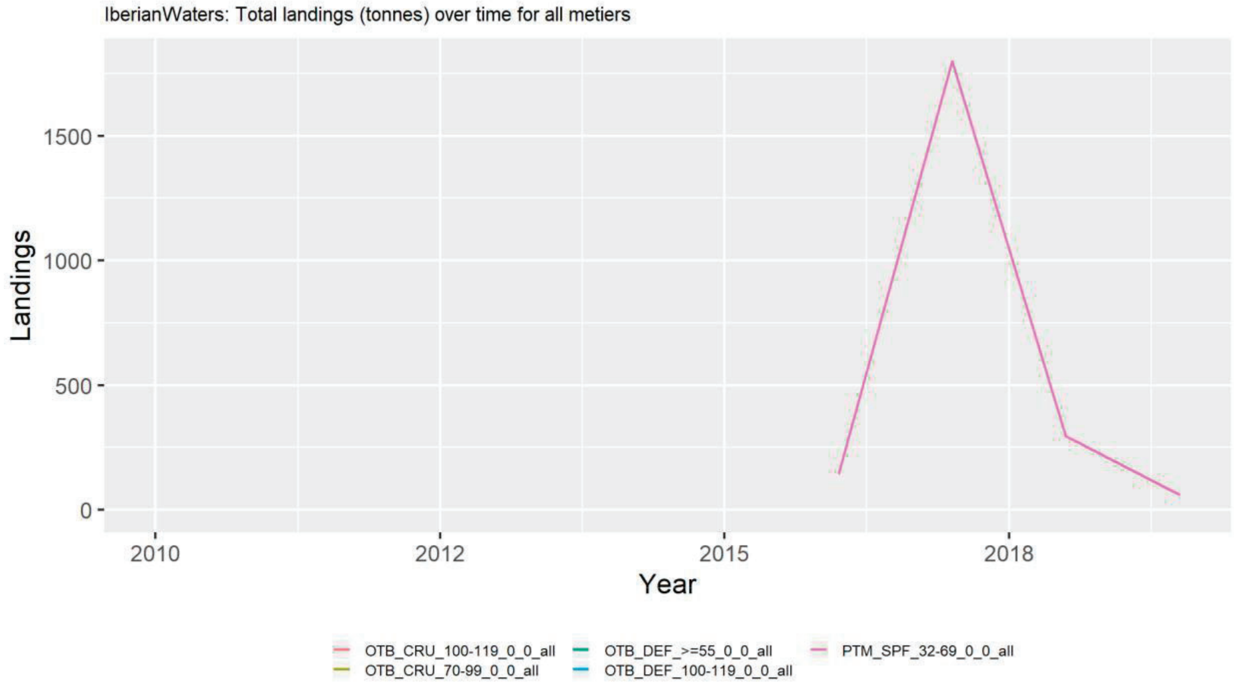
	2010	2011	2016	2017	2018	2019
OTB_CRU_100-119_0_0_all	-	-	1	-	-	-
OTB_CRU_70-99_0_0_all	-	0	-	-	-	-
OTB_DEF_>=55_0_0_all	0	-	-	-	-	-
OTB_DEF_100-119_0_0_all	-	-	-	-	-	0
PTM_SPF_32-69_0_0_all	-	-	143	1800	296	59

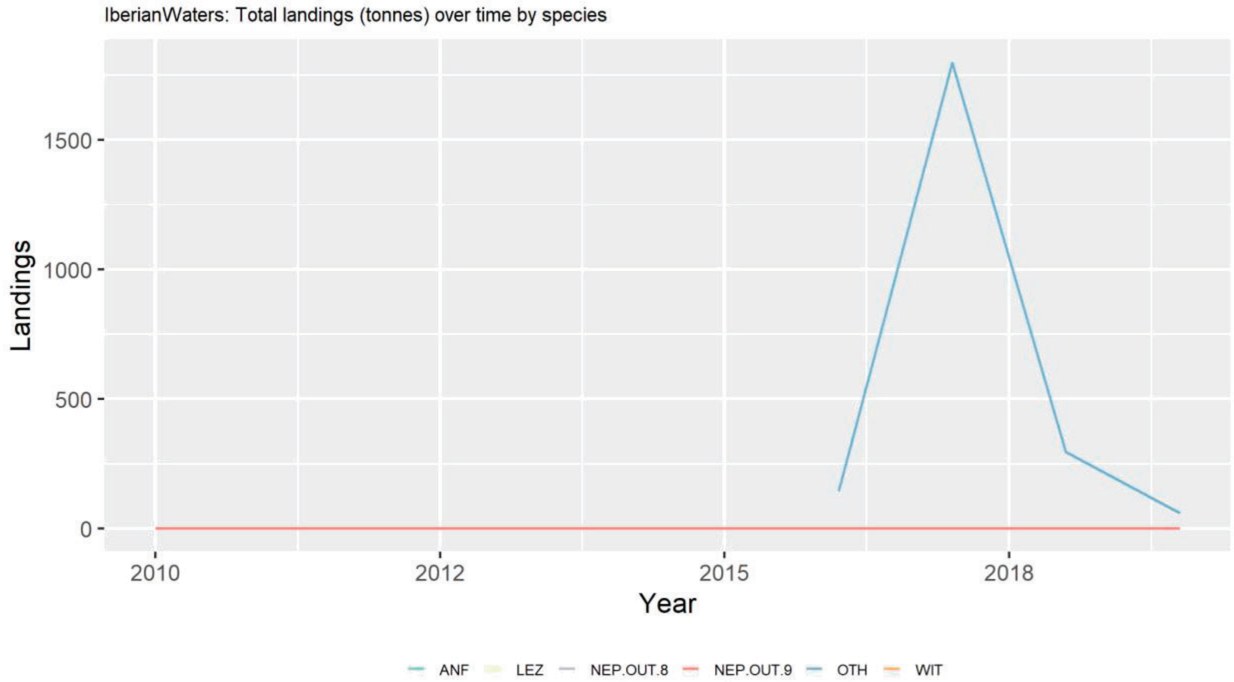
Table 20: Iberian Waters: Total landings by area by year (tonnes)

	2010	2011	2016	2017	2018	2019
27.8.c	-	0	143	1800	296	59
27.9.a	0	-	-	-	-	0

Table 21: Iberian Waters: Total landings by species by year (tonnes)

	2010	2011	2016	2017	2018	2019
ANF	-	0	-	-	-	-
LEZ	0	-	-	-	-	-
NEP.OUT.8	-	-	1	-	-	-
NEP.OUT.9	0	-	-	-	-	0
OTH	-	-	143	1800	296	59
WIT	-	-	0	-	-	-


IberianWaters: Total landings (tonnes) over time for all metiers
Landings
1500
1000
500
0
2010
2012
2015
2018
Year
OTB_CRU_100-119_0_0_all
OTB_CRU_70-99_0_0_all
OTB_DEF_>=55_0_0_all
OTB_DEF_100-119_0_0_all
PTM_SPF_32-69_0_0_all


IberianWaters: Total landings (tonnes) over time by species
Landings
1500
1000
500
0
2010
2012
2015
2018
Year
ANF
LEZ
NEP.OUT.8
NEP.OUT.9
OTH
WIT

Irish Sea

Table 22: Irish Sea: Total landings by metiers by year (tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	3440	2034	2524	2230	2492	1979	2003	2077	1272	1843
FPO_CRU_0_0_0_all	230	211	132	103	117	99	316	326	354	335
FPO_MOL_0_0_0_all	2254	2575	2504	1718	1268	1521	1896	2349	1967	2223
GNS_DEF_120-219_0_0_all	142	115	80	21	44	18	34	15	39	8
LLS_FIF_0_0_0_all	1	1	18	-	0	0	-	-	-	0
MIS_MIS_0_0_0_HC	35	56	261	51	93	36	-	-	-	-
OTB_CRU_100-119_0_0_all	-	-	-	1	-	-	-	-	-	-
OTB_CRU_70-99_0_0_all	2803	3887	4171	2567	3009	2376	1820	1290	1551	1750
OTB_DEF_100-119_0_0_all	805	690	583	804	771	624	805	1059	1099	1434
OTB_DEF_70-99_0_0_all	2	33	27	12	6	28	9	7	6	20
PTM_SPF_32-69_0_0_all	779	1815	6522	3453	1802	4362	2870	2634	3747	4516
SSC_DEF_100-119_0_0_all	42	198	462	224	127	266	378	482	247	411
TBB_DEF_70-99_0_0_all	522	544	396	281	407	475	491	472	564	638

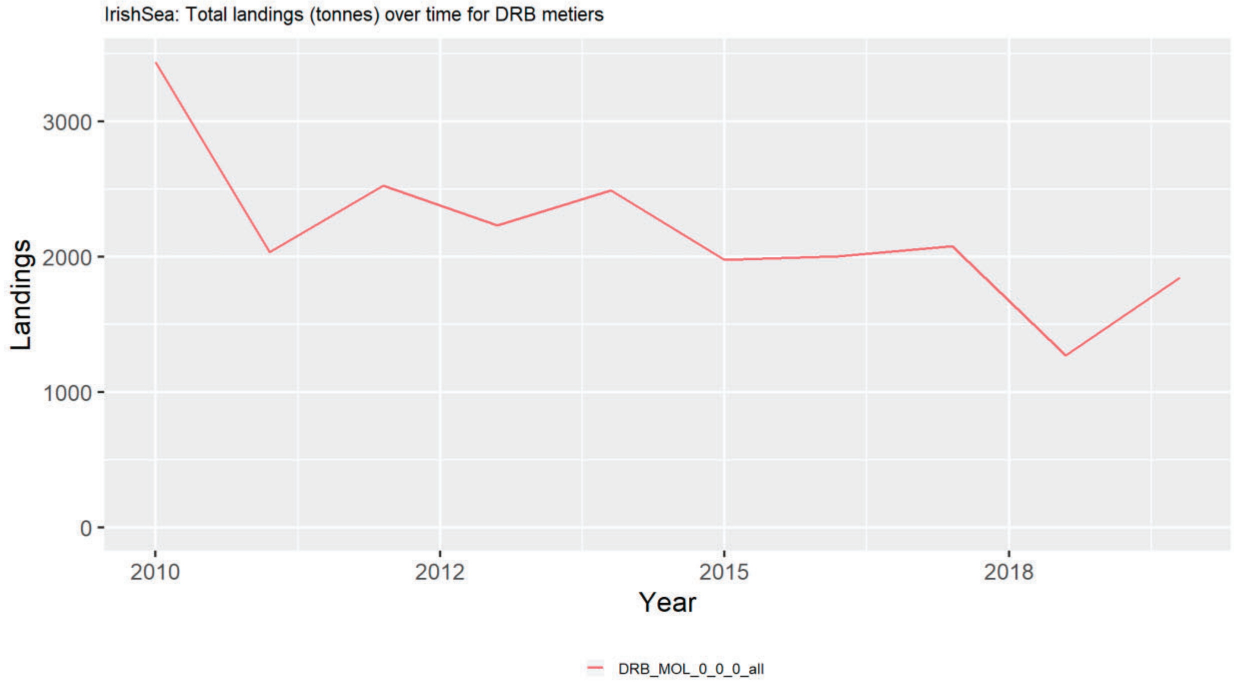
Table 23: Irish Sea: Total landings by area by year (tonnes)

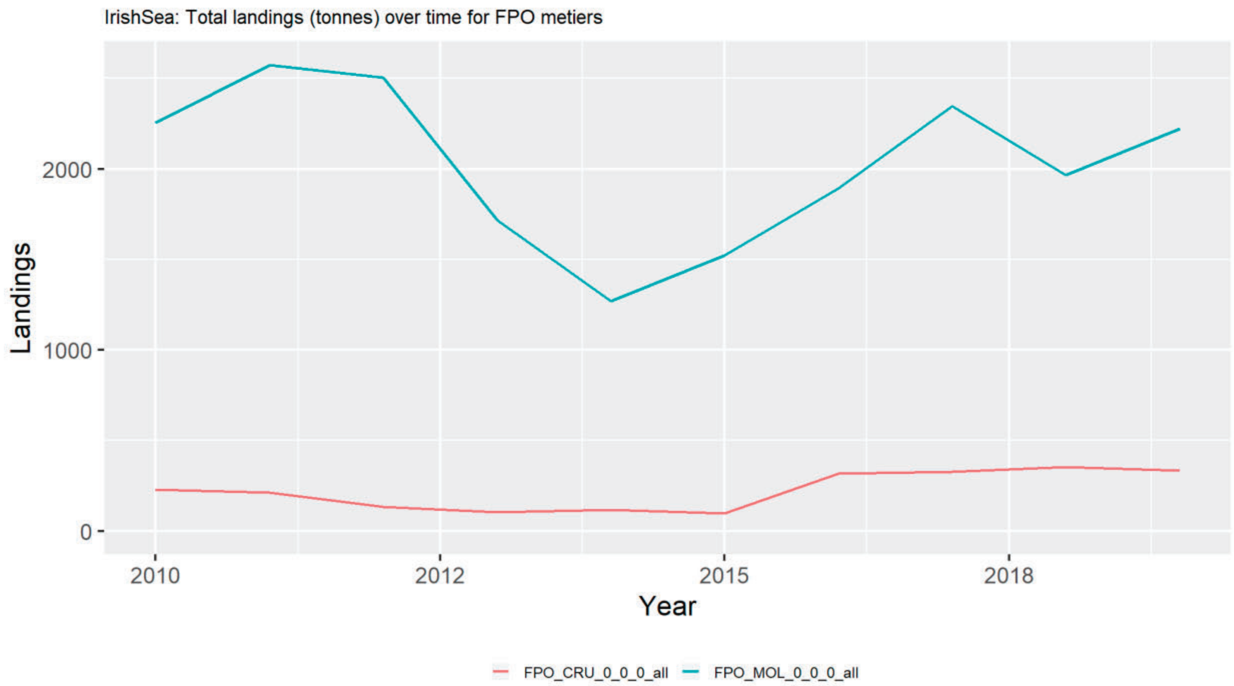
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
27.7.a	11055	12158	17680	11466	10136	11784	10623	10711	10847	13178

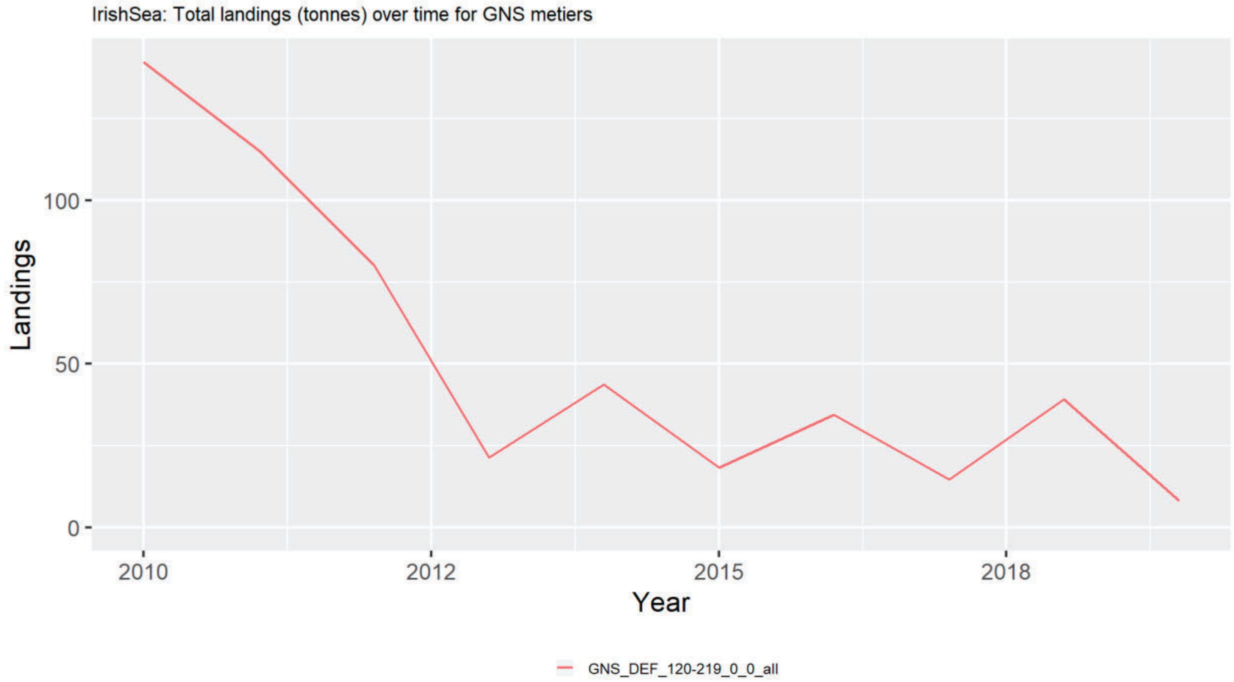
Table 24: Irish Sea: Total landings by species by year (tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ANF	80	98	69	77	119	105	108	83	123	140
COD	289	300	191	157	147	135	85	53	101	127
COE	6	3	6	5	6	10	11	12	12	9
DAB	-	-	-	-	-	0	-	-	-	-
FLE	1	-	2	-	0	2	0	0	-	-
GUR	-	0	0	1	1	1	7	7	2	1
HAD	331	428	560	491	540	506	648	1109	933	1335

