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# Scientific, Technical and Economic Committee for Fisheries (STECF) - Skates & Rays Management (STECF-22-08)

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Joint Research Centre

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## 1.1 Abstract

Commission Decision of 25 February 2016 setting up a Scientific, Technical and Economic Committee for Fisheries, C(2016) 1084, OJ C 74, 26.2.2016, p. 4–10. The Commission may consult the group on any matter relating to marine and fisheries biology, fishing gear technology, fisheries economics, fisheries governance, ecosystem effects of fisheries, aquaculture or similar disciplines. This report has been reviewed by STECF during the 2022 winter plenary meeting.

## 1.2 SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF) – Skates & Rays Management (STECF-22-08)

## 1.3 Background provided by the Commission

Skates and rays are currently managed under five regional TACs. Each is a general skate and ray TAC including several species (SRX TAC). Historically, ICES has provided biennial catch advice for skates and rays at this very general level. Over the past ten years and more, ICES have been able to provide catch advice at the species level for more and more stocks and has several times advised that generic TACs are not effective management measures for skates and rays. However, there may be practical, legal, scientific or biological issues that complicate the translation of the single-stocks advice into the TAC setting.

The management of skates and rays has been subject to ongoing review and research, including requests to the STECF to evaluate possible changes to TAC setting and alternative management approaches (STECF 15-01, STECF 17-16 (EWG 17-10)).

For the 2021 EU-UK consultations, the EU proposed to maintain the current approach, whereby the mean change in advice across the single stocks is applied to reach a composite TAC figure for the SRX group for a given management area. The UK proposed a different approach, adding up the individual advised tonnages for the relevant management area.

The Parties agreed to work in the EU-UK Specialised Committee for Fisheries (SCF) to agree on a way forward and to consider the various options of translating the scientific advice into the group TAC setting (paragraph 5 (e) of the Written Record of fisheries consultations between the United Kingdom and the European Union For 2021 and 2022). Following a positive conclusion of this work, this should then provide the basis for the approach to calculate the SRX TAC in the annual consultations for 2023. The output of this work should help inform the Commission in its preparation of the engagement in the SCF.

As a second step, a more comprehensive discussion in the SCF should be held on alternative management approaches to the SRX group TAC. This should be coupled with an update of the application of the landing obligation and the possible use of the prohibited species list. The work should be based on the best available science, but also consider the broader management challenges, as well as socio-economic and internal quota allocation issues in the short term for EU member states and fishing fleets. The established EWG should carry out a number of tasks in this regard.

## 1.4 Request to the STECF

STECF is requested to review the report of the STECF Expert Working Group meeting, evaluate the findings and make any appropriate comments and recommendations.

## 1.5 STECF General Comments

The working group was held in Brussels, Belgium, 26-30 September 2022. The meeting was attended by 12 experts in total, including 2 STECF members and 1 JRC expert.

STECF considers that the EWG adequately addressed the TORs.

## 1.6 STECG Comments

### ToR 1 - Appropriateness of the current EU and UK approaches to set the TAC for skates and rays

STECF notes the differences between the two methods used by the EU and UK to set the TACs for skates and rays. When applying the UK method, the stock-specific catch advice is summed to derive the group TAC, whereas applying the EU method, the group TAC is derived from the mean proportional change in advised catch from one year to the next.

STECF notes that the UK and EU methods cannot be directly compared because the EU method is applied to the agreed TACs from the previous year, which are the result of negotiation and over time, may diverge from advised catches.

STECF notes that the EWG collated stock-specific landings data and ICES advice spanning 2016-2021 for skates and rays in the Greater North Sea, Celtic Seas, and Iberian waters ecoregions (the same regions used by the current skates and rays group TAC (SRX TAC)). This provided insights as to whether landings taken as part of the group TAC can be considered sustainable at the stock level. Differences between landings and advice in terms of relative values (landings divided by advice) as well as absolute values (landings minus advice) were presented in tables. In the analysis the rays and skates were also grouped according to species vulnerability and ICES stock category.

For the purpose of the analysis, the EWG defined "overexploited/overexploitation" as stock-specific landings exceeded the ICES advice, while "underexploited/under exploitation" meant stock-specific landings that fell below the ICES advice. STECF notes that the degree of over- or under-exploitation is variable among species, ecoregion, species vulnerability and ICES stock category. In particular, blonde ray as well as several stocks currently assessed by ICES using category 5 and 6 methods, are being overexploited as part of the group TAC. Especially in the Celtic Seas and Greater North Sea ecoregions, overexploitation of other category 5 and 6 stocks is observed.

STECF observes that the assumption of proportional exploitation that is explicitly made when using a group TAC, is unlikely to be valid because of the historical overexploitations demonstrated. It is therefore questionable whether a group TAC will deliver sustainable exploitation of the stocks concerned, regardless of the method used to derive them, because for some stocks the actual landings are not proportionate to the advice.

The EWG presented a simple, theoretical simulation reflecting different stock dynamics to demonstrate the suitability of the EU and UK methods for calculating group TACs. The simulation was run for three separate stocks with 1 category 3 and the other two category 5 and 6. Four scenarios were investigated as follows:

1. A 10% decrease in landings advice for the category 3 stock
2. A 10% increase in landings advice for the category 3 stock
3. The advice for the category 3 stock (A) remained unchanged, whilst a precautionary reduction (-20%) was applied to stocks B and C.
4. Same as case 3, but landings from stock B were 20 times bigger compared to its landings in the third case.

For each case, it was assumed that the landings from each stock during the two-year period following the advice year would be proportional to the landings prior to the advice year. The outcomes of each scenario are summarised in Table 5.1.1.

Table 5.1.1: Theoretical comparisons of the EC and UK methods for calculating group TACs for three separate stocks.

| Case | Stock | ICES stock category | Landings year x | Advice year x+1 | % advice change year x+1 vs year x | EU method | UK method |
|---|---|---|---|---|---|---|---|
| 1 | Stock A | Cat. 3 | 3000 | 2700 | -10 | | |
| | Stock B | Cat.5-6 | 50 | 50 | 0 | | |
| | Stock C | Cat.5-6 | 50 | 50 | 0 | | |
| | TAC | | 3100 | | | 2997 | 2800 |
| | % TAC change | | | | | -3.333 | -9.677 |
| 2 | Stock A | Cat. 3 | 3000 | 3300 | 10 | | |
| | Stock B | Cat.5-6 | 50 | 50 | 0 | | |
| | Stock C | Cat.5-6 | 50 | 50 | 0 | | |
| | TAC | | 3100 | | | 3203 | 3400 |
| | % TAC change | | | | | 3.333 | 9.677 |
| 3 | Stock A | Cat. 3 | 3000 | 3000 | 0 | | |
| | Stock B | Cat.5-6 | 50 | 40 | -20 | | |
| | Stock C | Cat.5-6 | 50 | 40 | -20 | | |
| | TAC | | 3100 | | | 2687 | 3080 |
| | % TAC change | | | | | -13.333 | -0.645 |
| 4 | Stock A | Cat. 3 | 3000 | 3000 | 0 | | |
| | Stock B | Cat.5-6 | 1000 | 800 | -20 | | |
| | Stock C | Cat.5-6 | 50 | 40 | -20 | | |
| | TAC | | 4050 | | | 3510 | 3840 |
| | % TAC change | | | | | -13.333 | -5.185 |

STECF notes that according to Table 5.1.1, the EU method results in an overall lower group TAC than the UK method when the larger stocks (category 3 stocks) show an increasing trend and vice versa when this stock shows a decrease (cases 1 and 2). The result of the EU method on the group TAC compared to the UK method is contrary to the need to apply a reduction or increase on the advised catch. It is applied irrespective of the individual stock sizes or the ICES stock category. Consequently, the precautionary reduction of 20% that is applied every few years for the smaller category 5-6 stocks are partly transferred to the category 3 stocks when category 2 and 3 stocks form part of the combined TAC. Therefore, in setting a group TAC for one category 3 stock and two category 5-6 stocks (case 3 and 4), the EU method will result in a lower TAC than the UK method, unless the previous advice for category 5-6 stocks amounted to more than twice that of the category 3 stock. Such a situation is unlikely in reality because category 3 stocks will usually be larger.

STECF notes that the EWG also presented a simple simulation for the Greater North Sea Ecoregion to provide further clarity on the EU and UK approaches and to demonstrate the variability associated with deriving separate group-TACs by ICES stock category.

Based on this simulation, STECF notes that in contrast to the EU method, the UK method accounts for the mismatch between TAC area and stock area by allocating a representative fraction of the advised tonnage based on the proportion of historic landings in each area. Stocks for which ICES does not provide advice (Rajidae, ICES category 6 stock), are considered by adding an average tonnage (based on recent landings) in the UK method, whereas in the EU method a -20% advice change is applied in the calculations as a precautionary measure.

STECF notes that the simulation results indicate that using the EU method, a split of the groups-TAC by ICES stock category will result in a continuous decline of the category 5 and 6 group TAC over time, because of the application of a -20% precautionary buffer. In addition, a group TAC of only category 3 stocks will fluctuate over time reflecting the average ICES advice change of those stocks.

Regarding the UK method, 3 methods of allocating the total Greater North Sea ecoregion advice to a specific TAC area (SRX/03A-C, SRX/2AC4-C, and SRX/07D) were considered: i) using a historical distribution of the TACs; ii) using an average distribution of the landings over the entire ecoregion or iii) using an average distribution of the landings within a specific TAC area. STECF notes the only difference between the second and the third method is the proportion used to allocate the Rajidae within the TAC area.