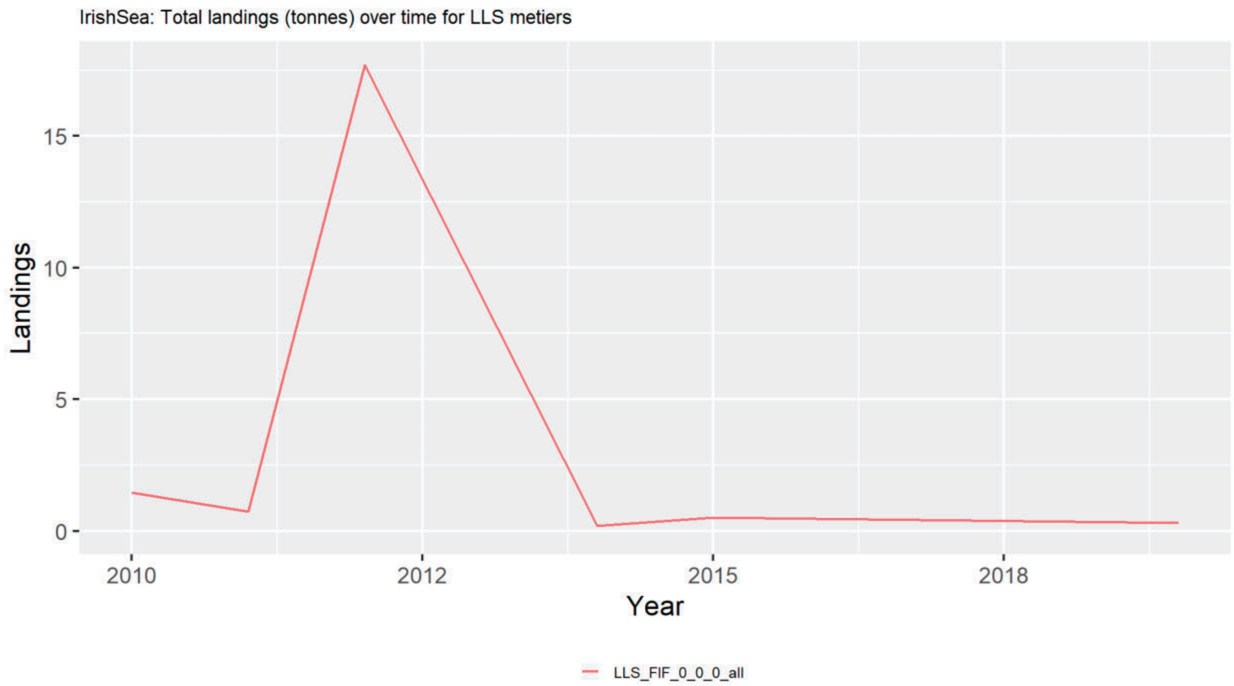
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
HER	435	511	1328	1472	1292	730	1982	1643	2786	1698
HKE	17	13	10	9	17	6	10	12	8	15
LEM	8	6	7	5	7	8	12	9	6	9
LEZ	17	13	18	13	12	5	7	8	11	11
LIN	15	23	12	6	7	7	10	9	7	3
MAC	2	1	0	16	0	1	15	5	1	-
NEP.FU.14	46	31	52	36	30	85	22	7	5	9
NEP.FU.15	2509	3611	4017	2348	2737	2060	1581	1164	1391	1598
NEP.FU.19	26	11	28	34	16	12	26	20	12	3
NEP.FU.22	-	-	-	2	1	-	-	-	-	-
NEP.OUT.7	3	6	167	76	49	42	46	7	22	18
OTH	6083	5185	5464	4143	3952	3696	4303	4912	3787	4519
PLE	88	115	106	102	120	248	547	445	312	244
POK	2	5	17	2	7	4	18	11	14	7
POL	26	37	43	23	25	35	36	22	22	12
RJA	553	497	472	404	410	341	190	166	256	394
SDV	9	4	12	6	2	7	2	0	0	1
SOL	47	48	50	40	43	32	15	14	16	55
SPR	336	1082	4972	1935	510	3632	872	941	939	2775
TUR	12	8	5	6	7	10	12	10	22	43
WHG	97	95	57	44	59	49	49	32	44	129
WIT	18	27	15	13	20	16	11	7	14	23


IrishSea: Total landings (tonnes) over time for DRB metiers
Landings
3000
2000
1000
0
2010
2012
2015
2018
Year
DRB_MOL_0_0_0_all

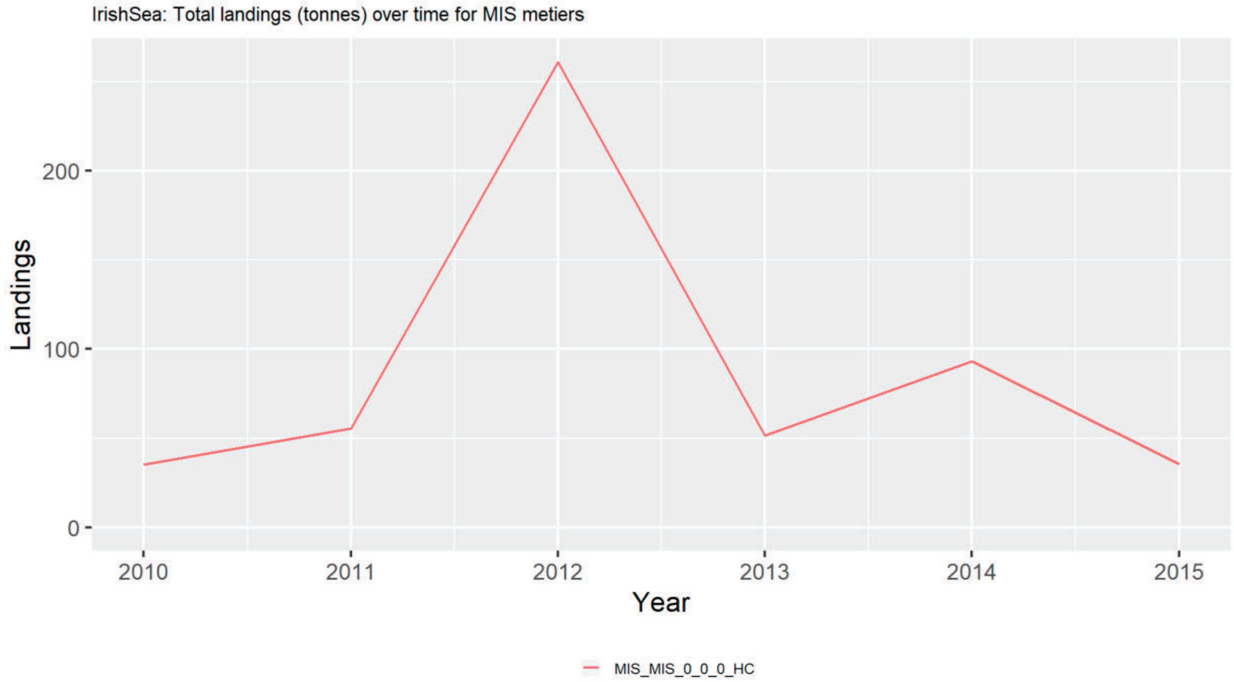

IrishSea: Total landings (tonnes) over time for FPO metiers
Landings
2000
1000
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all
FPO_MOL_0_0_0_all

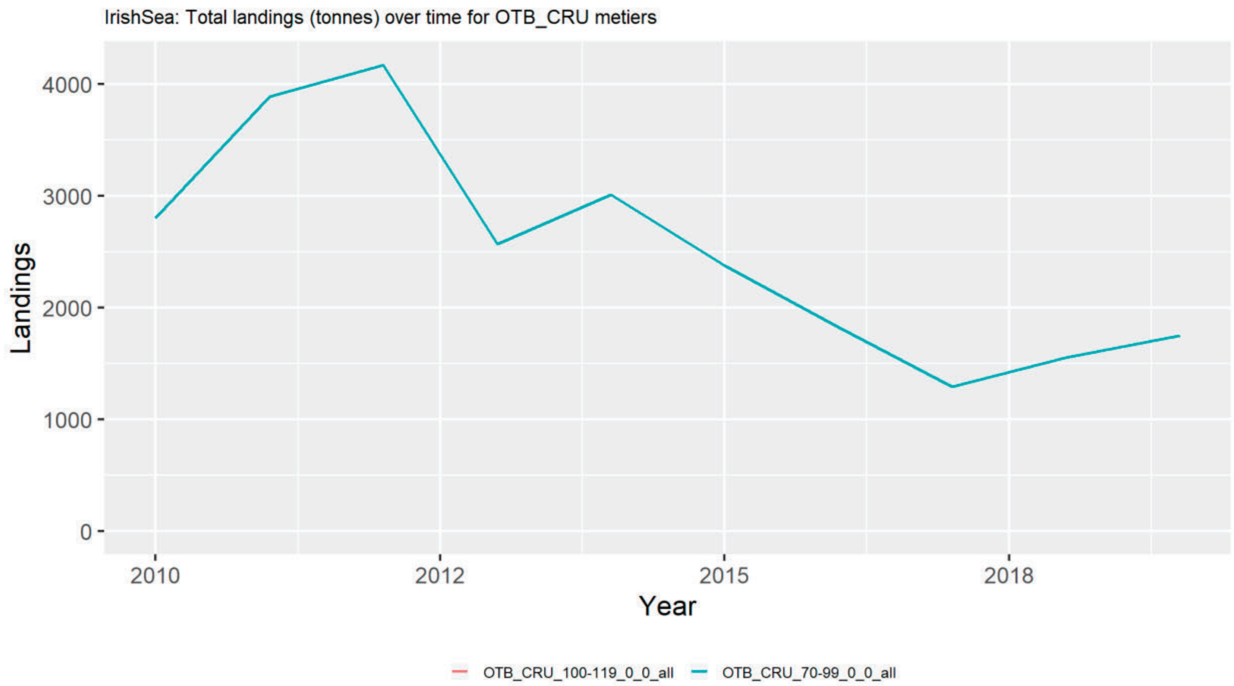


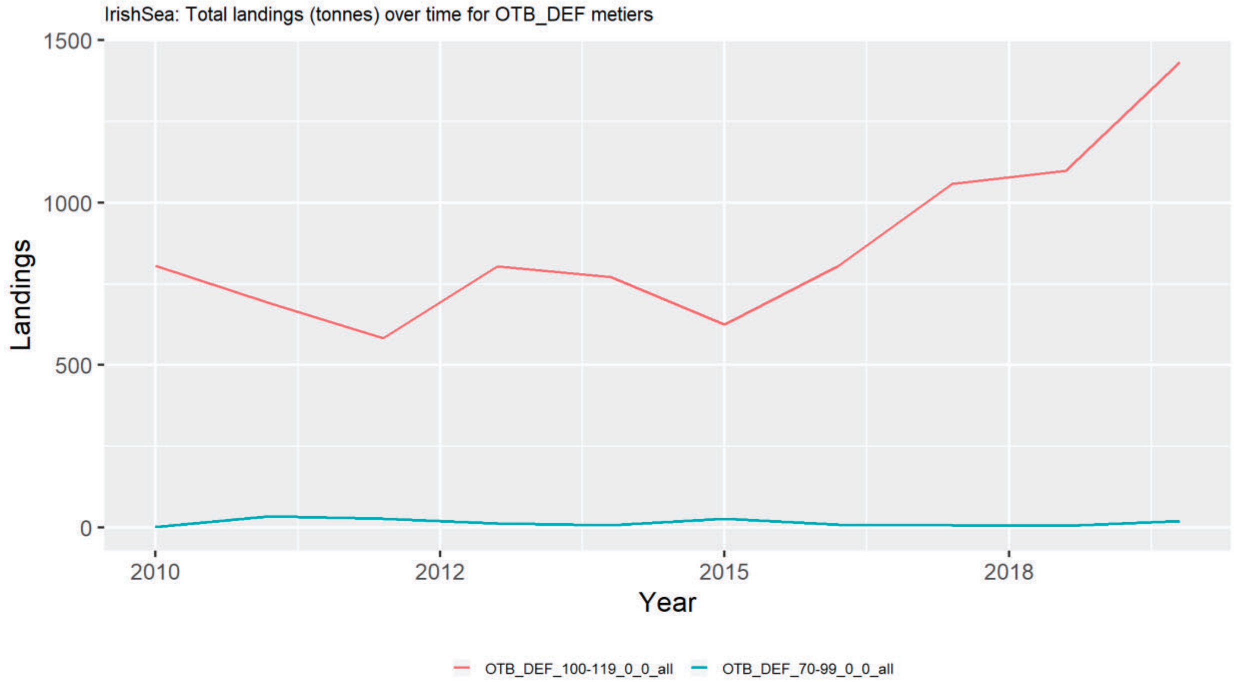
IrishSea: Total landings (tonnes) over time for GNS metiers
Landings
100
50
0
2010
2012
2015
2018
Year
GNS_DEF_120-219_0_0_all