Overall, the UK method results in a more variable pattern for both category 3 and category 5 and 6 group-TACs. In the third method, the contribution of Rajidae within the specific TAC area is considered. The changes in advice over time for both category 3 and category 5 and 6 group TACs follow a more similar pattern compared to the second method. The first method seems more precautionary (delivers lower TACs) for category 5 and 6 stocks in TAC areas 3.a and 2a and 4 compared to the second method.

STECF agrees with the EWG conclusion that the potential alternative approach where TACs would be based on the advice for category 3 and category 5 and 6 groupings, is not a good alternative for setting the current group TACs.

In terms of the current approaches used, STECF observes that the EU method is less likely to deliver sustainable exploitation of skates and rays because in deriving a group TAC, differences in stock dynamics and productivity are not taken account. The EU method is also biased by being driven by previous TACs, which reflect both the methodology used and the outcome of negotiation. However, STECF agrees with the EWG that the EU method is straightforward to calculate. It can be consistently applied even with changes in the ICES stock or advice cycle and where large stocks are on the increase, this method is more precautionary for smaller stocks.

STECF observes that the UK methodology, which applies the ICES advice as directly as possible, is also relatively simple to calculate and is also closer to standard practices for setting group TACs (e.g., group TACs for *Nephrops* based on summing advice from different Functional Units). It follows the ICES stock advice more closely because it accounts for the mismatch between TAC area and stock area; and for vulnerable stocks with decreasing survey trends and associated decreasing catch advice, the advice translates directly to the resulting TAC.

STECF agrees with the EWG that while both methods have their pros and cons but neither approach is optimal for management of the exploitation of skates and rays.

**ToR 2 - Appropriateness of single species sub-TACs**

STECF notes the issues highlighted by the EWG related to the biology and exploitation of skates and rays that need to be considered when setting single-species TACs.

STECF observes the precautionary approach used by ICES for category 5 stocks, results in a decrease in single stock TACs over time. This highlights the need to improve quantitative single-stock advice in order to implement more appropriate TAC management. Such improvements need additional data to be routinely collected in order to fill existing data gaps so that appropriate quantitative assessments can be undertaken.

STECF notes the EWG explored the process and potential outcomes of setting an initial TAC for one stock based upon knowledge of another stock ("Robin Hood approach", ICES, 2020); or based on life-history traits (STECF 15-03, Zhou et al. (2012) and Le Quesne and Jennings (2012)). Undulate ray in the English Channel, was used as an example because landings from this stock were prohibited between 2009 and 2014 and a separate precautionary TAC was introduced from 2015 onwards. The analysis showed the robustness of the estimated catches corresponding to $F_{MSY}$ simulated from life-history traits (natural mortality, intrinsic rate of population increase) for this stock.

STECF notes that applying the "Robin Hood approach", which uses the biomass indices and the length at maturity as a proxy for biological productivity should only be applied if both species are exploited at similar levels relative to their biological productivity proxies and biomass indices. The EWG demonstrated this using thornback ray to estimate the catches of undulate ray. An additional Robin Hood analysis where the landings of blonde ray were derived from the biomass indices and the length at maturity of thornback ray, resulted in lower landings compared to the actual recent landings of blonde ray. Therefore, STECF notes that the different species managed under a group TAC may not always be exploited at similar harvest rates relative to their biological productivities.

STECF observes that the methods to calculate a sub-TAC (separate share of the group TAC for several species) presented by the EWG are potentially useful for stocks that have been subject to protection (e.g., listed as a prohibited species) and require rebuilding. STECF considers that such an approach should be further explored to ascertain its utility and robustness before adopting as an approach for TAC setting.

**ToR 3 - Possibility of developing bespoke management plans.**

STECF notes that the EWG highlighted separate management objectives for skates and rays should be set out in the existing EU multiannual management plan (MAP) covering the North Sea, Western waters and Iberian waters. Currently, rays and skates are only referred to in these MAPs as by-catch stocks.

STECF agrees with the EWG that it would be appropriate to include some stocks of skates and rays in the MAP as target species, given they are caught in targeted fisheries. However, STECF notes their inclusion in the MAP would not provide an alternative to the current management by TACs and quotas. Essentially, the MAPs set the rules for setting TACs and the need to put in place remedial management measures when a stock falls below biological reference points.

**ToR 4 - Progress made in underpinning the exemption to the landing obligation.**

STECF observes that one of the items requested under ToR4 ('assessing catch data') was not addressed by the EWG. However, while not being requested, an overview of measures being taken by national Producer Organisations (PO) that are currently being applied was provided. STECF observes the added value of this overview is to inform alternative management measures for skates and rays that may have benefits for management going forward.

Discard survival rates

STECF notes that progress on survival estimates and methods for improving the avoidance, selectivity and survival has been made in relation to the Road Map of skates and rays, that was implemented in 2018 in the NWW, SWW and North Sea.

STECF notes the EWG presented useful tables summarising the studies and research projects regarding observed at vessel mortality (AVM), delayed mortality and indicators of the fish condition in continuation of the review carried out by EWG-17-10. The EWG noted that those new studies confirm the existing estimates of AVM (0 to 25 % for most species and gears) and delayed mortality (20 to 60% for most species and gears).

STECF agrees that operational measures to increase overall discard survival should aim to reduce air exposure and sorting time as this significantly improves the condition of the fish and leads to lower AVM.

STECF observes that although progress has been made in providing survival information, it is acknowledged that it remains difficult to cover the large diversity in species, gear types and areas subject to the existing exemptions from the landing obligation. While it is useful to make a compilation of the new available information on survivability, it is unclear to STECF whether those studies are sufficiently representative of the range of species and gears to inform and assess requests for exemptions from the landing obligation. STECF emphasises the importance of the critical review framework that is developed by ICES WKMEDS and used by STECF (STECF-22-05) to assess discard survival studies.

STECF notes that the EWG suggested to prioritise discard survival analysis of species shown to be less resilient (e.g., cuckoo ray) and for which rather limited survival information is available. STECF observes that this is appropriate and notes that the Delegated Acts implementing the regional discard plans include a special condition in particular for cuckoo ray to submit additional discard survival information on an annual basis (Commission Delegated Regulation (EU) 2020/2014 and Commission Delegated Regulation (EU) 2020/2015).

SETCF agrees with the EWG that the use of large-scale tag and recapture experiments provides an alternative to traditional survival trials because such methods take account of the effects of predation, which is not accounted for using captive observations. However, such methods rely heavily on sufficient levels of recapture to be useful or alternatively the use of expensive satellite tags.

Methods for improving avoidance, selectivity and survival

STECF observes that although there are ongoing trials to improve avoidance and selectivity using technologies which could influence the particular sensory behaviour of skates and rays in and around fishing gear, limited progress to address this issue has been made since EWG-17-10 in 2017.

Additional management measures

STECF notes that the implementation of minimum landings sizes (MLS) is the measure most applied nationally by some Member States and the UK. These are mainly applied for economic/market purposes and the sizes themselves vary between countries.

STECF observes that the EWG suggested adjusting the MLS towards "length at 50% maturity (L50)". This would potentially help to reduce fishing mortality on juveniles. However, STECF notes that this is only true if the current MLS is less than the L50 for the species concerned. Such an adjustment should also be accompanied by a change in size-selectivity to avoid catching individuals below the MLS. However, STECF notes that improving the size selectivity for skates and rays in towed gear fisheries is very difficult because of their large, flattened body shape. Therefore, it is not clear what value such MLS adjustments have from a management perspective as all they are likely to achieve in practice is increased levels of unwanted catches that under the high survivability exemption can be discarded. Given survival rates for skates and rays are highly variable, it is possible that the implementation of MLS may increase unaccounted mortality of discarded skates and rays below MLS is because a a larger proportion smaller less resilient rays may die on release.

**ToR 5 - Transparent criteria for the classification of prohibited species.**

STECF agrees with the EWG that there is currently no transparent decision-making procedure on which to include or exclude species from the prohibited species list. This may account for the inconsistencies (including specific species-area combinations and species-gear combinations) between the lists in the Fishing Opportunities regulation and the Technical Measures Regulation (Regulation (EU) 2019/1241).

The EWG summarised the criteria used to classify prohibited species by relevant international conventions/treaties. STECF notes that the criteria used are quite diverse but that such information may be useful in identifying candidate criteria which could be used to classify species in need of protection.

STECF considers that the proposed decision tree proposed by the EWG represents a good starting point to set out a standardised approach to classify protected species in the future. The process outlined by the decision tree suggests a review of every proposed inclusion or exclusion by an independent scientific panel.

**Socio-economic impacts**

STECF observes that the social and economic impact of different skates and rays' management approaches could not be addressed by the EWG. STECF agrees that it would be important to assess the socio-economic impacts of radically changing the current management approach.

## 1.7 STECF Conclusions

STECF concludes that in general, group TACs (SRX TACs) are not optimal for managing the exploitation of skates and rays. STECF concludes that setting single-stock TACs would be a more appropriate management measure than group TACs, particularly given the recent progress towards improved ICES advice for elasmobranch stocks.

STECF concludes that while the use of single-stock TACs is favoured, this may have severe practical implications and limitations to what is possible to implement. It may potentially create more choke species under the landing obligation and there is a risk to misallocate the stock specific TACs due to misidentification of the elasmobranch species.

STECF concludes that the current EU and UK methods for establishing group TACs have pros and cons. Both are relatively straightforward. However, the EU method is less likely to deliver sustainable exploitation of skates and rays because in deriving a group TAC, differences in stock dynamics and productivity are not taken account. The EU method is also biased by being driven by previous TACs, which reflect both the methodology used and the outcome of negotiation.

STECF concludes the UK methodology, applies the ICES advice as directly as possible and is also closer to standard practices for setting group TACs (e.g., setting a group TAC for *Nephrops* based on summing advice from different Functional Units). It follows the ICES stock advice more closely because it accounts for the mismatch between TAC area and stock area and thus may be more appropriate for setting a group TAC.

STECF concludes that the potential alternative approach where TACs would be based on the advice for category 3 and category 5 and 6 groupings, should not be implemented as an alternative for the current group TACs.

STECF concludes that the methods to calculate a sub-TAC (separate share of the group TAC for several species) presented by the EWG are potentially useful for stocks that have been subject to protection and are rebuilding. STECF considers that such an approach should be further explored to ascertain its utility and robustness before the approach is adopted in TAC setting.

STECF agrees with the EWG that separate management objectives for skates and rays should be included in the existing EU multiannual management plan (MAP) but doing so, does not provide an alternative to the current management by TACs and quotas.

STECF concludes that while significant progress has been made on providing survival estimates for skates and rays to support a high survivability exemption from the landing obligation, large gaps still remain due to the large diversity in species, gear types and areas subject to the existing exemption. Gathering information on less resilient species such as cuckoo ray and exploring the use of other methods such as tag and recapture programmes to provide survival estimates should be prioritised.

STECF concludes that there is currently no transparent decision-making procedure on which to include or exclude species from the prohibited species list. STECF considers that the proposed decision tree proposed by the EWG represents a good starting point to set out a standardised approach to classify protected species in the future. The process outlined by the decision tree suggests a review of every proposed inclusion or exclusion by an independent scientific panel.

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# REPORT TO THE STECF

# EXPERT WORKING GROUP ON Skates & Rays Management (EWG-22-08)

## Hybrid meeting (Brussels, Belgium), 26-30 September 2022

# 1 INTRODUCTION

Since the introduction of the relevant TACs, skates and rays have been managed under generic TACs. These have applied to the main species in the skate and ray assemblages under the main ecoregions in the North-East Atlantic, namely, the North Sea, the Celtic Seas, and Biscay & Iberia. While various changes to the system have been made over the years, e.g. the introduction of clauses allowing "no more than" certain tonnes to be caught of particular species in particular areas, in general the system has remained essentially unchanged.

The International Council for the Exploration of the Seas (ICES) has several times advised that generic TACs are not effective management measures for stocks such as these. However there may be practical, legal, scientific or biological reasons why single-stocks TACs, as used for most other species, may not be suitable. Skates and rays are considered to be slower-growing, have lower fecundity, and in several cases exist in lower numbers than fish such as gadoids, and so special consideration needs to be given to their sustainable management.

The departure of the United Kingdom from the EU has meant that there are now two different management authorities in several areas and over several stocks. For the first two years of this situation, the UK and the EU took different approaches to how to advise on a final TAC figure for each assemblage. In essence, the UK sums up the advice for each species in the assemblage, whereas the EU takes the mean change in advice across the species. This Expert Group was convened to examine the pros and cons of each method. It was also tasked with examining other issues in the management of skates and rays, as outlined in the Terms of Reference in Section 1.1 below.

Prior to the convening of this Group, two independent experts were asked to produce a report calculating what TACs for a reference year would be using the two approaches, and to compare and contrast issues in each (Batsleer & Lorance 2023). This group's response to Terms of Reference 1 and 2 are mainly lead by work presented in this report.

In this report the terms of reference are addressed individually, with each chapter addressing one term. Terms of Reference 1 and 2 are also addressed together in Section 7, with final conclusions in Section 8.

## 1.1 Terms of Reference for EWG-22-08

1. To consider the appropriateness of the current EU and UK approaches in terms of ensuring the sustainable exploitation and conservation of all skates and rays species falling under the SRX group TACs.
2. To consider the appropriateness of using single species sub-TACs as an alternative to the current SRX group TACs.
3. To consider the possibility of developing bespoke management plans as a replacement to SRX group TACs.
4. To consider progress made in underpinning the exemption to the landing obligation and next steps, by species and by gears, by assessing catch data, discard survival rates, methods for improving avoidance, selectivity and survival.
5. To consider transparent criteria to classify skate and ray species as prohibited species.
6. The work should build on the EWG 17-01 report and any additional knowledge from more recent years.

The work under TOR 1 should, as a starting point, be based on the following documents:

- Joint UK-EU Non-Paper: EU and UK approaches to Skates and Rays TAC-setting for 2021 and 2022 (Draft, July 2022) – explanatory document of the two approaches
- Exploring alternative methods for Skates and rays TAC and quota management (Batsleer and Lorance, May 2022) – STECF ad hoc contract
- EU request for a Technical Service to provide catch statistics for skates and rays caught in ICES areas 3, 4, 5, 6, 7, 8 and 9 included in the SRX TAC group (ICES Technical Service, 20 April 2022)

For TOR 1-3, the EWG should discuss pros and cons of each approach considered, including their practical application, and especially in light of achieving conservation objectives, but also in terms of inter alia, relative stability and socioeconomics, species identification and reporting.

TOR 4 should draw on the work done by the STECF EWG relating to the landing obligation.

The EWG should also provide guidance on where specific questions cannot be fully answered as further scientific advice from ICES is required.

# 2 TERM OF REFERENCE 1

"*1. To consider the appropriateness of the current EU and UK approaches in terms of ensuring the sustainable exploitation and conservation of all skates and rays species falling under the SRX group TACs.*"

## 2.1 Initial study

In early 2022 a report (Batsleer & Lorance 2022) was commissioned by the EU. This report gave an independent assessment of what a theoretical TAC would be for a reference year, using the UK and the EU approaches. The authors were also asked to examine any alternative methods to the two, and to provide pros and cons to each method. A closer examination of alternative methods is provided in Section 3.

### *2.1.1 Comparison of UK and EU methods*

ICES considers 39 stocks of skates and rays in the Northeast Atlantic, for a few of which advices are not requested or cannot be provided. With a few exceptions, TACs are not stock-specific but covers all skates and rays in an area. There are five skates and rays covering the North Sea and Norwegian (Division 2.a and Subarea 4, SRX/2AC4-C), The Kattegat/Skagerrak (Division 3.a, (SRX/03A-C.), the Eastern English Chanel (Division 7.d, SRX/07D), the Celtic Seas (subareas 6 and 7, SRX/67AKXD) and the Biscay and Iberia ecoregion (subareas 8 and 9, SRX/89-C). Every TAC covers several stocks so that various methods may be applied to aggregate ICES advice for individual stocks into a multi-stock TAC. The EU and UK currently use two different methods, which are compared in the next sections.

#### 2.1.1.1 Analysis of landings and advice within the group TAC

Both the EC and UK method for group TAC calculation use stock-specific ICES advice. In doing so, it is explicitly assumed that the fishery exploits different stocks at levels that are proportional to that advice, therefore ensuring that the fishing mortality is both precautionary and sustainable (i.e., in line with the ICES MSY or ICES precautionary approach to fisheries management). For instance, in the simplified case of two species, A and B, with advice of 1000 and 100 tonnes respectively, it is expected that species A will make up a large majority (~90%) of the catch within the group TAC.

To test the validity of this assumption, we collated stock-specific landings data spanning 2016-2021 for skates and rays in the Greater North Sea, Celtic Seas, and Iberian waters ecoregions (the same regions used by the current skates and rays group TAC). We then quantitatively compared these landings (by stock, year and ecoregions) to annual ICES advice, and investigated whether landings taken as part of the group TAC can be considered sustainable at the stock level. To further investigate the levels of exploitation, we also aggregated species and stocks by ICES category (category 3 vs. category 5 and 6) and species-specific vulnerability. Here, vulnerability is used as a rank metric (1 = most vulnerable, etc.) based on species-specific life histories, as well as the catchability and susceptibility of different species to fisheries capture by different metiers. Vulnerability ranks were taken directly from McCully *et al*. (2013) and are detailed in Table 2.1. ICES categories by stock are also listed in Table 1.