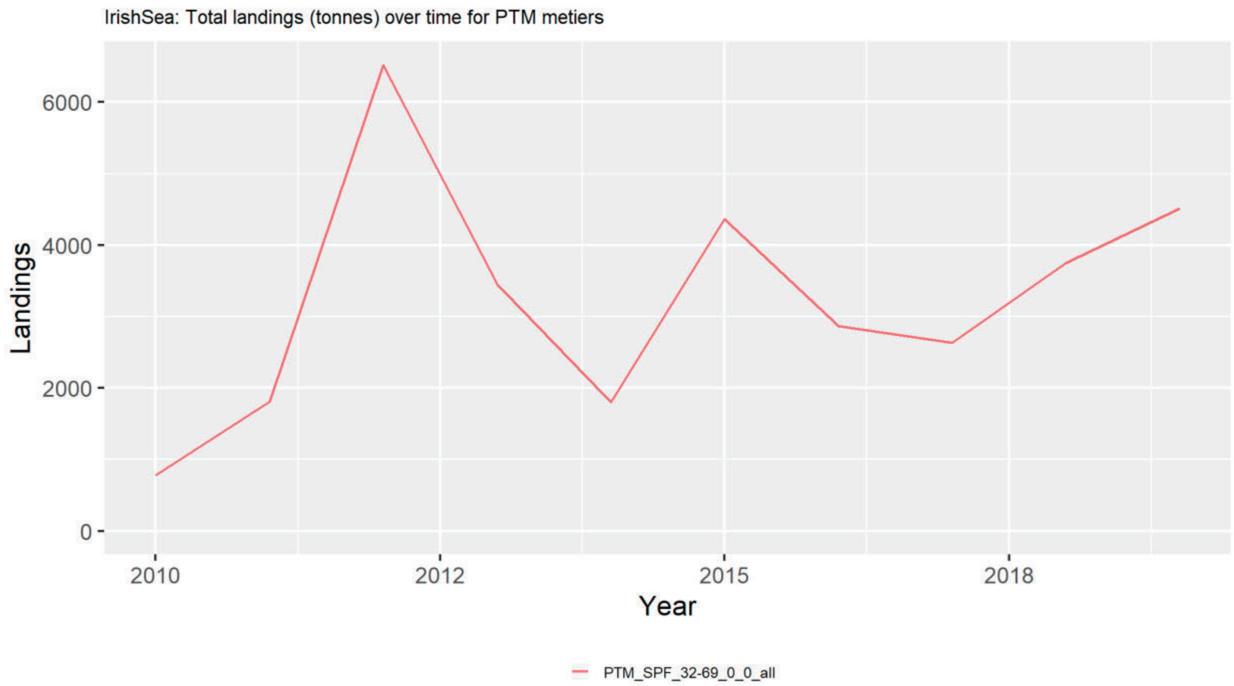


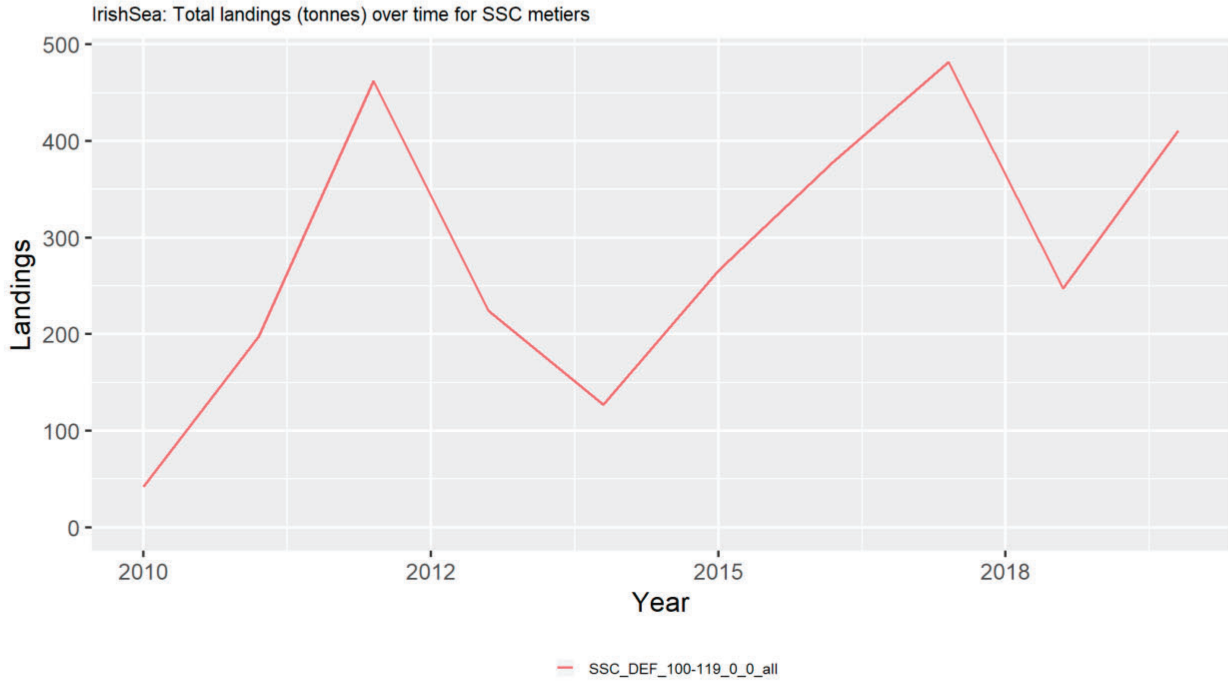
IrishSea: Total landings (tonnes) over time for LLS metiers
Landings
15
10
5
0
2010
2012
2015
2018
Year
LLS_FIF_0_0_0_all

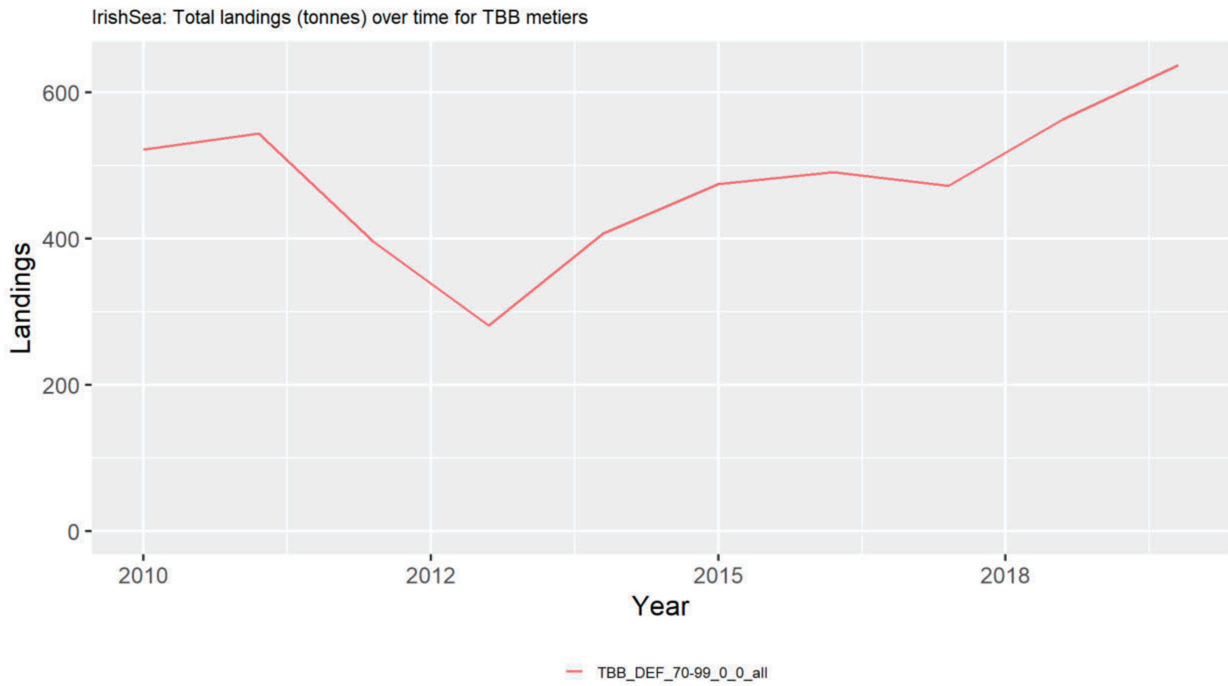

IrishSea: Total landings (tonnes) over time for MIS metiers
Landings
0
100
200
2010
2011
2012
2013
2014
2015
Year
MIS_MIS_0_0_0_HC

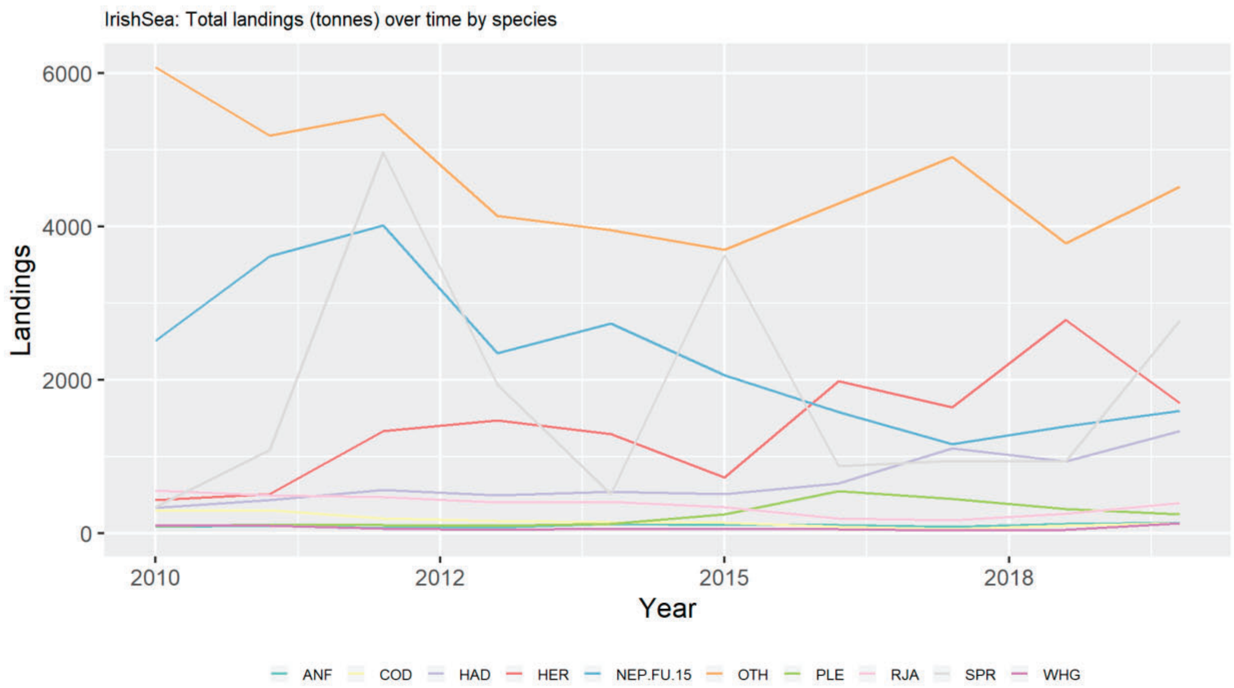

IrishSea: Total landings (tonnes) over time for OTB_CRU metiers
Landings
0
1000
2000
3000
4000
2010
2012
2015
2018
Year
OTB_CRU_100-119_0_0_all
OTB_CRU_70-99_0_0_all

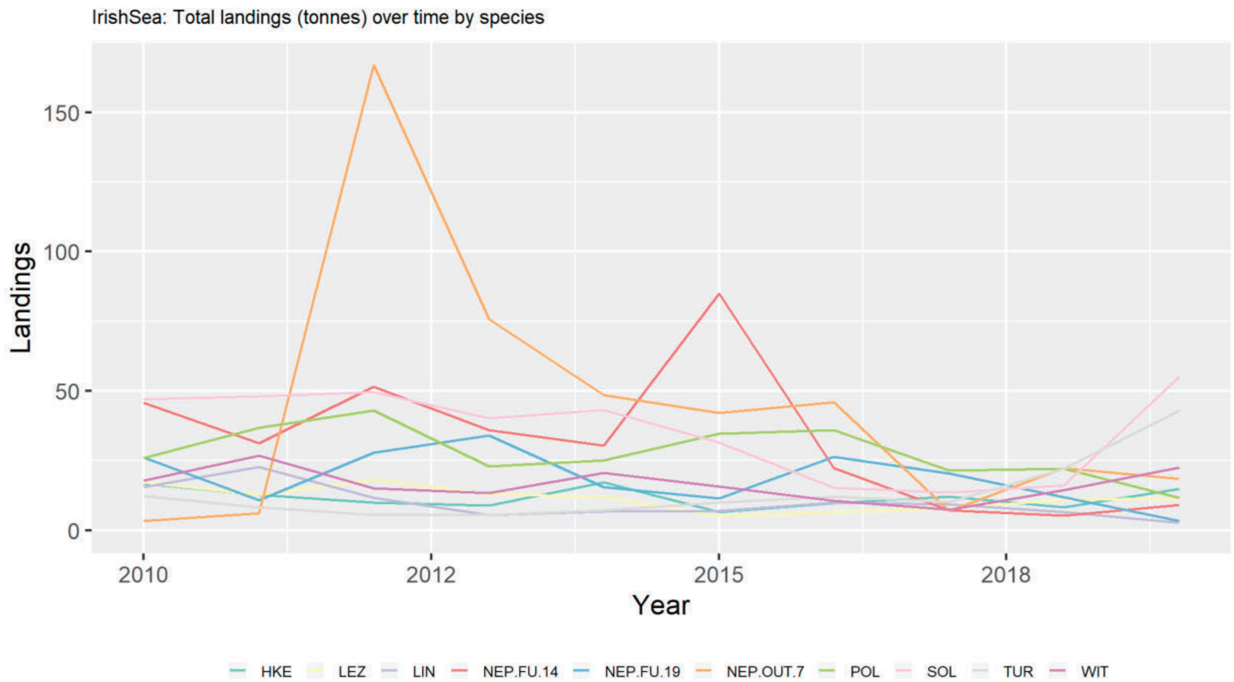

IrishSea: Total landings (tonnes) over time for OTB_DEF metiers
1500
1000
500
0
Landings
2010
2012
2015
2018
Year
OTB_DEF_100-119_0_0_all
OTB_DEF_70-99_0_0_all

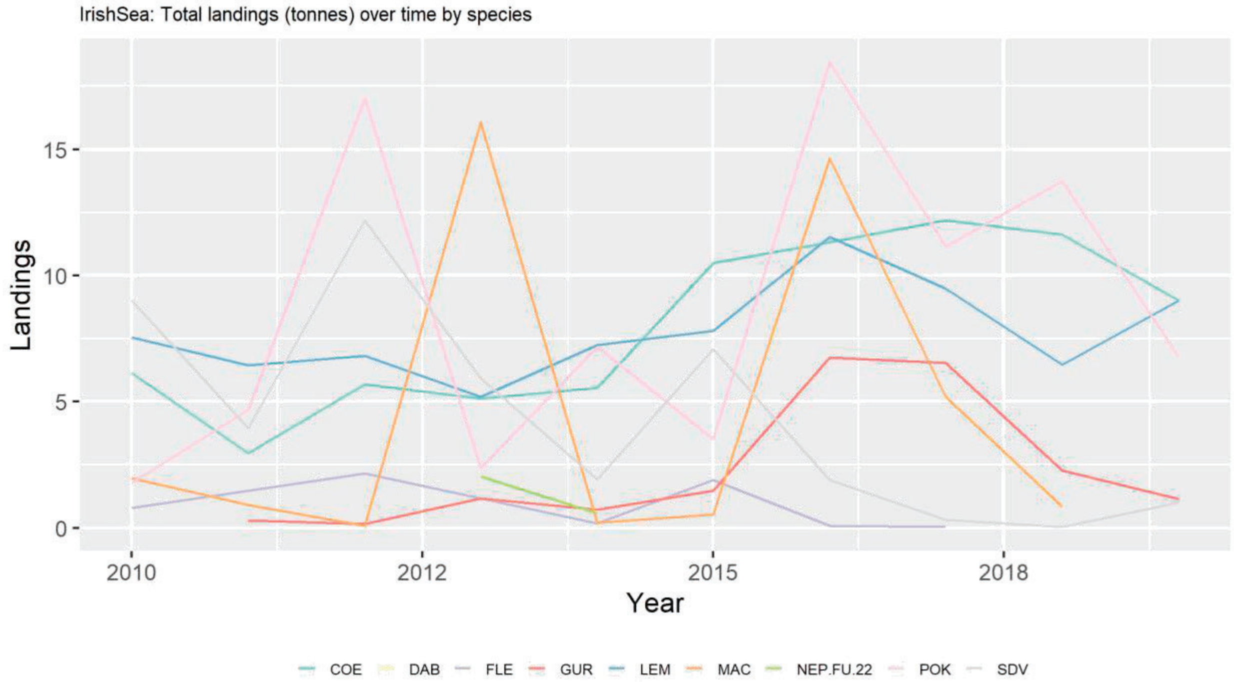

IrishSea: Total landings (tonnes) over time for PTM metiers
6000
4000
2000
0
Landings
2010
2012
2015
2018
Year
PTM_SPF_32-69_0_0_all


IrishSea: Total landings (tonnes) over time for SSC metiers
Landings
500
400
300
200
100
0
2010
2012
2015
2018
Year
SSC_DEF_100-119_0_0_all


IrishSea: Total landings (tonnes) over time for TBB metiers
Landings
600
400
200
0
2010
2012
2015
2018
Year
TBB_DEF_70-99_0_0_all


IrishSea: Total landings (tonnes) over time by species
Landings
6000
4000
2000
0
2010
2012
2015
2018
Year
ANF
COD
HAD
HER
NEP.FU.15
OTH
PLE
RJA
SPR
WHG


IrishSea: Total landings (tonnes) over time by species
Landings
150
100
50
0
2010
2012
2015
2018
Year
HKE
LEZ
LIN
NEP.FU.14
NEP.FU.19
NEP.OUT.7
POL
SOL
TUR
WIT


IrishSea: Total landings (tonnes) over time by species
Landings
15
10
5
0
2010
2012
2015
2018
Year
COE
DAB
FLE
GUR
LEM
MAC
NEP.FU.22
POK
SDV

North Sea

Table 25: North Sea: Total landings by metiers by year (tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
DRB_MOL_0_0_0_all	-	25	295	500	342	310	577	678	781	801
FPO_CRU_0_0_0_all	4560	3544	3438	3673	4098	3855	4766	4613	4040	3927
FPO_MOL_0_0_0_all	76	-	-	432	559	893	721	139	178	241
GNS_DEF_120-219_0_0_all	8	19	1	68	23	34	54	56	40	18
LLS_FIF_0_0_0_all	9	32	20	12	11	4	53	1	3	6
MIS_MIS_0_0_0_HC	8	17	-	-	30	15	-	5	-	-
OTB_CRU_70-99_0_0_all	1	6	0	1	3	-	-	1	3	-
OTB_DEF_>=120_0_0_all	-	-	-	-	-	-	-	-	4	-
OTB_DEF_100-119_0_0_all	2983	2306	2350	2309	2138	2120	2917	2626	2304	2428
OTB_DEF_70-99_0_0_all	-	0	4	0	0	-	1	0	1	0
OTB_DEF_79-99_0_0_all	-	-	-	-	1	-	-	-	-	-
OTB_MCF_>=120_0_0_all	-	-	-	-	-	-	-	3	10	-
PTM_SPF_32-69_0_0_all	81365	85412	91205	72854	105820	80061	86678	119916	85347	90670
SSC_DEF_100-119_0_0_all	-	-	77	62	80	287	370	85	132	124
TBB_DEF_70-99_0_0_all	-	-	-	-	-	-	-	1	-	-

North Sea Catch: There were no metiers with FDF flags reported

Table 26: North Sea: Total landings by area by year (tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
27.4.a	14675	18178	20461	13752	45237	34363	24050	36825	25082	1684
27.4.b	1494	964	1288	1149	1389	1152	1307	1228	1054	1663
27.4.c	-	-	-	0	1	-	-	1	1	3
27.6.a	72841	72215	75375	64522	66136	51756	70202	89389	65930	94072
27.7.d	-	5	268	489	342	307	577	678	776	796

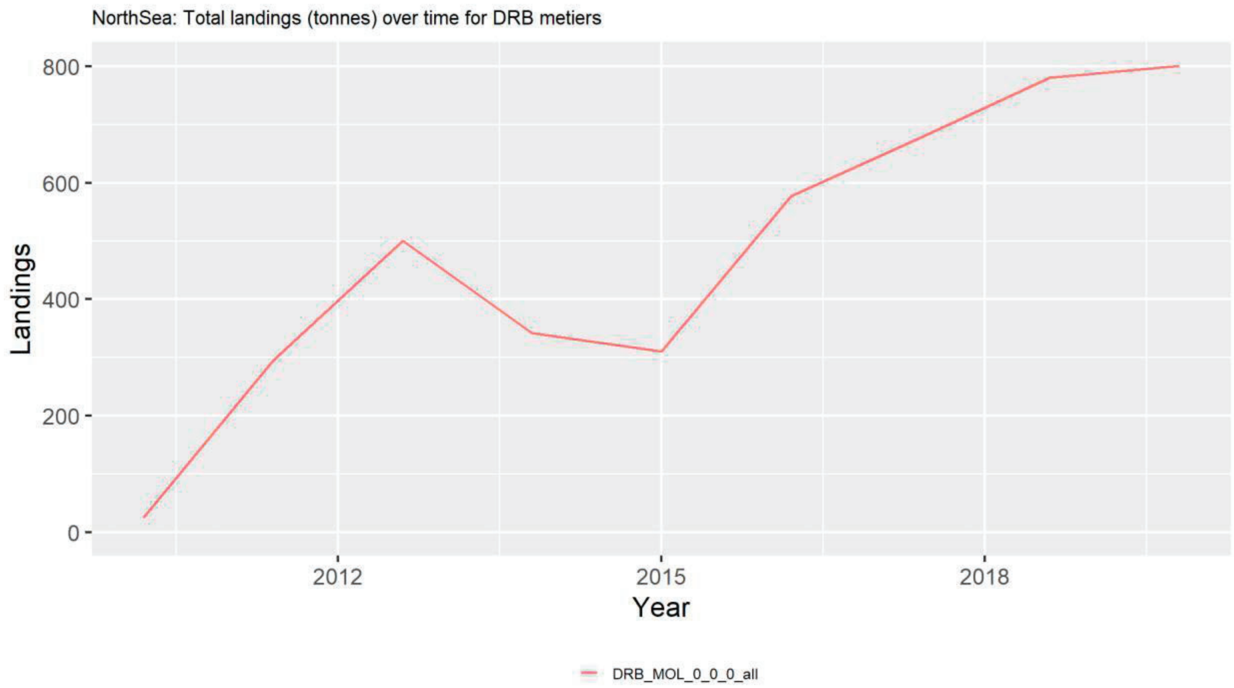
Table 27: North Sea: Total landings by species by year (tonnes)

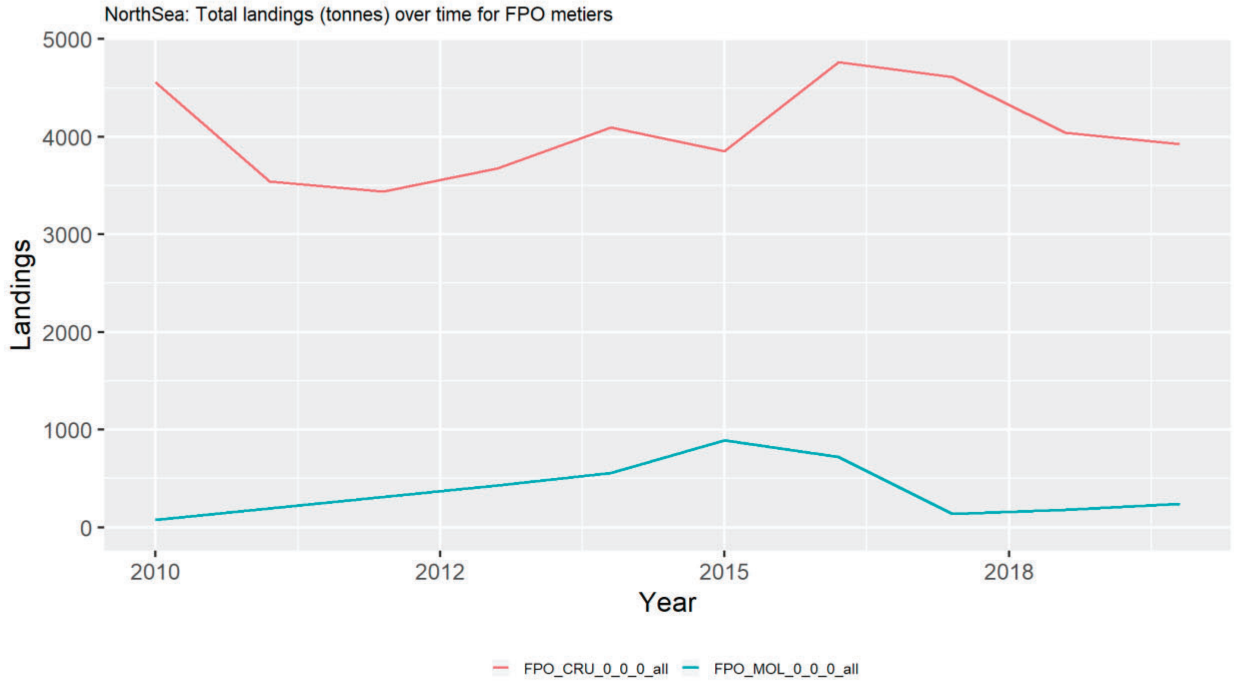
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ANF	510	488	325	342	400	443	581	579	596	897
CAA	0	-	-	-	-	-	-	-	-	-
COD	49	41	18	13	12	17	28	19	12	40
COE	10	8	8	6	5	3	6	7	6	9
FLE	-	-	-	-	-	-	-	-	-	0
GUG	-	-	-	-	-	-	-	-	-	0
GUR	-	0	0	0	-	-	-	0	0	0
HAD	396	290	845	747	667	768	1034	641	758	562
HAL	2	0	-	0	-	-	-	0	0	0
HER	10152	6515	7202	4808	5563	2049	2028	2389	1413	1375
HKE	507	259	233	196	191	226	260	212	104	108
HOM	4527	1735	2019	205	-	-	-	-	-	-
LEM	10	7	5	7	6	8	13	12	14	17
LEZ	318	227	214	203	245	311	410	336	301	271
LIN	164	95	47	54	39	65	156	156	93	142
MAC	46873	54349	49948	44366	79274	57391	67139	82021	55386	40482
NEP.FU.11	-	-	2	-	-	-	-	-	-	-
NEP.FU.12	5	9	6	0	18	33	59	58	36	38
NEP.FU.13	-	0	-	-	0	-	1	2	-	0
NEP.OUT.4	-	-	-	-	1	-	-	-	-	-
NEP.OUT.6	25	28	22	5	28	39	42	55	29	57
NEP.OUT.7	-	-	1	1	-	-	-	0	0	-
OTH	21687	26153	31254	25231	21348	16268	20570	21833	23534	26802
PLE	26	17	13	24	27	30	30	18	35	25
POK	460	330	341	276	112	73	140	124	87	27

(continued...)

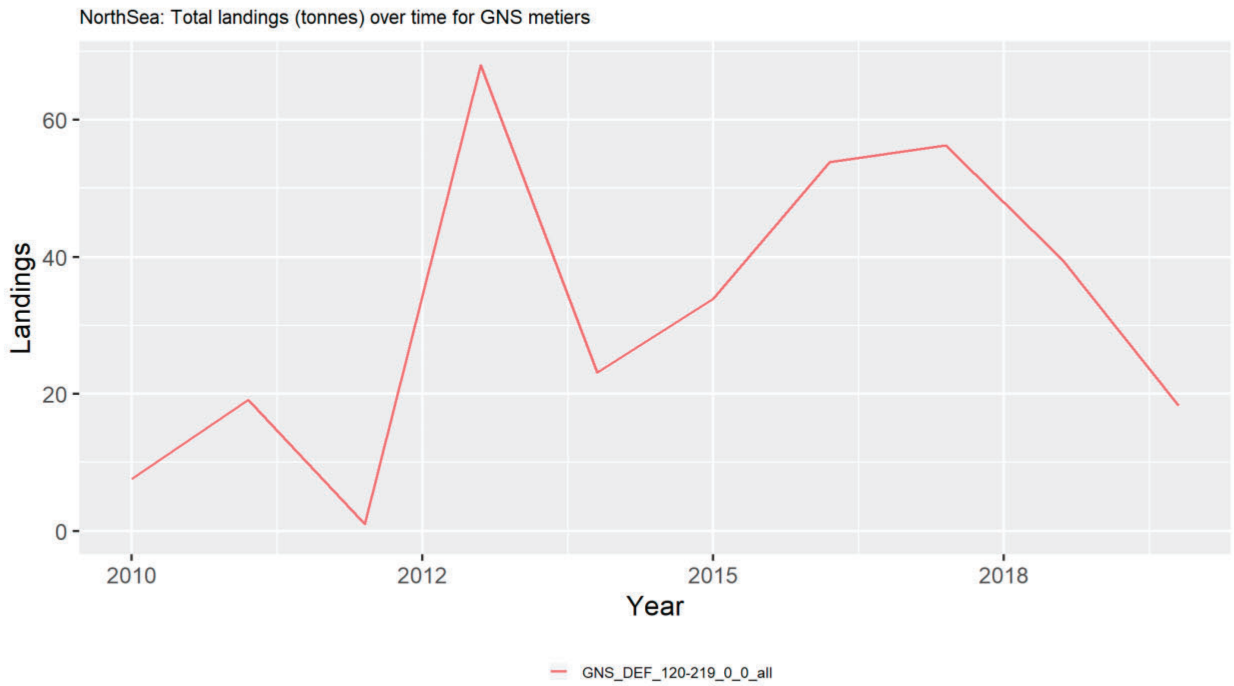
Table 27: North Sea: Total landings by species by year (tonnes) *(continued)*

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
POL	34	13	10	35	25	23	44	27	22	18
RJA	106	90	106	94	81	98	122	134	118	127
SDV	9	-	-	-	-	0	5	0	3	0
SOL	23	12	9	18	14	16	31	12	16	15
SPR	332	468	108	430	3	1301	428	620	1	3071
TUR	5	4	2	3	4	3	7	6	7	5
WHB	2662	50	4539	2731	4917	8284	2892	18787	10184	23960
WHG	99	149	96	97	97	88	77	53	72	160
WIT	19	22	20	22	30	39	35	22	13	8