**Table 2.1: Skate and ray species and stocks considered in this analysis. IW = Iberian Waters, CS = Celtic Seas and GNS = Greater North Sea. Group TAC details those stocks that are currently included in the group TAC for skates and rays in the corresponding ecoregion.**

| Species (Latin name) | Species (Common name) | Stock Code | ICES category | Vulnerability rank (1-10) | Ecoregion | TAC code | Group TAC |
|---|---|---|---|---|---|---|---|
| *Rajidae* | Rays and skates | raj.27.89a | 5 | NA | IW | SRX/89-C | Y |
| - | Common skate complex | rjb.27.67a-ce-k | 6 | 8 | CS | SRX/67AK XD | N |
| - | Common skate complex | rjb.27.89a | 6 | 8 | IW | SRX/89-C | Y |
| *Raja clavata* | Thornback ray | rjc.27.3a47d | 3 | 2 | GNS | SRX/03A-C. | Y |
| *Raja clavata* | Thornback ray | rjc.27.6 | 3 | 2 | CS | SRX/67AKXD | Y |
| *Raja clavata* | Thornback ray | rjc.27.7afg | 3 | 2 | CS | SRX/67AKXD | Y |
| *Raja clavata* | Thornback ray | rjc.27.7e | 5 | 2 | CS | SRX/67AKXD | Y |
| *Raja clavata* | Thornback ray | rjc.27.8 | 3 | 2 | IW | SRX/89-C | Y |
| *Raja clavata* | Thornback ray | rjc.27.9a | 3 | 2 | IW | SRX/89-C | Y |
| *Raja microocellata* | Small-eyed ray | rje.27.7de | 5 | 6 | CS GNS | SRX/67AKXD | Y |
| *Raja microocellata* | Small-eyed ray | rje.27.7fg | 3 | 6 | CS | RJE/7FG | Y |
| *Leucoraja fullonica* | Shagreen ray | rjf.27.67 | 5 | 4 | CS | SRX/67AKXD | Y |
| *Raja brachyura* | Blonde ray | rjh.27.4a6 | 5 | 1 | GNS | SRX/67AKXD SRX/2AC4-C | Y |
| *Raja brachyura* | Blonde ray | rjh.27.4c7d | 3 | 1 | GNS | SRX/07D. | Y |
| *Raja brachyura* | Blonde ray | rjh.27.7afg | 5 | 1 | CS | SRX/67AKXD | Y |
| *Raja brachyura* | Blonde ray | rjh.27.7e | 5 | 1 | CS | SRX/67AKXD | Y |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Raja brachyura* | Blonde ray | rjh.27.9a | 3 | 1 | IW | SRX/89-C | Y |
| *Raja circularis* | Sandy ray | rji.27.67 | 5 | 3 | CS | SRX/67AKXD | Y |
| *Raja montagui* | Spotted ray | rjm.27.3a47d | 3 | 7 | GNS | SRX/2AC4-C SRX/07D | Y |
| *Raja montagui* | Spotted ray | rjm.27.67bj | 3 | 7 | CS | SRX/67AKXD | Y |
| *Raja montagui* | Spotted ray | rjm.27.7ae-h | 3 | 7 | CS | SRX/67AKXD | Y |
| *Raja montagui* | Spotted ray | rjm.27.8 | 3 | 7 | IW | SRX/89-C | Y |
| *Raja montagui* | Spotted ray | rjm.27.9a | 5 | 7 | IW | SRX/89-C | Y |
| *Leucoraja naevus* | Cuckoo ray | rjn.27.3a4 | 3 | 9 | GNS | RJN/2AC4-C | Y |
| *Leucoraja naevus* | Cuckoo ray | rjn.27.678abd | 3 | 9 | CS GNS IW | SRX/2AC4-C | Y |
| *Leucoraja naevus* | Cuckoo ray | rjn.27.8c | 3 | 9 | IW | SRX/89-C | Y |
| *Leucoraja naevus* | Cuckoo ray | rjn.27.9a | 3 | 9 | IW | SRX/89-C | Y |
| *Amblyraja radiata* | Starry ray | rjr.27.23a4 | 3 | 10 | GNS | SRX/2AC4-C | N |
| *Raja undulata* | Undulate ray | rju.27.7bj | 6 | 5 | CS | NA | N |
| *Raja undulata* | Undulate ray | rju.27.7de | 3 | 5 | CS GNS | RJU/7DE | N |

Stock-specific landings data were taken directly from the dataset (landings and discards) collated during the ICES working group for elasmobranch fishes (WGEF; ICES 2021). Stock-specific ICES advice was collated from ICES advice sheets. Landings are typically reported by ICES division and were allocated to ecoregions based on the information provided in Table 2. In comparison, advice is typically given at the stock level, and therefore for stocks that straddle ecoregions a correction is needed to split the advised TACs into ecoregions. To do this, we calculated the annual proportion of landings per ecoregion for each stock and applied this proportion as a correction factor to split the ICES advice. For instance, landings of small-eyed ray in 7de (rje.27.7de) occurred in both the Greater North Sea and the Celtic Seas ecoregions. In 2017, 15 (0.4) and 22 (0.6) tonnes were landed in the Celtic Seas and Greater North Sea, respectively. The advice in 2017 was 36 tonnes, and was therefore split into advised landings of 14 tonnes in the Celtic Seas and 22 tonnes in the Greater North Sea.
Discards are also reported by stock and year in the WGEF dataset but were not considered here.

**Table 2.2: ICES divisions assigned to each of the three ecoregions in the Northeast Atlantic.**

| Ecoregion | ICES divisions |
|---|---|
| Greater North Sea | 27.2.b, 27.3.a.20, 27.3.a.21, 27.4.a, 27.4.b, 27.4.c, 27.2.a, 27.7.d, 27.4 |
| Celtic Seas | 27.6.a, 27.6.b, 27.7.a, 27.7.b, 27.7.c, 27.7.e, 27.7.f, 27.7.g, 27.7.h, 27.7.j, 27.7.k, 27.7, 27.6, 27.7.c.2, 27.7.j.2, 27.7.k.2, 27.6.b.1 |
| Iberian waters | 27.8.a, 27.8.b, 27.8.c, 27.8.d, 27.9.a, 27.8.e, 27.9.b, 27.8.abd, 27.8.ce, 27.8.d.2 |

A total of 30 stocks were considered in this analysis (Table 2.1). Stocks were not considered if they either had no reported landings or no advice. Undulate ray (rju.27.7bj, rju.27.7de) was included, however, this species has had its own stock-specific advice since 2015 and is no longer considered in the group TAC. That said, understanding whether undulate rays are currently under- and/or overexploited by the fishery remains valuable and informative. For clarity, we report differences between landings and advice in terms of relative values (landings divided by advice) as well as absolute values (landings minus advice). Relative values provide an indicative measure of stock-specific exploitation and sustainability, whereas absolute values are more likely to be informative to fisheries advice and ongoing TAC negotiations. In some cases, the advised TAC for a stock is 0 but landings still occur (e.g., rjb.27.67a-ce-k); in these cases the relative value has been fixed at 1 for illustrative purposes. For the purpose of this analysis "overexploited/overexploitation" means that landings exceeded the advice, "underexploited/under exploitation" that landings fell below the advice.

In Figures 2.1-2.3, we present relative and absolute values by year, stock and ecoregion. In the Greater North Sea, our findings show that blonde ray (rjh.27.4a6 and rjh.27.4c7d) and cuckoo ray (rjn.27.3a4) have been overexploited, both in terms of relative and absolute landings, in all years (Figure 2.1). For instance, in 2021 the landings of blonde ray in 4c and 7d were 274 tonnes compared to an advised landings of 164 tonnes. In comparison, thornback ray (rjc.27.3a47d) was underexploited from 2016 to 2019, whereas spotted ray (rjm.27.3a47d) was underexploited in 2020 and 2021.

Both stocks of blonde ray (rjh.27.7afg and rjh.27.7e) have also been overexploited in the Celtic Seas, a trend that is consistent in all years (Figure 2.2). Thornback ray (rjc.27.6 and rjc.27.7e), undulate ray (rju.27.7de) and the common skate complex (rjb.27.67a-ce-k) have also been overexploited in certain years, albeit the emergent trend is less clear than for the two blonde ray stocks. Few stocks in the Celtic Seas have been consistently underexploited, albeit thornback ray (rjc.27.7afg) and spotted ray (rjm.27.678abd) have landings that fall below their respective ICES advice. In Iberian waters, spotted ray (rjm.27.8) has been consistently overexploited, whereas the two cuckoo ray stocks (rjn.27.8c and rjn.27.9a) have been both over- and underexploited over recent years (Figure 2.3). Thornback ray (rjc.27.9a) has also been underexploited.

When landings and advice are aggregated across 2016-2021 and split by ICES categories (Figure 2.4) and species vulnerability (Figure 2.5) we observed complementary trends. Specifically, we found that category 5 and 6 stocks have been overexploited in the Celtic Seas, whereas category 3 stocks have been underexploited (Figure 2.4). In fact, landings of category 5 and 6 stocks have exceeded ICES advice by nearly 10,000 tonnes over the last six years. In comparison, the Greater North Sea and Iberian waters ecoregions display some under exploitation of category 3 stocks, although the trends are much less pronounced than in the Celtic Seas. Landings of the most vulnerable species (blonde ray, thornback ray and sandy ray) have also exceeded ICES advice in the Celtic Seas, whereas those classified as least vulnerable (spotted ray and cuckoo ray) have been underexploited (Figure 2.5). These trends are reversed in the Greater North Sea and Iberian waters.

In summary, we have found that certain vulnerable species and stocks, in particular blonde ray as well as several stocks currently assessed by ICES using category 5 and 6 methods, are being overexploited as part of the group TAC. These findings call into question the sustainability and suitability of a group TAC for skates and rays, especially in the Celtic Seas and Greater North Sea ecoregions. It also suggests that the assumption of proportional exploitation that is explicitly made when using a group TAC is unlikely to be valid in this case.

Such trends of under and overexploitation could be a consequence of high grading, where certain species and/or sizes are preferentially landed over others. It could be also be driven by changing market demand and pricing, as fishers strive to maximise commercial profits. For instance, it is widely accepted that blonde ray might be targeted in areas of high local abundance, due to its large size and high market value (ICES 2022a, b). Further work will be needed to disentangle cause and effect, and the linkage of exploitation rates to socio-economic factors might prove fruitful to both scientists and managers.