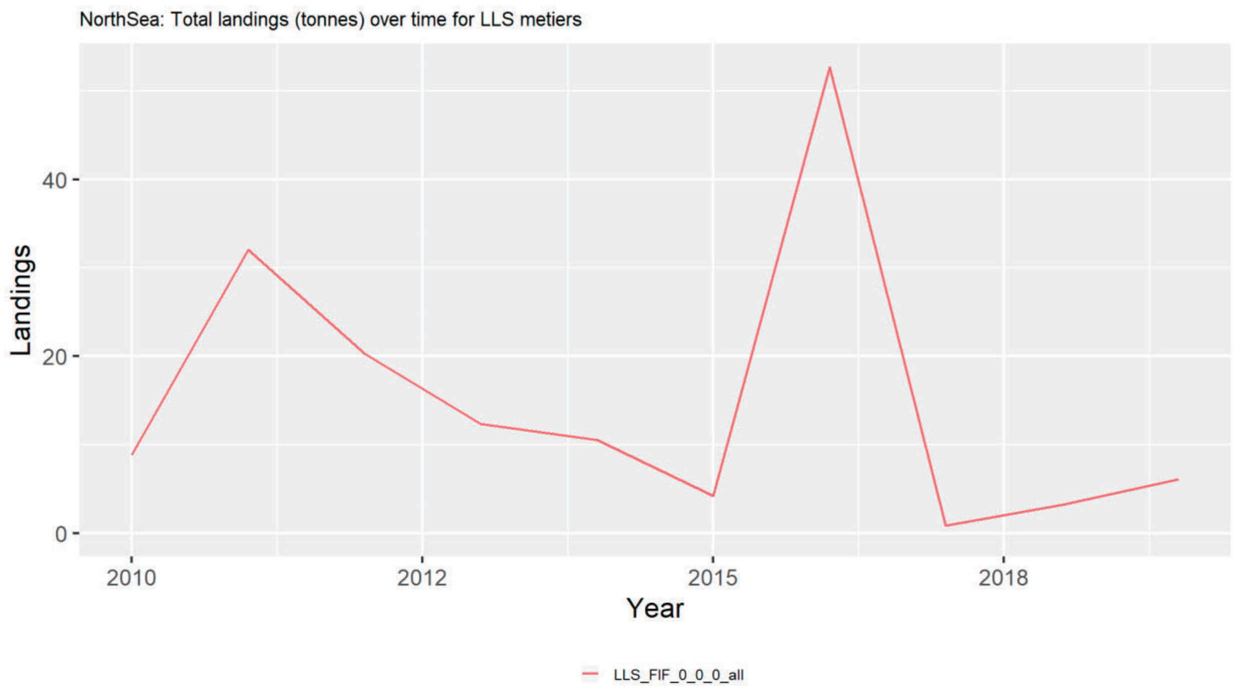


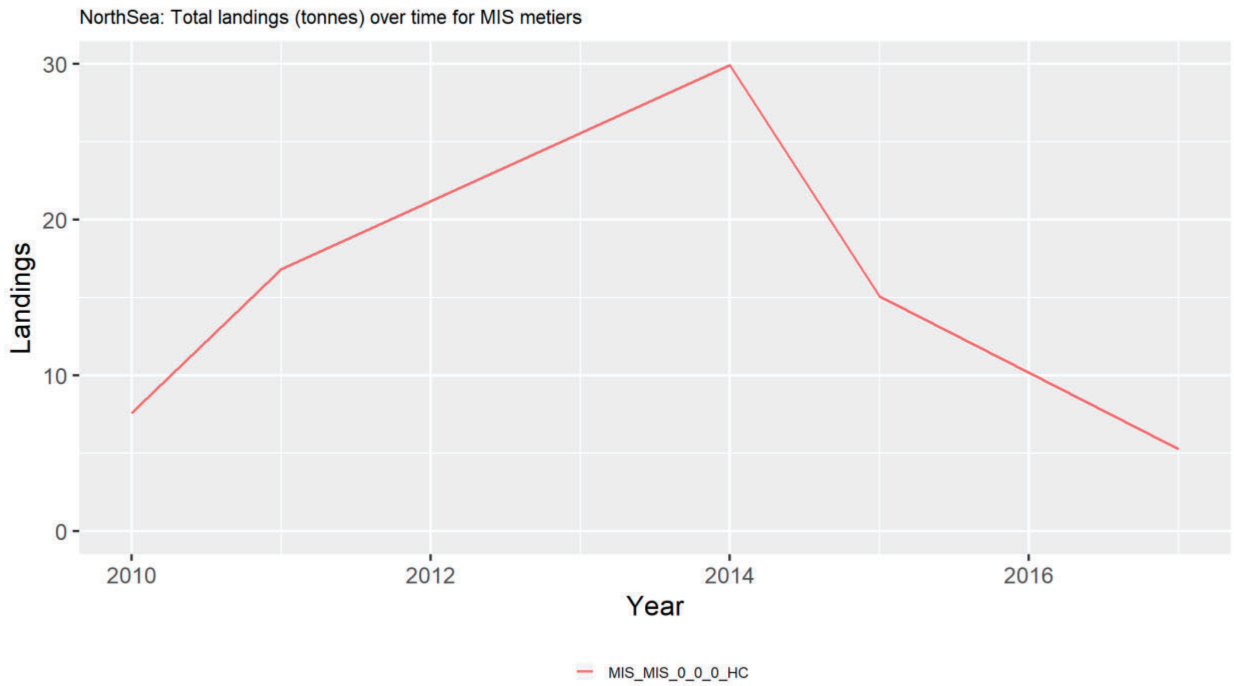


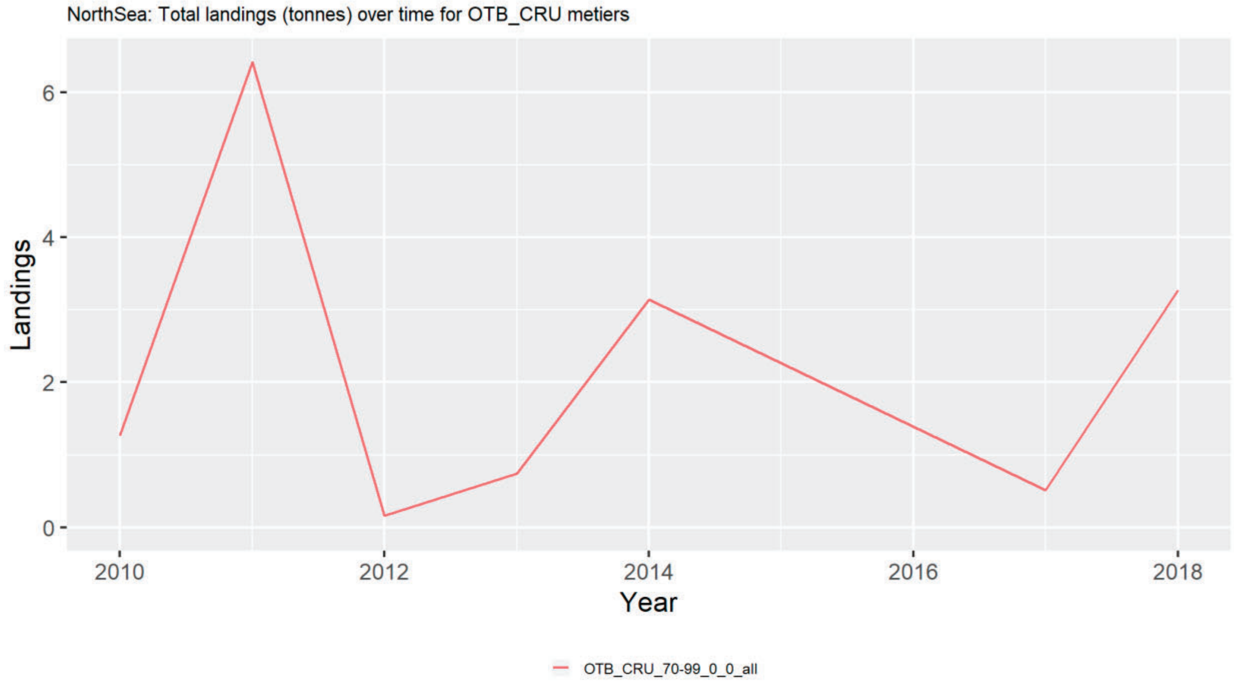
NorthSea: Total landings (tonnes) over time for FPO metiers
Landings
5000
4000
3000
2000
1000
0
2010
2012
2015
2018
Year
FPO_CRU_0_0_0_all
FPO_MOL_0_0_0_all

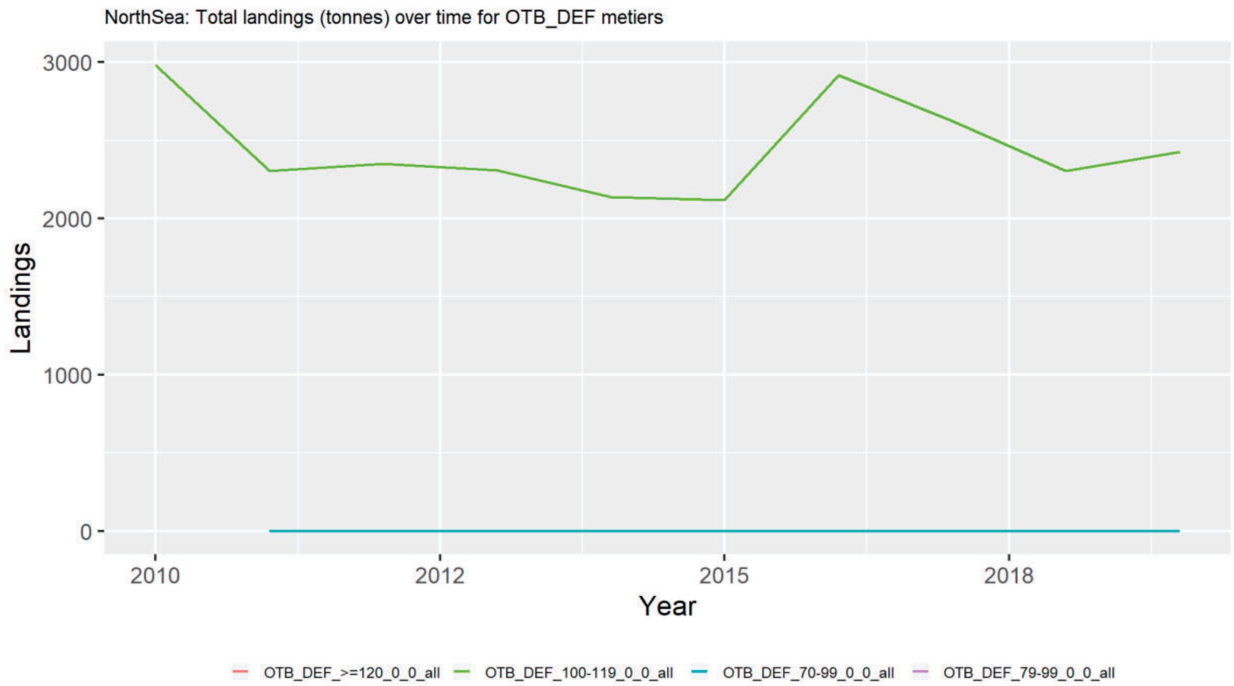


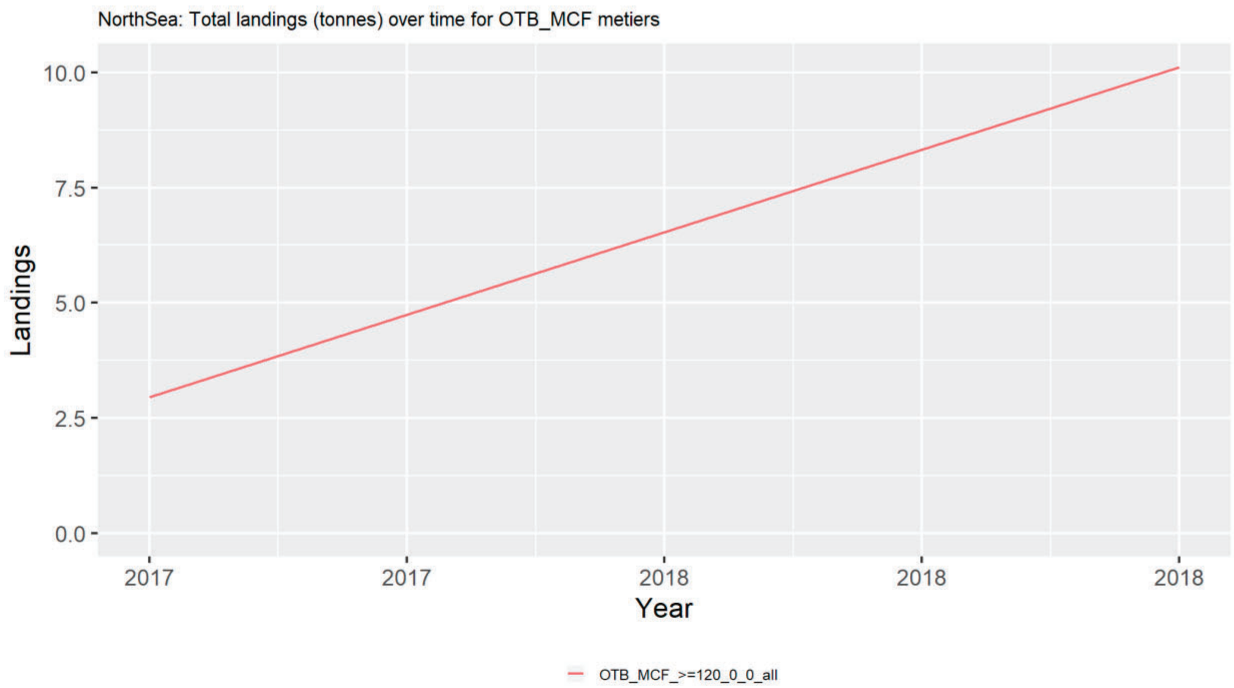
NorthSea: Total landings (tonnes) over time for GNS metiers
Landings
60
40
20
0
2010
2012
2015
2018
Year
GNS_DEF_120-219_0_0_all

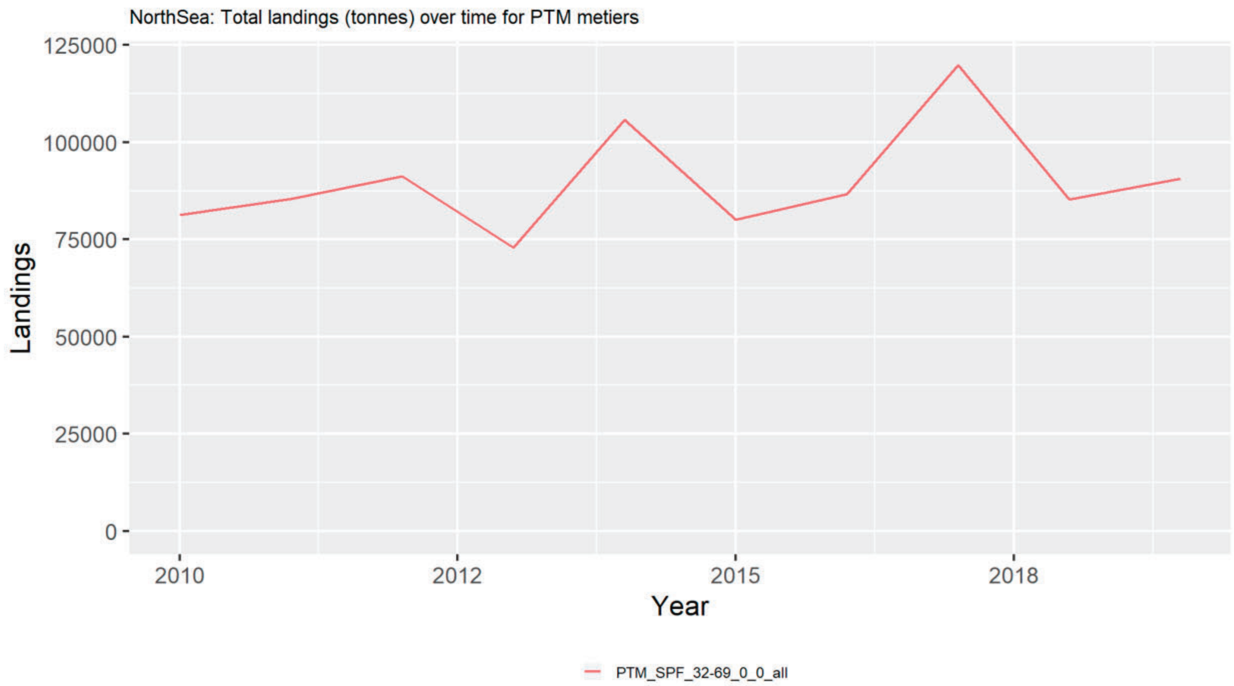

NorthSea: Total landings (tonnes) over time for LLS metiers
Landings
Year
0
20
40
2010
2012
2015
2018
LLS_FIF_0_0_0_all

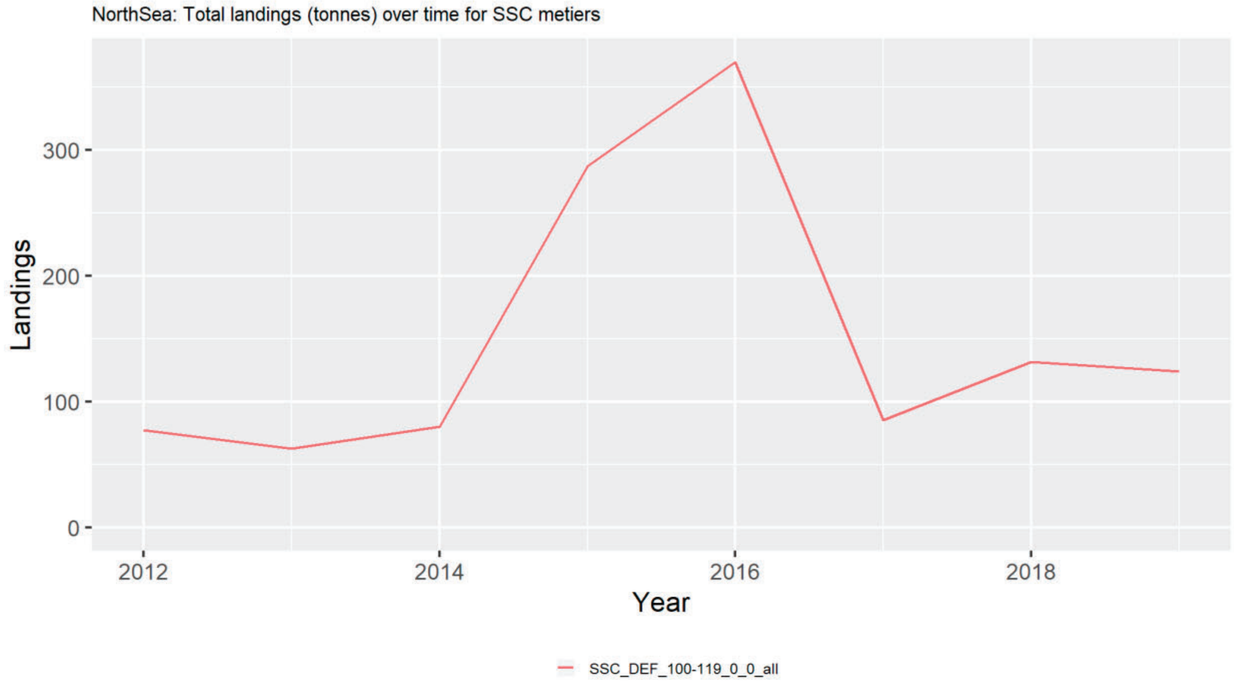

NorthSea: Total landings (tonnes) over time for MIS metiers
Landings
Year
0
10
20
30
2010
2012
2014
2016
MIS_MIS_0_0_0_HC

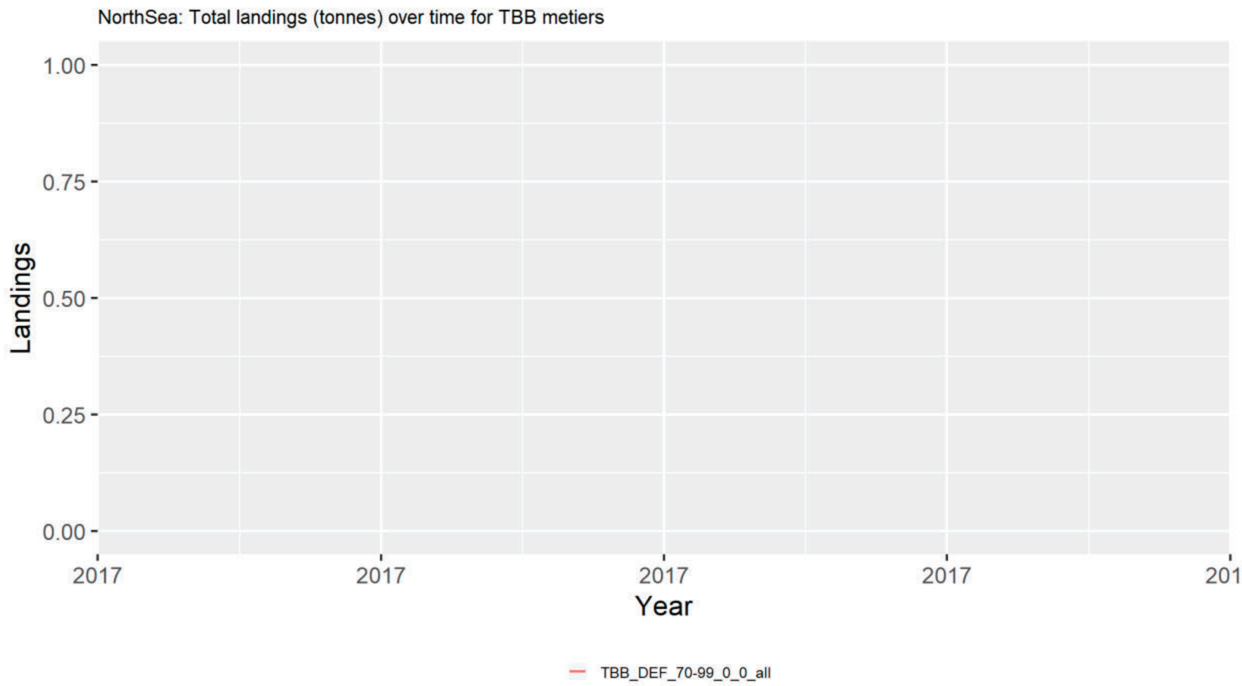

NorthSea: Total landings (tonnes) over time for OTB_CRU metiers
Landings
0
2
4
6
2010
2012
2014
2016
2018
Year
OTB_CRU_70-99_0_0_all

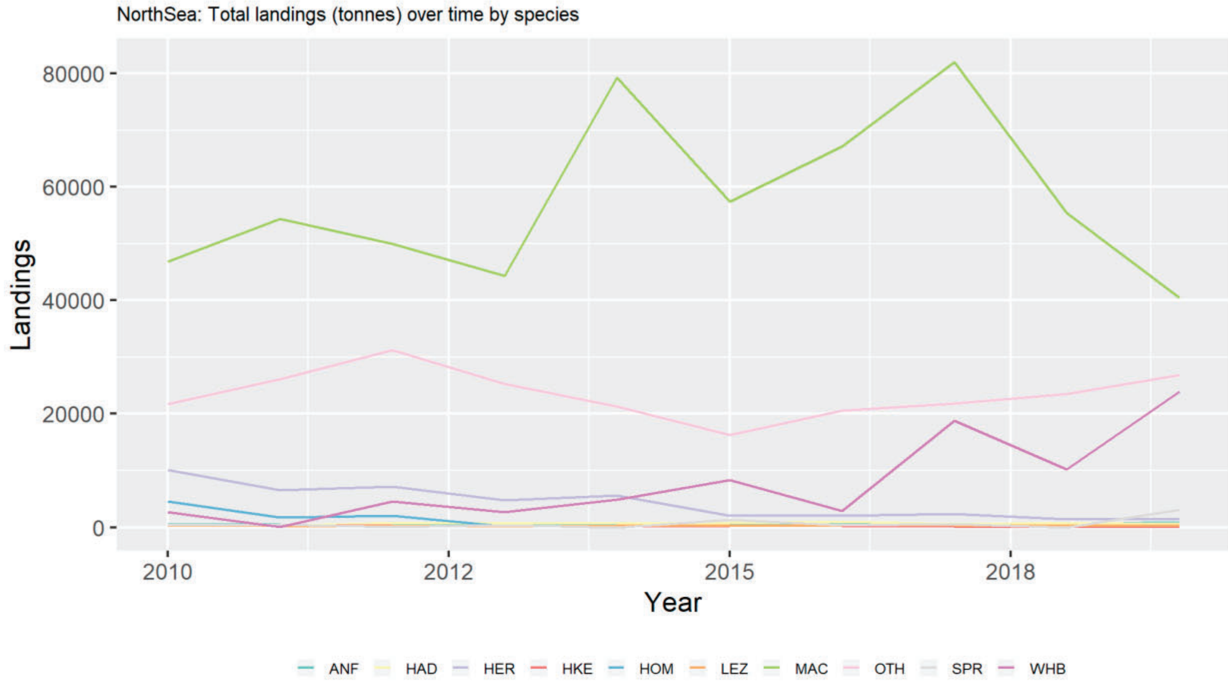

NorthSea: Total landings (tonnes) over time for OTB_DEF metiers
Landings
0
1000
2000
3000
2010
2012
2015
2018
Year
OTB_DEF_>=120_0_0_all
OTB_DEF_100-119_0_0_all
OTB_DEF_70-99_0_0_all
OTB_DEF_79-99_0_0_all

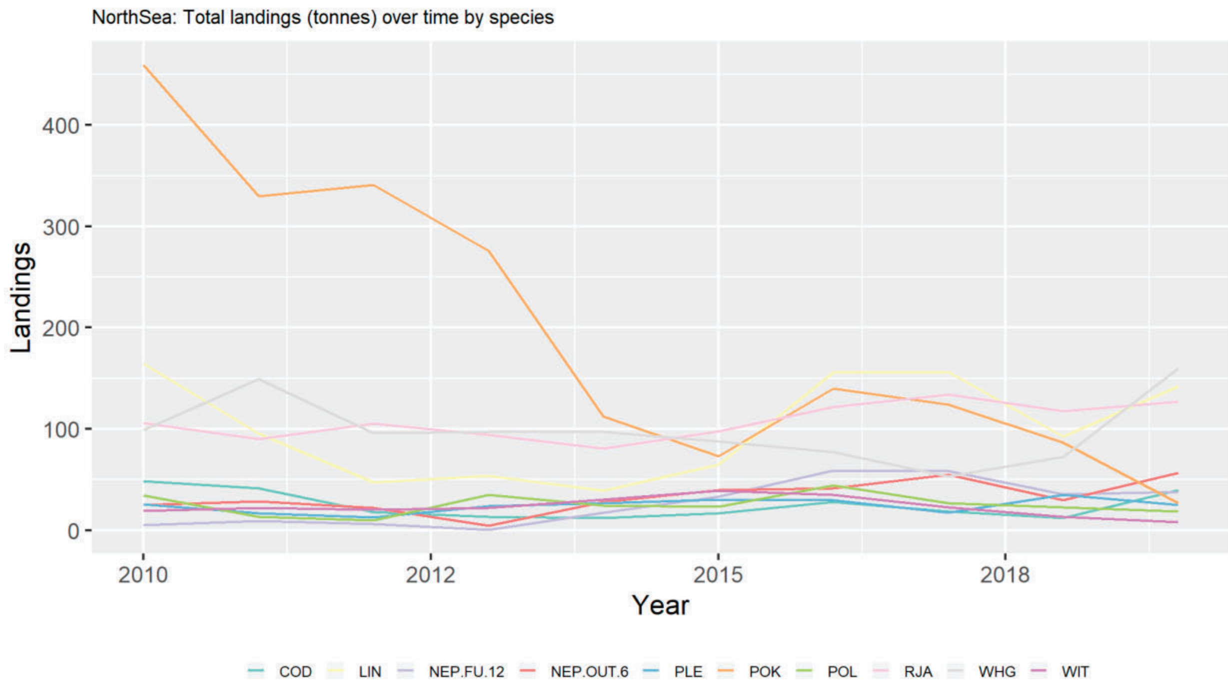

NorthSea: Total landings (tonnes) over time for OTB_MCF metiers
Landings
10.0
7.5
5.0
2.5
0.0
2017
2017
2018
2018
2018
Year
OTB_MCF_>=120_0_0_all

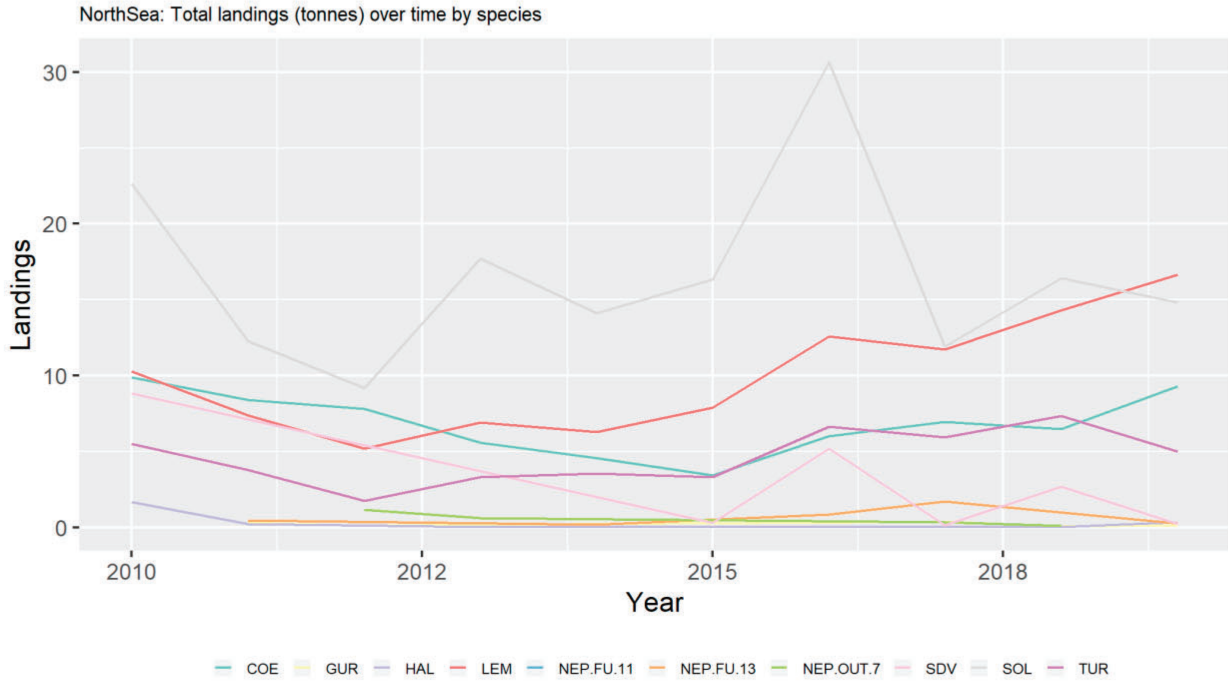

NorthSea: Total landings (tonnes) over time for PTM metiers
Landings
125000
100000
75000
50000
25000
0
2010
2012
2015
2018
Year
PTM_SPF_32-69_0_0_all

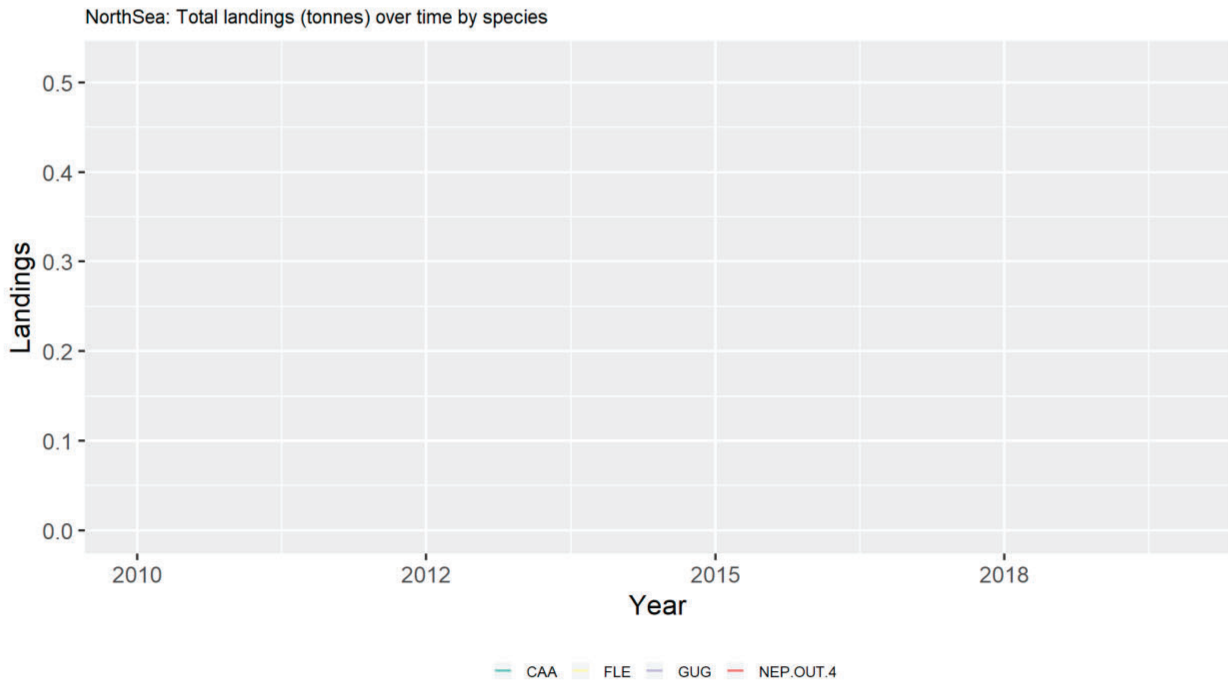

NorthSea: Total landings (tonnes) over time for SSC metiers
Landings
0
100
200
300
2012
2014
2016
2018
Year
SSC_DEF_100-119_0_0_all


NorthSea: Total landings (tonnes) over time for TBB metiers
Landings
0.00
0.25
0.50
0.75
1.00
2017
2017
2017
2017
201
Year
TBB_DEF_70-99_0_0_all


NorthSea: Total landings (tonnes) over time by species
Landings
80000
60000
40000
20000
0
2010
2012
2015
2018
Year
ANF
HAD
HER
HKE
HOM
LEZ
MAC
OTH
SPR
WHB


NorthSea: Total landings (tonnes) over time by species
Landings
400
300
200
100
0
2010
2012
2015
2018
Year
COD
LIN
NEP.FU.12
NEP.OUT.6
PLE
POK
POL
RJA
WHG
WIT





Consistency between effort and catch submissions

The tables in this section summarise the consistency between the effort and catch submissions. Ideally, effort and catch data should be submitted for the same metiers in each area every year. The degree of consistency is summarised in the first table for each ecoregion.