Based on our findings, a short term recommendation might be to consider group TACs split by ICES categories, i.e., separate group TACs for category 3 and category 5 & 6 stocks, respectively (This is further explored in Section 3). A group TAC split by ICES category is likely to be more precautionary, especially for those stocks that are data limited. That said, the current ICES approach to data-limited stocks invokes a systematic periodic reduction of catch advice by 20% and will undoubtedly result in a group TAC for category 5 and 6 stocks that declines through time. This decline could be addressed by further at sea sampling or the development of CPUE trends, thus allowing scientists to gain the relevant information needed to analyse these stocks using more established techniques (i.e., use of category 3 methodologies). This recommendation is discussed in more detail below.

In the long term, the meeting agreed that stock specific TACs would likely be more appropriate for skates and rays in the Northeast Atlantic. Single stock advice is already given by ICES for most species, and therefore the framework already exists to support its implementation. This recommendation will likely remain valid in the long-term due to the presence of high grading, variable market demand and valuation, as well as stock-specific sensitivities to fishing.

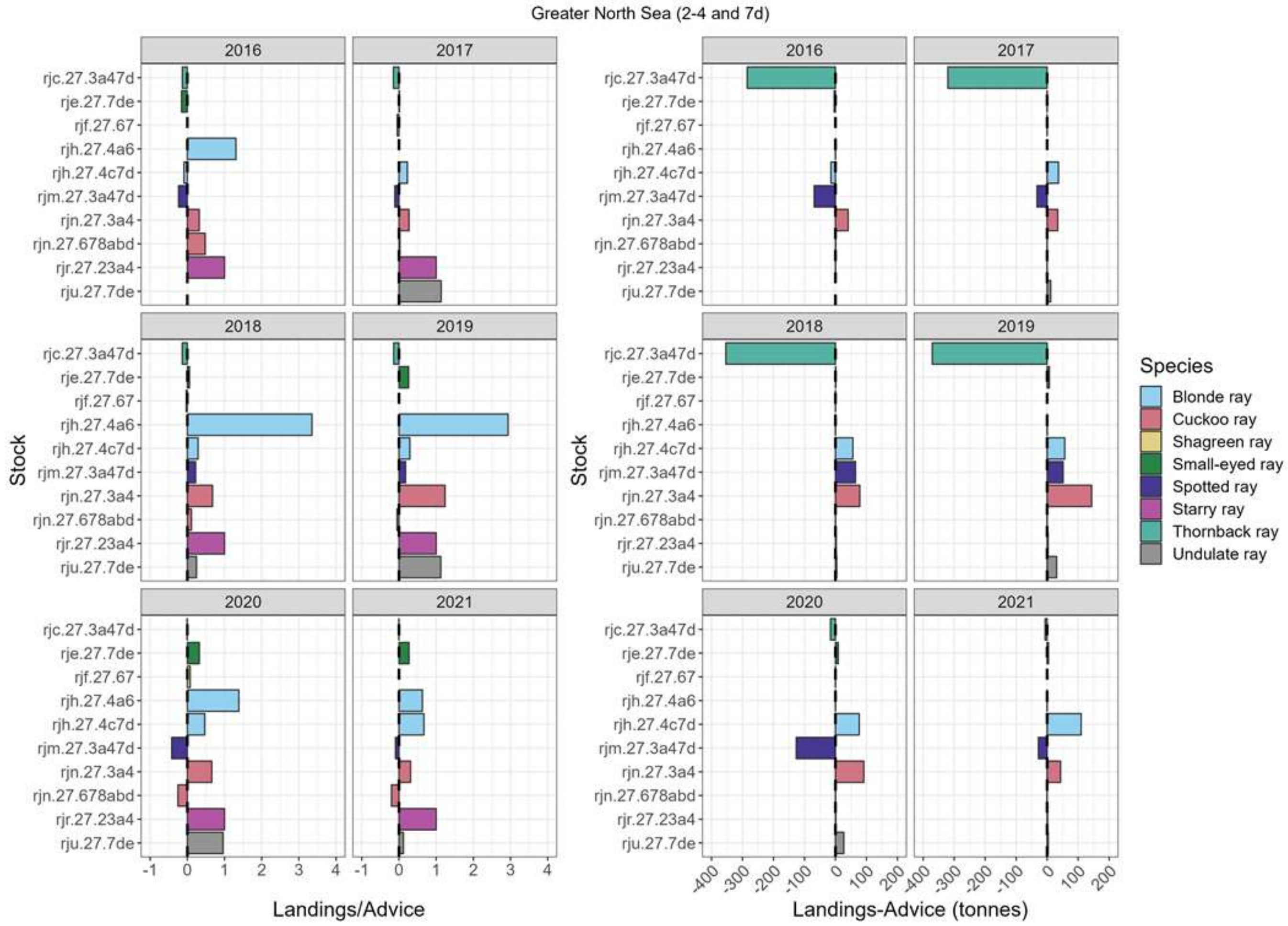


**Figure 2.1: Relative (left) and absolute (right) differences between stock-specific landings and advice in the Greater North Sea (2, 3a, 4 and 7d) ecoregion (2016-2021). Stocks are detailed on the y axis and colours represent species. The vertical dotted line at 0 represents equality between stock-specific landings and advice, such that values above and below this line indicate annual landings that exceeded or fell short of the ICES advice, respectively.**

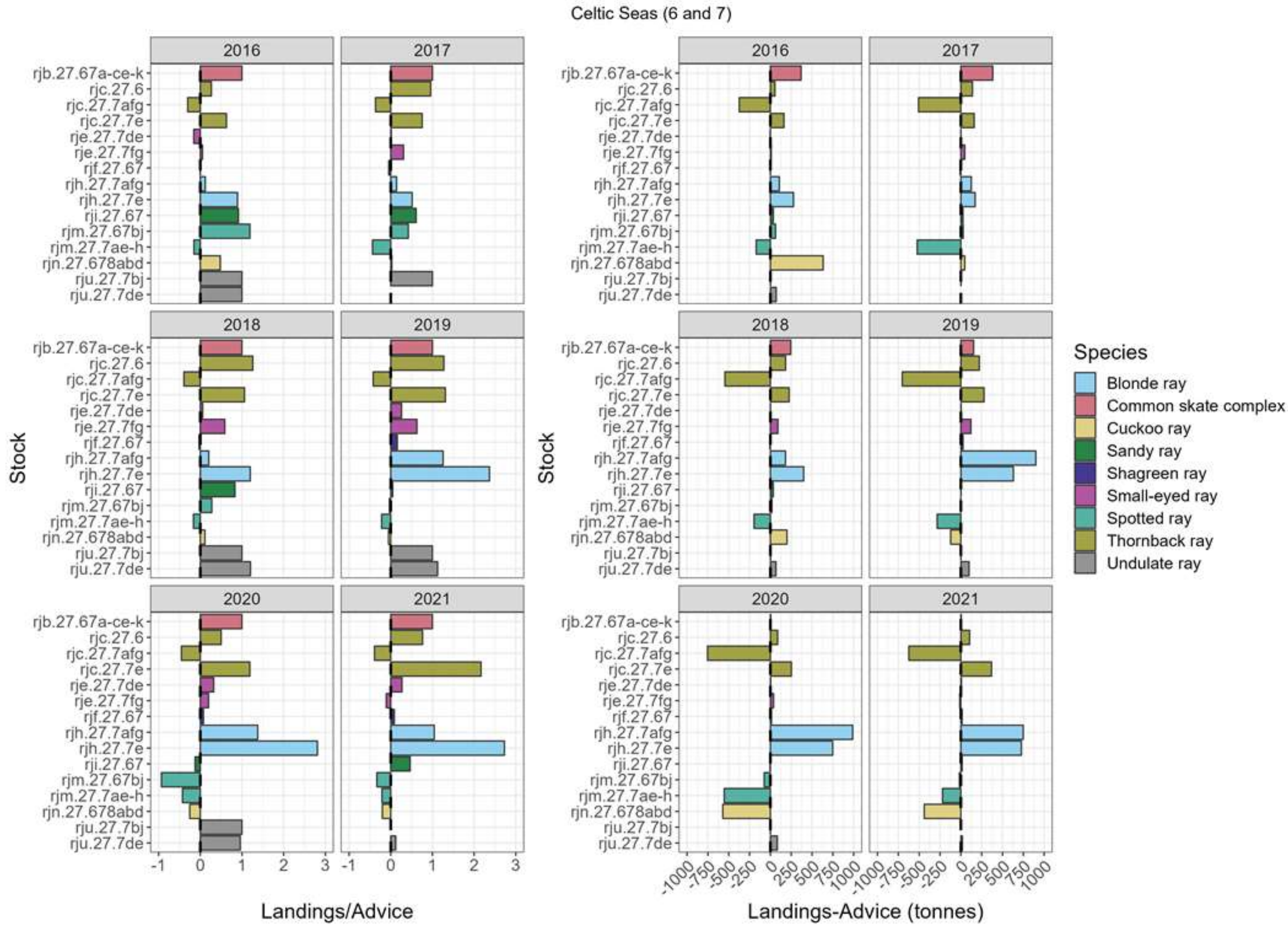


**Figure 2.2: Relative (left) and absolute (right) differences between stock-specific landings and advice in the Celtic Seas (6 and 7) ecoregion (2016-2021). Stocks are detailed on the y axis and colours represent species ID. The vertical dotted line at 0 represents equality between stock-specific landings and advice, such that values above and below this line indicate annual landings that exceeded or fell short of the ICES advice, respectively.**