Some simple changes to increase consistency can be ensuring both catch and effort metiers have the same suffixes (e.g. _HC, _all) and to the check the capitalisation of metier names.

Please note that a major source of inconsistencies is the area codes that denote *Nephrops* functional units. Using these *Nephrops* specific area codes is correct and should not be changed in either the catch or effort data to increased consistency.

Celtic Sea

Table 28: Celtic Sea: Consistency between metiers in catch and effort data

Year	Percentage of unmatched metiers	Total landings from unmatched metiers	Total effort with zero catch
2010	5.556	191.05	318924
2011	5.970	224.73	399466
2012	1.333	16.10	1024036
2013	4.615	2.97	431417
2014	1.449	0.05	441966
2015	1.471	202.57	410012
2016	2.778	94.70	260892
2017	2.985	50.14	22971
2018	1.429	0.07	150497
2019	1.471	0.04	33827

Table 29: Celtic Sea: Consistency between metiers (detailed)

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2010	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2010	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2010	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2010	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2010	FPO_CRU_0_0_0_all	27.7.f	x	x
IE	2010	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2010	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.7.f	x	-
IE	2010	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.7.h	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.7.k	x	x
IE	2010	GNS_DEF_>=220_0_0_all	27.7.b	x	x
IE	2010	GNS_DEF_>=220_0_0_all	27.7.c	x	x
IE	2010	GNS_DEF_>=220_0_0_all	27.7.g	x	x
IE	2010	GNS_DEF_>=220_0_0_all	27.7.j	x	x
IE	2010	GNS_DEF_>=220_0_0_all	27.7.k	x	-
IE	2010	LHP_DEF_0_0_0_all	27.7.j	-	x
IE	2010	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2010	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2010	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2010	LLS_FIF_0_0_0_all	27.7.k	x	x
IE	2010	MIS_MIS_0_0_0_HC	27.7.b	-	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	MIS_MIS_0_0_0_HC	27.7.g	-	x
IE	2010	MIS_MIS_0_0_0_HC	27.7.j	-	x
IE	2010	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2010	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2010	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2010	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2010	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2010	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2010	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2010	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2010	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2010	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2010	OTB_CRU_70-99_0_0_all	27.7.j	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2010	PTM_LPF_100-119_0_0_all	27.7.g	x	-
IE	2010	PTM_LPF_100-119_0_0_all	27.7.h	x	-
IE	2010	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2010	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2010	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.e	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2010	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2010	SSC_DEF_100-119_0_0_all	27.7.h	x	x
IE	2010	SSC_DEF_100-119_0_0_all	27.7.j	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2010	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2010	TBB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2010	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.h	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2011	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2011	FPO_CRU_0_0_0_all	27.7.f	x	x
IE	2011	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2011	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2011	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2011	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2011	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2011	GNS_DEF_>=220_0_0_all	27.7.b	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2011	GNS_DEF_>=220_0_0_all	27.7.g	x	x
IE	2011	GNS_DEF_>=220_0_0_all	27.7.j	x	x
IE	2011	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2011	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2011	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2011	LLS_FIF_0_0_0_all	27.7.k	x	x
IE	2011	MIS_MIS_0_0_0_HC	27.7.b	x	-

Country	Year	Metier	Area	EffortFile	LandFile
IE	2011	MIS_MIS_0_0_0_HC	27.7.g	-	x
IE	2011	MIS_MIS_0_0_0_HC	27.7.j	-	x
IE	2011	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2011	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2011	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2011	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2011	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.f	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.h	-	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2011	PTM_LPF_100-119_0_0_all	27.7.j	x	-

Country	Year	Metier	Area	EffortFile	LandFile
IE	2011	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2011	PTM_SPF_32-69_0_0_all	27.7	-	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.e	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2011	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2011	SSC_DEF_100-119_0_0_all	27.7.f	x	x
IE	2011	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2011	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2011	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2011	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2011	TBB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2011	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2012	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2012	FPO_CRU_0_0_0_all	27.7.c	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) ***(continued)***

Country	Year	Metier	Area	EffortFile	LandFile
IE	2012	FPO_CRU_0_0_0_all	27.7.f	x	x
IE	2012	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2012	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.7.h	x	-
IE	2012	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.7.k	x	x
IE	2012	GNS_DEF_>=220_0_0_all	27.7.b	x	x
IE	2012	GNS_DEF_>=220_0_0_all	27.7.g	x	x
IE	2012	GNS_DEF_>=220_0_0_all	27.7.j	x	x
IE	2012	LLS_FIF_0_0_0_all	27.7	-	x
IE	2012	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2012	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2012	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2012	LLS_FIF_0_0_0_all	27.7.k	x	x
IE	2012	MIS_MIS_0_0_0_HC	27.7.b	x	-
IE	2012	MIS_MIS_0_0_0_HC	27.7.c	x	-
IE	2012	MIS_MIS_0_0_0_HC	27.7.g	x	x
IE	2012	MIS_MIS_0_0_0_HC	27.7.j	x	x
IE	2012	MIS_MIS_0_0_0_HC	27.7.k	x	-
IE	2012	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2012	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2012	OTB_CRU_100-119_0_0_all	27.7.f	x	x
IE	2012	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2012	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2012	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2012	OTB_CRU_100-119_0_0_all	27.7.k	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2012	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.f	x	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.e	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2012	PTM_LPF_100-119_0_0_all	27.7.g	x	-
IE	2012	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2012	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2012	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2012	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2012	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2012	PTM_SPF_32-69_0_0_all	27.7.h	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2012	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2012	PTM_SPF_32-69_0_0_all	27.7.k	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2012	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2012	SSC_DEF_100-119_0_0_all	27.7.f	x	x
IE	2012	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2012	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2012	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2012	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2012	TBB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2012	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2013	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2013	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2013	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2013	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2013	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2013	GNS_DEF_120-219_0_0_all	27.7.h	x	-
IE	2013	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2013	GNS_DEF_>=220_0_0_all	27.7.g	x	x
IE	2013	GNS_DEF_>=220_0_0_all	27.7.j	x	x
IE	2013	LLS_FIF_0_0_0_all	27.7.b	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2013	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2013	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2013	LLS_FIF_0_0_0_all	27.7.k	x	x
IE	2013	MIS_MIS_0_0_0_HC	27.7.g	x	x
IE	2013	MIS_MIS_0_0_0_HC	27.7.j	x	x
IE	2013	MIS_MIS_0_0_0_HC	27.7.k	x	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.c	-	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.f	-	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.e	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.c	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2013	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2013	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2013	PTM_LPF_100-119_0_0_all	27.7.k	x	-

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2013	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2013	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2013	SSC_DEF_100-119_0_0_all	27.7.f	-	x
IE	2013	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2013	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2013	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2013	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2013	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2014	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2014	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2014	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2014	DRB_MOL_0_0_0_all	27.7.g	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2014	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2014	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2014	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2014	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2014	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2014	GNS_DEF_120-219_0_0_all	27.7.f	x	-
IE	2014	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2014	GNS_DEF_120-219_0_0_all	27.7.h	x	x
IE	2014	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2014	GNS_DEF_>=220_0_0_all	27.7.g	x	x
IE	2014	GNS_DEF_>=220_0_0_all	27.7.j	x	x
IE	2014	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2014	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2014	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2014	MIS_MIS_0_0_0_HC	27.7.b	x	x
IE	2014	MIS_MIS_0_0_0_HC	27.7.c	x	-
IE	2014	MIS_MIS_0_0_0_HC	27.7.g	x	x
IE	2014	MIS_MIS_0_0_0_HC	27.7.h	x	-
IE	2014	MIS_MIS_0_0_0_HC	27.7.j	x	x
IE	2014	MIS_MIS_0_0_0_HC	27.7.k	x	-
IE	2014	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.e	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.f	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2014	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.b	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2014	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.f	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.e	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.k	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2014	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.f	-	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2014	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2014	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2014	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2014	PTM_SPF_32-69_0_0_all	27.7.c	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2014	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2014	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2014	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2014	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2014	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2014	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2014	SSC_DEF_100-119_0_0_all	27.7.h	x	x
IE	2014	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2014	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2014	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2014	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.h	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2015	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2015	FPO_CRU_0_0_0_all	27.7.c	x	x
IE	2015	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2015	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2015	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2015	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2015	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2015	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2015	GNS_DEF_>=220_0_0_all	27.7.g	x	x
IE	2015	GNS_DEF_>=220_0_0_all	27.7.j	x	-
IE	2015	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2015	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2015	LLS_FIF_0_0_0_all	27.7.j	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2015	MIS_MIS_0_0_0_HC	27.7.g	x	x
IE	2015	MIS_MIS_0_0_0_HC	27.7.h	x	x
IE	2015	MIS_MIS_0_0_0_HC	27.7.j	-	x
IE	2015	MIS_MIS_0_0_0_HC	27.7.k	x	-
IE	2015	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2015	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2015	OTB_CRU_100-119_0_0_all	27.7.f	x	x
IE	2015	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2015	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2015	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2015	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.f	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.c	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) ***(continued)***

Country	Year	Metier	Area	EffortFile	LandFile
IE	2015	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.k	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2015	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2015	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2015	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2015	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.e	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.e	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.f	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.h	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2015	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2015	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2016	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2016	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2016	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2016	DRB_MOL_0_0_0_all	27.7.g	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2016	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2016	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2016	FPO_CRU_0_0_0_all	27.7.c	x	x
IE	2016	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2016	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.f	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.h	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.k	x	x
IE	2016	GNS_DEF_>=220_0_0_all	27.7.c	x	-
IE	2016	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2016	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2016	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2016	MIS_MIS_0_0_0_HC	27.7.b	x	-
IE	2016	MIS_MIS_0_0_0_HC	27.7.g	x	-
IE	2016	MIS_MIS_0_0_0_HC	27.7.j	-	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.f	x	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2016	OTB_CRU_100-119_0_0_all	27.7.k	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) ***(continued)***

Country	Year	Metier	Area	EffortFile	LandFile
IE	2016	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2016	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2016	OTB_CRU_70-99_0_0_all	27.7.f	x	x
IE	2016	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2016	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2016	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2016	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2016	OTB_DWS_100-119_0_0_all	27.7.j	x	x
IE	2016	PTM_LPF_100-119_0_0_all	27.7.b	x	-
IE	2016	PTM_LPF_100-119_0_0_all	27.7.c	x	-
IE	2016	PTM_LPF_100-119_0_0_all	27.7.e	x	-
IE	2016	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2016	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2016	PTM_SPF_32-69_0_0_all	27.7.b	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2016	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2016	PTM_SPF_32-69_0_0_all	27.7.e	-	x
IE	2016	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2016	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2016	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2016	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2016	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2016	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2016	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2016	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2016	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2016	TBB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2016	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.h	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2017	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2017	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2017	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2017	FPO_CRU_0_0_0_all	27.7.k	x	x
IE	2017	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2017	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2017	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2017	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2017	GNS_DEF_>=220_0_0_all	27.7.b	x	x
IE	2017	GNS_DEF_>=220_0_0_all	27.7.c	x	-

Country	Year	Metier	Area	EffortFile	LandFile
IE	2017	GNS_DEF_>=220_0_0_all	27.7.g	x	-
IE	2017	GNS_DEF_>=220_0_0_all	27.7.j	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2017	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2017	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2017	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2017	MIS_MIS_0_0_0_HC	27.7.j	-	x
IE	2017	OTB_CEP_0-0_0_0_all	27.7.e	x	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.f	-	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2017	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.e	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.h	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2017	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2017	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2017	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.7.f	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2017	TBB_DEF_70-99_0_0_all	27.7.e	x	-
IE	2017	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2017	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2017	TBB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2017	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2018	DRB_MOL_0_0_0_all	27.7.b	x	x
IE	2018	DRB_MOL_0_0_0_all	27.7.e	x	x
IE	2018	DRB_MOL_0_0_0_all	27.7.f	x	x
IE	2018	DRB_MOL_0_0_0_all	27.7.g	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2018	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.c	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.k	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.b	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2018	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.e	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.f	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.k	x	x
IE	2018	GNS_DEF_>=220_0_0_all	27.7.g	x	-
IE	2018	GTR_CRU_100-119_0_0_all	27.7.g	x	x
IE	2018	LLS_FIF_0_0_0_all	27.7.b	x	x
IE	2018	LLS_FIF_0_0_0_all	27.7.g	x	-
IE	2018	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2018	MIS_MIS_0_0_0_HC	27.7.b	x	-
IE	2018	OTB_CEP_0-0_0_0_all	27.7.e	x	x
IE	2018	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2018	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2018	OTB_CRU_100-119_0_0_all	27.7.f	x	x
IE	2018	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2018	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2018	OTB_CRU_100-119_0_0_all	27.7.j	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2018	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.e	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.c	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2018	OTM_SPF_16-31_0_0_all	27.7.j	x	x
IE	2018	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2018	PTM_LPF_100-119_0_0_all	27.7.k	x	-
IE	2018	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.7.g	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2018	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2018	SSC_DEF_100-119_0_0_all	27.7.b	x	x
IE	2018	SSC_DEF_100-119_0_0_all	27.7.c	x	-
IE	2018	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2018	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2018	SSC_DEF_100-119_0_0_all	27.7.k	-	x
IE	2018	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2018	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2018	TBB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2019	DRB_MOL_0_0_0_all	27.7.b	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2019	DRB_MOL_0_0_0_all	27.7.g	x	x
IE	2019	DRB_MOL_0_0_0_all	27.7.j	x	x
IE	2019	FPO_CRU_0_0_0_all	27.7.b	x	x
IE	2019	FPO_CRU_0_0_0_all	27.7.c	x	x
IE	2019	FPO_CRU_0_0_0_all	27.7.g	x	x
IE	2019	FPO_CRU_0_0_0_all	27.7.j	x	x
IE	2019	FPO_CRU_0_0_0_all	27.7.k	x	x
IE	2019	GNS_DEF_120-219_0_0_all	27.7.b	x	x
IE	2019	GNS_DEF_120-219_0_0_all	27.7.c	x	x
IE	2019	GNS_DEF_120-219_0_0_all	27.7.g	x	x
IE	2019	GNS_DEF_120-219_0_0_all	27.7.j	x	x
IE	2019	GNS_DEF_>=220_0_0_all	27.7.g	x	-
IE	2019	GNS_DEF_>=220_0_0_all	27.7.j	x	-
IE	2019	LLS_FIF_0_0_0_all	27.7.b	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2019	LLS_FIF_0_0_0_all	27.7.g	x	x
IE	2019	LLS_FIF_0_0_0_all	27.7.j	x	x
IE	2019	MIS_MIS_0_0_0_HC	27.7.k	x	-
IE	2019	OTB_CEP_0-0_0_0_all	27.7.e	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.b	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.c	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.e	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.f	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.g	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.h	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.j	x	x
IE	2019	OTB_CRU_100-119_0_0_all	27.7.k	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.b	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.c	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.f	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.g	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.h	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.j	x	x
IE	2019	OTB_CRU_70-99_0_0_all	27.7.k	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.b	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.c	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.e	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.f	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.g	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.h	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.j	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.k	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.b	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.c	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2019	OTB_DEF_70-99_0_0_all	27.7.e	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.h	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.j	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.k	x	x
IE	2019	OTB_DEF_>=120_0_0_all	27.7.g	x	x
IE	2019	OTB_DEF_>=120_0_0_all	27.7.j	x	x
IE	2019	OTB_DWS_100-119_0_0_all	27.7.j	x	x
IE	2019	PTM_LPF_100-119_0_0_all	27.7.j	x	-
IE	2019	PTM_SPF_32-69_0_0_all	27.7.b	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.7.c	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.7.g	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.7.h	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.7.j	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.7.k	x	x
IE	2019	SSC_DEF_100-119_0_0_all	27.7.b	x	x

(continued...)