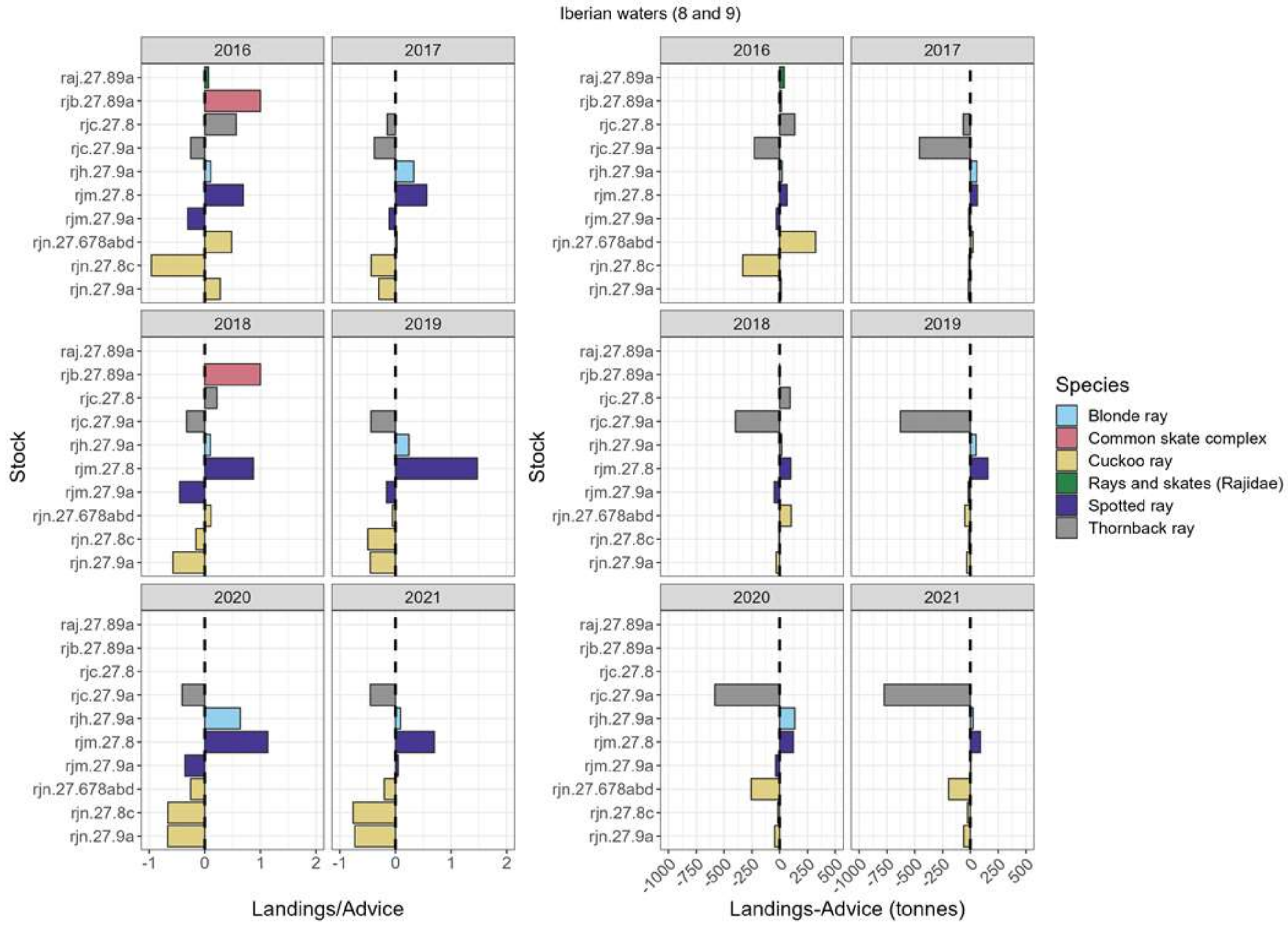


**Figure 2.3: Relative (left) and absolute (right) differences between stock-specific landings and advice in the Iberian waters (8 and 9) ecoregion (2016-2021). Stocks are detailed on the y axis and colours represent species ID. The vertical dotted line at 0 represents equality between stock-specific landings and advice, such that values above and below this line indicate annual landings that exceeded or fell short of the ICES advice, respectively.**

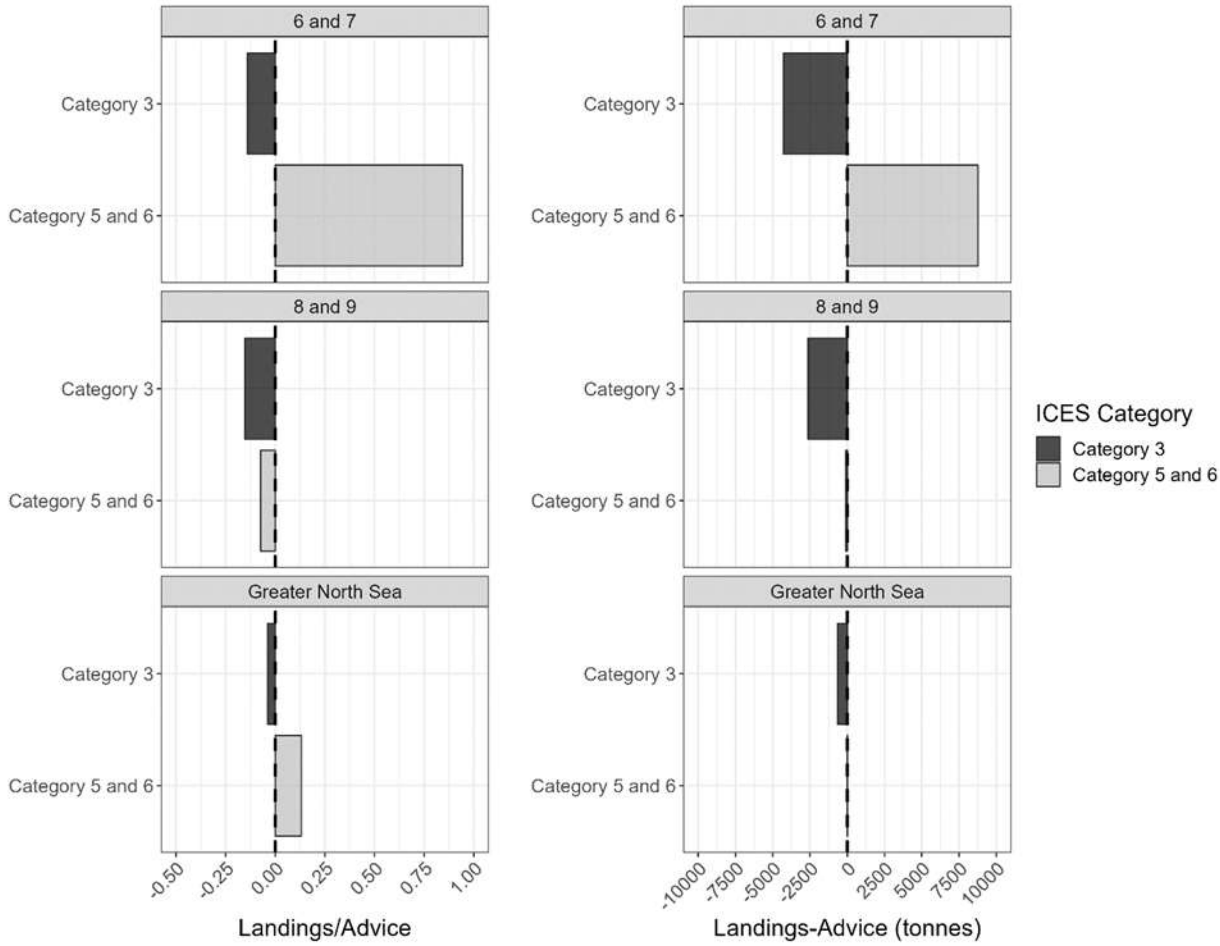


**Figure 2.4: Relative (left) and absolute (right) differences between stock-specific landings and advice by ICES category. Values are totals taken over a 6 year period (2016-2021). The vertical dotted line at 0 represents equality between stock-specific landings and advice, such that values above and below this line indicate annual landings that exceeded or fell short of the ICES advice, respectively. Stock-specific categories are detailed in Table X1.**