Table 29: Celtic Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2019	SSC_DEF_100-119_0_0_all	27.7.f	x	x
IE	2019	SSC_DEF_100-119_0_0_all	27.7.g	x	x
IE	2019	SSC_DEF_100-119_0_0_all	27.7.j	x	x
IE	2019	TBB_DEF_70-99_0_0_all	27.7.f	x	x
IE	2019	TBB_DEF_70-99_0_0_all	27.7.g	x	x
IE	2019	TBB_DEF_70-99_0_0_all	27.7.h	-	x
IE	2019	TBB_DEF_70-99_0_0_all	27.7.j	x	x

Iberian Waters

Table 30: Iberian Waters: Consistency between metiers in catch and effort data

Year	Percentage of unmatched metiers	Total landings from unmatched metiers	Total effort with zero catch
2010	0.00	0.00	0
2011	100.00	0.06	0
2016	25.00	142.74	90204
2017	0.00	0.00	575500
2018	50.00	295.60	111461
2019	33.33	58.64	20992

Table 31: Iberian Waters: Consistency between metiers (detailed)

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	OTB_DEF_>=55_0_0_all	27.9.a	x	x
IE	2011	OTB_CRU_70-99_0_0_all	27.8.c	-	x
IE	2016	FPO_CRU_0_0_0_all	27.9.a	x	-
IE	2016	OTB_CRU_100-119_0_0_all	27.8.c	x	x
IE	2016	PTM_LPF_100-119_0_0_all	27.8.c	x	-
IE	2016	PTM_SPF_32-69_0_0_all	27.8.c	-	x
IE	2017	PTM_LPF_100-119_0_0_all	27.8.c	x	-
IE	2017	PTM_SPF_32-69_0_0_all	27.8.c	x	x
IE	2018	PTM_LPF_100-119_0_0_all	27.8.c	x	-
IE	2018	PTM_SPF_32-69_0_0_all	27.8.c	-	x
IE	2019	OTB_DEF_100-119_0_0_all	27.9.a	x	x
IE	2019	PTM_LPF_100-119_0_0_all	27.8.c	x	-
IE	2019	PTM_SPF_32-69_0_0_all	27.8.c	-	x

Irish Sea

Table 32: Irish Sea: Consistency between metiers in catch and effort data

Year	Percentage of unmatched metiers	Total landings from unmatched metiers	Total effort with zero catch
2010	7.692	35.19	142
2011	8.333	55.61	0
2012	7.692	261.18	3990
2013	8.333	51.48	0
2014	0.000	0.00	0
2015	8.333	35.55	0
2016	0.000	0.00	321
2017	0.000	0.00	0
2018	0.000	0.00	0
2019	0.000	0.00	749

Table 33: Irish Sea: Consistency between metiers (detailed)

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2010	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2010	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2010	GNS_DEF_>=220_0_0_all	27.7.a	x	-
IE	2010	LLS_FIF_0_0_0_all	27.7.a	x	x
IE	2010	MIS_MIS_0_0_0_HC	27.7.a	-	x
IE	2010	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2010	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2010	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2011	FPO_CRU_0_0_0_all	27.7.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2011	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2011	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2011	LLS_FIF_0_0_0_all	27.7.a	x	x
IE	2011	MIS_MIS_0_0_0_HC	27.7.a	-	x
IE	2011	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2011	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2011	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2012	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2012	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2012	LLS_FIF_0_0_0_all	27.7.a	x	x
IE	2012	MIS_MIS_0_0_0_HC	27.7.a	-	x
IE	2012	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2012	PTM_LPF_100-119_0_0_all	27.7.a	x	-
IE	2012	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2012	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2012	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2013	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2013	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2013	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2013	MIS_MIS_0_0_0_HC	27.7.a	-	x
IE	2013	OTB_CRU_100-119_0_0_all	27.7.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2013	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2013	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2013	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2014	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2014	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2014	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2014	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2014	LLS_FIF_0_0_0_all	27.7.a	x	x
IE	2014	MIS_MIS_0_0_0_HC	27.7.a	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2014	PTM_SPF_32-69_0_0_all	27.7.a	x	x

(continued...)

Table 33: Irish Sea: Consistency between metiers (detailed) ***(continued)***

Country	Year	Metier	Area	EffortFile	LandFile
IE	2014	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2014	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2015	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2015	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2015	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2015	LLS_FIF_0_0_0_all	27.7.a	x	x
IE	2015	MIS_MIS_0_0_0_HC	27.7.a	-	x
IE	2015	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.7.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2015	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2015	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2016	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2016	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2016	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2016	GNS_DEF_>=220_0_0_all	27.7.a	x	-
IE	2016	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2016	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2016	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2016	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2017	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2017	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2017	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2017	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2017	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2017	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2018	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2018	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.7.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2018	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2018	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2018	TBB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2019	DRB_MOL_0_0_0_all	27.7.a	x	x
IE	2019	FPO_CRU_0_0_0_all	27.7.a	x	x
IE	2019	FPO_MOL_0_0_0_all	27.7.a	x	x
IE	2019	GNS_DEF_120-219_0_0_all	27.7.a	x	x
IE	2019	LLS_FIF_0_0_0_all	27.7.a	x	x
IE	2019	MIS_MIS_0_0_0_HC	27.7.a	x	-
IE	2019	OTB_CRU_70-99_0_0_all	27.7.a	x	x
IE	2019	OTB_DEF_100-119_0_0_all	27.7.a	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.7.a	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.7.a	x	x
IE	2019	SSC_DEF_100-119_0_0_all	27.7.a	x	x
IE	2019	TBB_DEF_70-99_0_0_all	27.7.a	x	x

North Sea

Table 34: North Sea: Consistency between metiers in catch and effort data

Year	Percentage of unmatched metiers	Total landings from unmatched metiers	Total effort with zero catch
2010	8.333	7.59	1872
2011	8.333	16.85	0
2012	0.000	0.00	929
2013	0.000	0.00	750
2014	10.000	1.80	5428
2015	12.500	2.61	4177
2016	0.000	0.00	2520

2017	9.524	5.59	488
2018	0.000	0.00	4632
2019	0.000	0.00	2039

Table 35: North Sea: Consistency between metiers (detailed)

Country	Year	Metier	Area	EffortFile	LandFile
IE	2010	FPO_CRU_0_0_0_all	27.4.a	x	x
IE	2010	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2010	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2010	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2010	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2010	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2010	MIS_MIS_0_0_0_HC	27.6.a	-	x
IE	2010	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2010	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2010	OTB_DEF_70-99_0_0_all	27.6.a	x	-
IE	2010	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2010	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2011	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2011	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2011	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2011	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2011	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2011	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2011	MIS_MIS_0_0_0_HC	27.6.a	-	x
IE	2011	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2011	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2011	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2011	PTM_SPF_32-69_0_0_all	27.6.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2012	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2012	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2012	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2012	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2012	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2012	GNS_DEF_>=220_0_0_all	27.7.d	x	-
IE	2012	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2012	MIS_MIS_0_0_0_HC	27.6.a	x	-
IE	2012	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2012	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2012	OTB_DEF_70-99_0_0_all	27.7.d	x	x
IE	2012	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2012	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2012	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2013	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2013	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2013	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2013	FPO_CRU_0_0_0_all	27.4.c	x	x
IE	2013	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2013	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2013	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2013	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2013	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.4.c	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2013	OTB_DEF_100-119_0_0_all	27.7.d	x	x
IE	2013	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2013	PTM_SPF_32-69_0_0_all	27.4.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2013	PTM_SPF_32-69_0_0_all	27.4.c	x	-
IE	2013	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2013	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2014	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2014	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2014	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2014	FPO_CRU_0_0_0_all	27.6.a	x	x

(continued...)

Table 35: North Sea: Consistency between metiers (detailed) ***(continued)***

Country	Year	Metier	Area	EffortFile	LandFile
IE	2014	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2014	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2014	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2014	MIS_MIS_0_0_0_HC	27.6.a	x	x
IE	2014	OTB_CRU_70-99_0_0_all	27.4.c	-	x
IE	2014	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2014	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.4.b	x	-
IE	2014	OTB_DEF_70-99_0_0_all	27.4.c	x	-
IE	2014	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2014	OTB_DEF_70-99_0_0_all	27.7.d	x	-
IE	2014	OTB_DEF_79-99_0_0_all	27.7.d	-	x
IE	2014	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2014	PTM_SPF_32-69_0_0_all	27.4.b	x	-
IE	2014	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2014	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2015	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2015	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2015	FPO_CRU_0_0_0_all	27.4.a	-	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2015	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2015	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2015	FPO_CRU_0_0_0_all	27.7.d	x	x
IE	2015	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2015	FPO_MOL_0_0_0_all	27.7.d	-	x
IE	2015	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2015	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2015	MIS_MIS_0_0_0_HC	27.6.a	x	x
IE	2015	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2015	OTB_DEF_70-99_0_0_all	27.6.a	x	-
IE	2015	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2015	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2015	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2016	DRB_MOL_0_0_0_all	27.4.b	x	x
IE	2016	DRB_MOL_0_0_0_all	27.4.c	x	-
IE	2016	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2016	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2016	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2016	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2016	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2016	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2016	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2016	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2016	PTM_LPF_100-119_0_0_all	27.6.a	x	-
IE	2016	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2016	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2016	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2017	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2017	DRB_MOL_0_0_0_all	27.7.d	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2017	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2017	FPO_CRU_0_0_0_all	27.4.c	x	x
IE	2017	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2017	FPO_CRU_0_0_0_all	27.7.d	x	x
IE	2017	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2017	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2017	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2017	MIS_MIS_0_0_0_HC	27.3.a	x	-
IE	2017	MIS_MIS_0_0_0_HC	27.6.a	-	x
IE	2017	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2017	OTB_DEF_100-119_0_0_all	27.7.d	-	x

(continued...)

Table 35: North Sea: Consistency between metiers (detailed) *(continued)*

Country	Year	Metier	Area	EffortFile	LandFile
IE	2017	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2017	OTB_MCF_>=120_0_0_all	27.6.a	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2017	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2017	SSC_DEF_100-119_0_0_all	27.7.d	x	x
IE	2017	TBB_DEF_70-99_0_0_all	27.7.d	x	x
IE	2018	DRB_MOL_0_0_0_all	27.4.c	x	-
IE	2018	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2018	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2018	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2018	FPO_CRU_0_0_0_all	27.4.c	x	x
IE	2018	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2018	FPO_CRU_0_0_0_all	27.7.d	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2018	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2018	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2018	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2018	OTB_CRU_70-99_0_0_all	27.6.a	x	x
IE	2018	OTB_DEF_100-119_0_0_all	27.4.b	x	-
IE	2018	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2018	OTB_DEF_70-99_0_0_all	27.6.a	x	-
IE	2018	OTB_DEF_70-99_0_0_all	27.7.d	x	x
IE	2018	OTB_DEF_>=120_0_0_all	27.6.a	x	x
IE	2018	OTB_MCF_>=120_0_0_all	27.6.a	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.4.a	x	x
IE	2018	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2018	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2019	DRB_MOL_0_0_0_all	27.4.c	x	x
IE	2019	DRB_MOL_0_0_0_all	27.6.a	x	x
IE	2019	DRB_MOL_0_0_0_all	27.7.d	x	x
IE	2019	FPO_CRU_0_0_0_all	27.4.b	x	x
IE	2019	FPO_CRU_0_0_0_all	27.4.c	x	x
IE	2019	FPO_CRU_0_0_0_all	27.6.a	x	x
IE	2019	FPO_MOL_0_0_0_all	27.6.a	x	x
IE	2019	GNS_DEF_120-219_0_0_all	27.6.a	x	x
IE	2019	GNS_DEF_>=220_0_0_all	27.6.a	x	-
IE	2019	LLS_FIF_0_0_0_all	27.6.a	x	x
IE	2019	MIS_MIS_0_0_0_HC	27.4.a	x	-
IE	2019	MIS_MIS_0_0_0_HC	27.6.a	x	-
IE	2019	OTB_CRU_70-99_0_0_all	27.4.b	x	-
IE	2019	OTB_DEF_100-119_0_0_all	27.6.a	x	x
IE	2019	OTB_DEF_70-99_0_0_all	27.6.a	x	x
IE	2019	PTM_SPF_32-69_0_0_all	27.4.a	x	x

Country	Year	Metier	Area	EffortFile	LandFile
IE	2019	PTM_SPF_32-69_0_0_all	27.6.a	x	x
IE	2019	SSC_DEF_100-119_0_0_all	27.6.a	x	x
IE	2019	SSC_DEF_100-119_0_0_all	27.7.d	x	-
IE	2019	TBB_DEF_70-99_0_0_all	27.6.a	x	-

Annex 4: List of participants

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Annex 5: Next meeting´s Resolution

WGMIXFISH-METHODS - Working Group on Mixed Fisheries Advice Methodology

The revised version of the resolution was approved 21 January 2021

2020/2/FRSG17 The Working Group on Mixed Fisheries Methods (WGMIXFISH-METHODS), chaired by Claire Moore, Ireland, will meet online 21 – 25 June 2021, to:

a) Continue the improvement of WGMIXFISH-ADVICE workflow, updating associated documentation and increasing transparency;

b) Respond to the outcomes of the Mixed Fisheries Scoping Meeting;

c) Horizon scanning for future developments in methodology and advice

d) Respond to the outcomes and issues encountered during WGMIXFISH-Advice;

e) Review of updated data call, and data processing procedures, identifying possible areas of improvements;

f) Develop mixed fisheries models for sea regions not currently covered in the mixed fisheries advice;

g) Continue the development of the combined implementation of FCube and FLBEIA in conjugation with STECF/WGECON economists.

h) Develop guidance for auditing of mixed fisheries advice.

i)

WGMIXFISH-METHODS will report by 30 July 2021 for the attention of ACOM.

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert's country can attend this Expert Group.

Supporting information

Priority:	The work is essential to ICES to progress in the development of its capacity to provide advice on multispecies fisheries. Such advice is necessary to fulfil the requirements stipulated in the MoUs between ICES and its client commissions.
Scientific justification and relation to action plan:	The issue of providing advice for mixed fisheries remains an important one for ICES. The Aframe project, which started on 1 April 2007 and finished on 31 march 2009 developed further methodologies for mixed fisheries forecasts. The work under this project included the development and testing of the FCube approach to modelling and forecasts. In 2008, SGMIXMAN produced an outline of a possible advisory format that included mixed fisheries forecasts. Subsequently, WKMIXFISH was tasked with investigating the application of this to North Sea advice for 2010. AGMIXNS further developed the approach when it met in November 2009 and produced a draft template for mixed fisheries advice. WGMIXFISH has continued this work since 2010.

Resource requirements:	No specific resource requirements, beyond the need for members to prepare for and participate in the meeting.
Participants:	Experts with qualifications regarding mixed fisheries aspects, fisheries management and modelling based on limited and uncertain data.
Secretariat facilities:	Meeting facilities, production of report.
Financial:	None
Linkages to advisory committee:	ACOM
Linkages to other committees or groups:	SCICOM through the WGMG. Strong link to STECF.
Linkages to other organizations:	This work serves as a mechanism in fulfilment of the MoU with EC and fisheries commissions. It is also linked with STECF work on mixed fisheries.

Annex 6: Recommendations

None