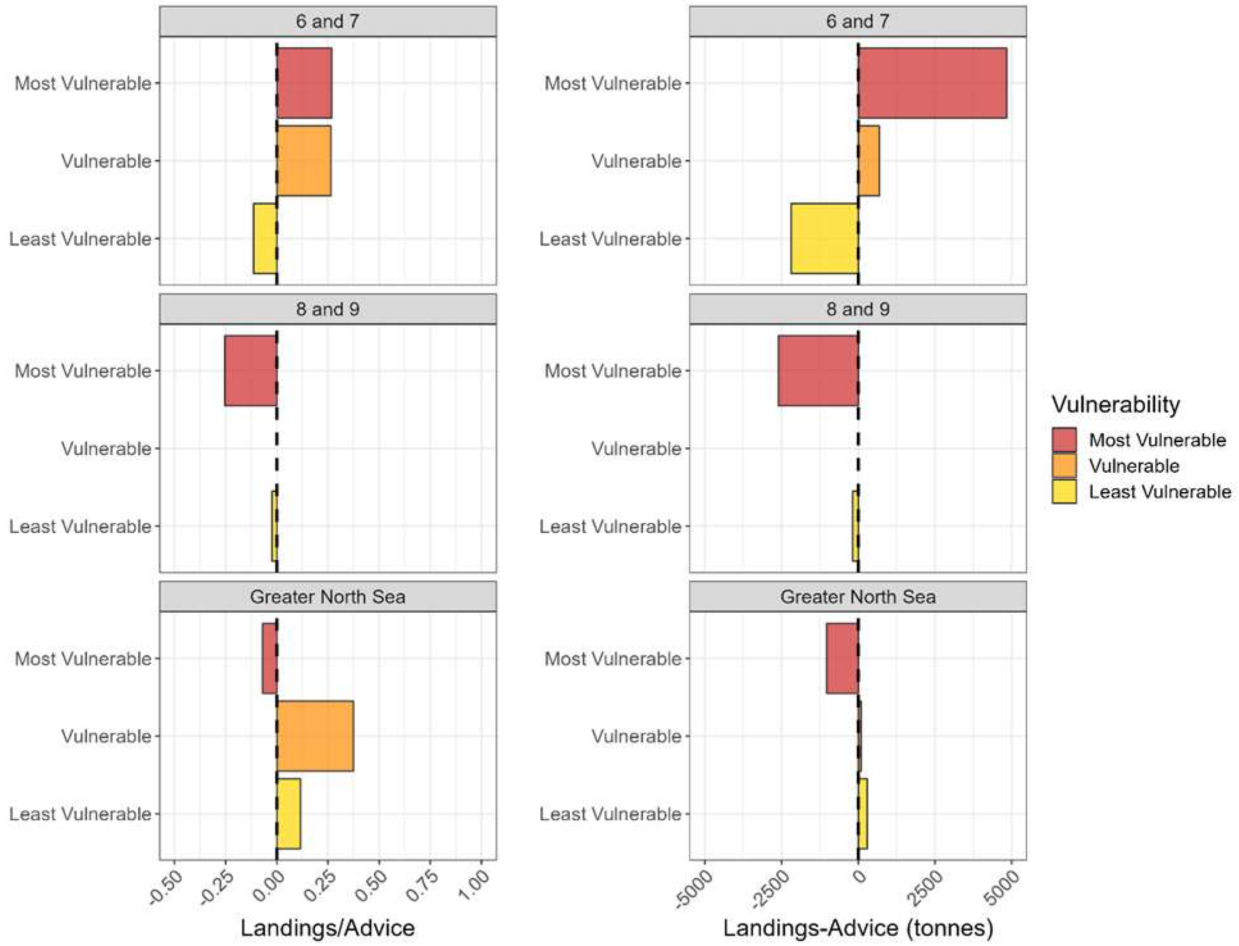


**Figure 2.5: Relative (left) and absolute (right) differences between stock-specific landings and advice by vulnerability. Values are totals taken over a 6 year period (2016-2021). The vertical dotted line at 0 represents equality between stock-specific landings and advice, such that values above and below this line indicate annual landings that exceeded or fell short of the ICES advice, respectively. Stock-specific vulnerability ranks are detailed in Table 2.1.**

#### 1.8.1.1 Use of the FDI database

The meeting also explored the use of the FDI (Fisheries Dependent Information) database as an additional source of information for this analysis. Preliminary investigations showed that the FDI included marginally less landings than the ICES WGEF dataset in almost all ecoregions and years, and therefore was not considered further (Figure 2.6). However, it is important to note that the FDI lacks stock-specific information, and therefore comparisons to the WGEF dataset at the stock and ecoregion level are unlikely to be meaningful. Further work beyond this meeting is needed to integrate stock-specific information into the FDI dataset. This work will be time consuming but will be crucial if the FDI is to be used to provide and/or complement stock-specific assessments and advice.

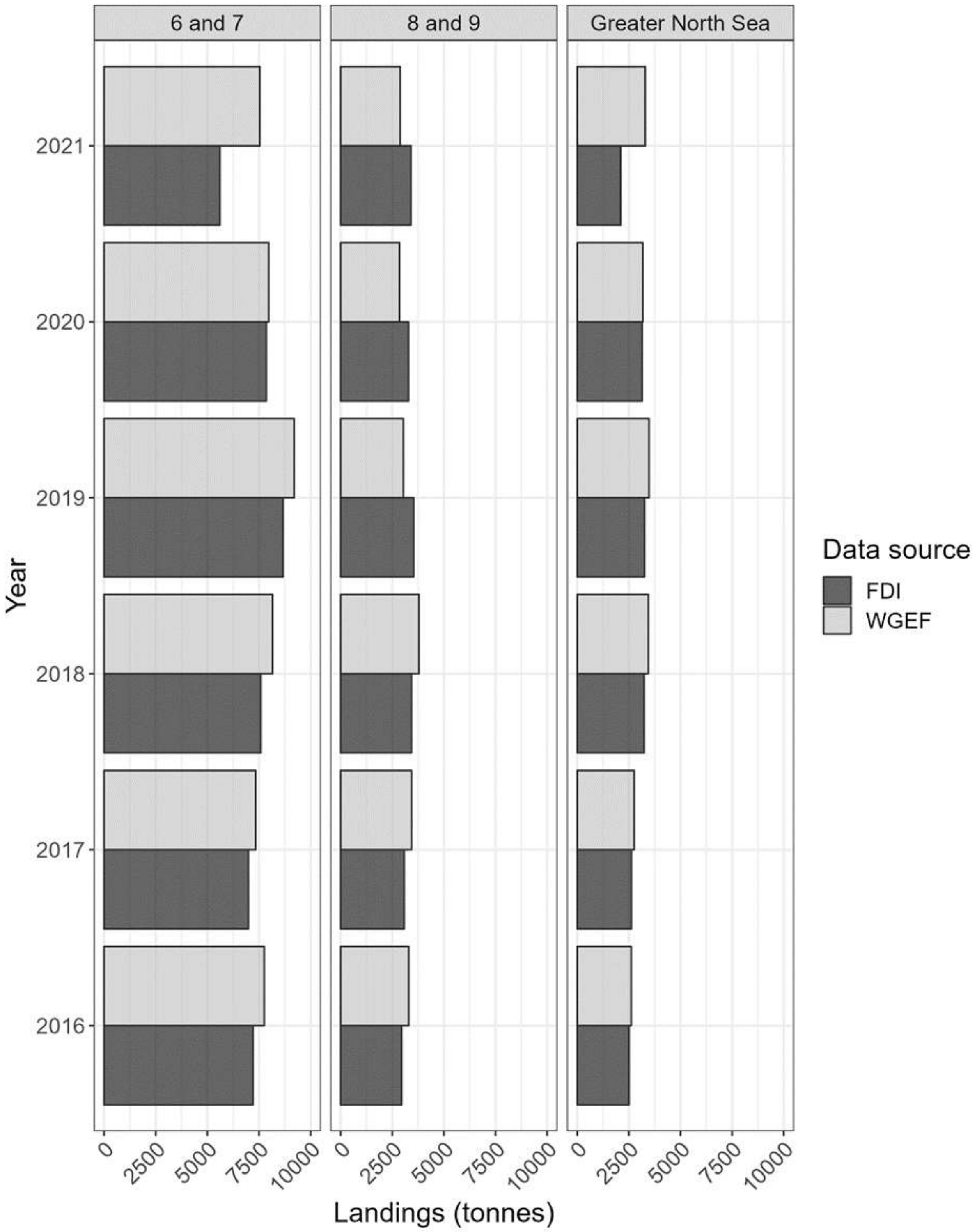


**Figure 2.6: Total landings by ecoregion in the FDI (black) and WGEF (grey) datasets. Only species and ICES divisions listed in Table 2.1 and Table 2.2 are considered.**

## 1.9 **Theoretical comparisons of the EC and UK methods for calculating SRX TACs**

Analyses and comparisons of the two methods were carried out to examine their suitability in terms of the conservation of smaller/more vulnerable stocks and exploitation of all stocks at suitable levels, here defined as ICES advised levels applying either the ICES MSY or the ICES precautionary approach. For stocks assessed as ICES stock data category 3 (Cat. 3) a trend-based assessment is carried out using a biomass index from scientific survey or CPUE. Advices for ICES stock data categories 5 or 6 (Cat. 5-6) do not result from an assessment and include the statement "There is no assessment for this stock in this area". For these stocks a 20% precautionary reduction in the catch or landings advice is applied, every 4 years for skates and rays stocks which are assessed biennially.

The UK method and the EC method to calculate SRX TACs were applied to a simple simulation, where a SRX TAC covers one large stock (stock A) of Cat. 3 and two smaller stocks (stocks B and C) of Cat. 5-6. Actual SRX TACs cover larger numbers of stocks, but may include one major stock (e.g. thornback ray in the Greater North Sea, rjc.27.3a47d) and several Cat. 5-6 stocks with smaller catches (e.g. SRX/67AKXD includes six Cat. 5-6 stocks and six Cat. 3 stocks). In the simulations, this was represented by the large Cat. 3 stock and the two smaller Cat. 5-6 stocks. The aim of these simple simulations was to separate the effects of changes in advised landings by stock on the SRX TACs calculated from the UK and EC methods. Therefore the approach was to calculate the SRX TAC from the two methods when changes in advices apply to only one ICES stock category. Lastly, an application to the SRX/67AKXD TAC was included to consider practical implications.

### 1.9.1 *Method*

To compare the SRX TAC resulting for the two methods, the previous landings (corresponding in reality to landings in the last year before the assessment year) were assumed to correspond exactly to previous advices by stock and to sum up to the previous TAC. In reality, the EC method applies the averaged change in advices to the previous agreed TAC, so that the difference between the new TAC derived from the EC and UK methods do not come from the differences in methods only but is also impacted by the difference between the previous TAC and the sum of previous advices. Stock A was subject to landings and advice of 3000 tonnes in the previous year and stocks B and C were subject to landings and advices of 50 tonnes.

Four cases were calculated, in the two first, the assessment of stock A (Cat. 3) resulted in a 10% decrease or increase of the advice for this stock with no change for stocks B and C (Cat. 5-6). These cases represent the situation where advices for assessed stocks change and no precautionary reduction in catch or landings is applied to non-assessed stocks. In the third case, the assessment of the Cat. 3 stock resulted in no change whilst the precautionary reduction (-20%) was applied to stocks B and C. The fourth case was the same as the third, but landings from stock B were made 20 times bigger.

For these various simulations, it is hypothesized that landings by stock during the two-year period following the advice year will be proportional to previous landings.

### 1.9.2 *Results*

#### 1.9.2.1 Case 1

The new advices were 2700 tonnes for stock A (-10% landings) and 50 tonnes for stocks B and C, as no precautionary reduction was applied (Table 1). Applying the EC method, the average relative TAC change was -3.33% and results in a TAC of 2997 tonnes in the next year, higher than the sum of the three advices (2800 tonnes, UK method). In that case, the EC method was less precautionary than the UK method because if the TAC was fully landed, at least one stock (Stock A) would be exploited at a higher level than advised.

**Table 2.3: Theoretical SRX TAC using the EC and UK methods in the situation where the advice for the Cat.3 stock decreases and the advices for the Cat. 5-6 stocks do not change**

| | ICES stock category | Previous landings | Advice | % advice change | EC method | UK method |
|---|---|---|---|---|---|---|
| Stock A | Cat. 3 | 3000 | 2700 | -10 | | |
| Stock B | Cat.5-6 | 50 | 50 | 0 | | |
| Stock C | Cat.5-6 | 50 | 50 | 0 | | |
| % TAC change | | | | | -3.333 | -9.677 |
| TAC | | 3100 | | | 2997 | 2800 |

### 1.9.2.2 Case 2

The new advices were 3300 tonnes for the Cat. 3 stock (+10% landings) and 50 tonnes for stocks B and C, as no precautionary reduction was applied (Table 2.2.2). Applying the EC method, the average relative TAC change was +3.33% and results in a TAC of 3203 tonnes in the next year, lower than the sum of the three advices (3400 tonnes, UK method). In that case, the EC method was more precautionary than the UK method because it restricted the SRX TAC to a level where advised landings cannot be taken for all stocks.

**Table 2.4: Theoretical SRX TAC using the EC and UK methods in the situation where the advice for the Cat.3 stock increases and the advices for the Cat. 5-6 stocks do not change**

| | ICES stock category | Previous landings | Advice | % advice change | EC method | UK method |
|---|---|---|---|---|---|---|
| Stock A | Cat. 3 | 3000 | 3300 | 10 | | |
| Stock B | Cat.5-6 | 50 | 50 | 0 | | |
| Stock C | Cat.5-6 | 50 | 50 | 0 | | |
| % TAC change | | | | | 3.333 | 9.677 |
| TAC | | 3100 | | | 3203 | 3400 |

### 1.9.2.3 Case 3

The new advices ware 3000 tonnes for stock A (no change) and 40 tonnes for stocks B and C, following a 20% decrease in advised landings from the precautionary reduction (Table 2.2.3). Applying the EC method, the average relative TAC change was -13.33% and results in a TAC of 2687 tonnes in the next year, lower than the sum of the three advices (3080 tonnes, UK method).

**Table 2.5: Theoretical SRX TAC using the EC and UK methods in the situation where the advice for the Cat.3 stock does not change and the advice for the Cat. 5-6 stocks decreased following the application of the precautionary reduction.**

| | ICES stock category | Previous landings | Advice | % advice change | EC method | UK method |
|---|---|---|---|---|---|---|
| Stock A | Cat. 3 | 3000 | 3000 | 0 | | |
| Stock B | Cat.5-6 | 50 | 40 | -20 | | |
| Stock C | Cat.5-6 | 50 | 40 | -20 | | |
| **% TAC change** | | | | | **-13.333** | **-0.645** |
| **TAC** | | **3100** | | | **2687** | **3080** |

### 1.9.2.4 Case 4

In this case, the landings of stock B were larger than in the three previous cases (1000 tonnes versus 50 tonnes) and the individual relative changes in advices were the same as in case 3. Therefore, this case is to be compared to case 3 only. The comparison with cases 1 and 2 is less straightforward because this combines the effect of larger previous landings and different advices. The application of the precautionary reduction to stocks B and C resulted in advised landings reduced by 210 tonnes for these two stocks combined, as a consequence applying the UK method, TAC is reduced by the same amount (Table 4). Applying the EC method, the average relative TAC change was -13.33% like in case 3, and resulted in a TAC of 3510 tonnes in the next year, lower than the previous TAC by 540 tonnes. The percent TAC change using the UK method was larger than in case 3 because one of the Cat. 5-6 stocks was larger. Nevertheless, with the setting with one Cat. 3 stock and two Cat. 5-6 stocks, the EC method will result in a lower TAC than the UK method, unless the previous advice for Cat. 5-6 stocks amounted to twice that of the Cat. 3 stock, which is far from real situations, where Cat. 3 stocks are larger.

**Table 6: Theoretical SRX TAC using the EC and UK methods in the situation where the advice for the Cat.3 stock does not change and the advice for the Cat. 5-6 stocks, one of which is large, decreased following the application of the precautionary reduction.**

| | ICES stock category | Previous landings | Advice | % advice change | EC method | UK method |
|---|---|---|---|---|---|---|
| Stock A | Cat. 3 | 3000 | 3000 | 0 | | |
| Stock B | Cat.5-6 | 1000 | 800 | -20 | | |
| Stock C | Cat.5-6 | 50 | 40 | -20 | | |
| **% TAC change** | | | | | **-13.333** | **-5.185** |
| **TAC** | | **4050** | | | **3510** | **3840** |

### 1.9.2.5 Application to one the four SRX TAC

In the Celtic Seas, the SRX/67AKXD TAC in 2021 and 2022 covered six Cat. 3 stocks (rjc.27.6, rjc.27.7afg, rje.27.fg, rjm.27.7ae-h, rjm.27.67bj, rjn.27.678abd) and six stock of ICES category 5 (Cat. 5 stocks: rjc.27.7e, rje.27.7de, rjh.27.7afg, rjh.27.7e, rji.27.67, rjf.27.67). Other stocks in this ecoregion are managed under stock-specific TACs (rju.27.7de), subject to prohibition or to 0 catch advice (rjb.27.67a-ce-h, rju.27.7bj) or ICES cannot provide advice (raj.27.67a-ce-h). The stock rje.27.fg, is subject to a sub-TAC of SRX/67AKXD, but this does not influence the calculation of the SRX TAC. The sum of the advised landings for 2021 and 2022 for the six Cat. 3 stocks and the six Cat. 5 stocks were 6098 and 1394 tonnes respectively, i.e. Cat. 5 stocks represented less than 20% of the advised landings covered by SRX/67AKXD. The TAC in 2022 allowed higher landings up to 9482 tonnes, 5% of which was allowed to be taken in adjacent areas.
With the assumption used in the cases above, the EC method would results in applying a -10% to the sum of previous advice, resulting in a new TAC of 6742 tonnes (reduced by 749 tonnes) and the UK method would result in a TAC of 7213 tonnes(reduced by 279 tonnes). Applying the averaged TAC change of -10% to the previous agreed TAC, as done by the EC, would result in reducing the TAC by 10%, (948 tonnes) to 8534 tonnes.

### 1.9.2.6 Conclusion from theoretical comparisons

In all cases, the UK method resulted in TACs equal to the sum of the advices. As ICES advices are based on either the MSY approach or the precautionary approach, the UK method results in exploiting all stocks at advised levels if and only if the contributions of stocks to landings counted against the TAC correspond to advices. In all other cases, the uptake of the TAC implies exploiting some stocks at higher levels than advised and others at lower levels. This point is integrated in ICES advices which state "Management of the catches of skates and rays under a combined TAC prevents effective control of single-stock exploitation rates and could lead to overexploitation of some species."

The EC method appears to drive the SRX TAC towards smaller values than the UK method when advices for the, usually larger, assessed stocks (Cat. 3) are increasing and vice-versa, higher TACs when advices are decreasing. Therefore, the EU-method is more precautionary than the UK method when the large stocks are on the increase and less when they are on the decrease, whilst the time where more precaution seems required is when a decreasing trend in abundance is observed. The perception that the EC method was a more precautionary approach may have been driven by the past 10-15 years, where biomass indicators and therefore advised landings increased for several main stocks.

Both the UK and the EC methods include the ICES advised change in catches for Cat. 5-6 stocks in the calculation of the SRX TAC. For these stocks, a precautionary reduction of 20% is applied every few years. Case 3 showed that the EC method resulted in decreasing the TAC by a larger than advised amount because it transferred part of the 20% precaution reduction to the large stock.

The application to the SRX/67AKXD TAC, also showed that the precautionary reduction applied to (small) Cat. 5 stocks resulted in a larger reduction of the TAC with the EC method than with the UK method. In reality, what makes the comparison of the two methods difficult is that the EC method is applied to the actual previous TAC, therefore it is a combination of a method for calculating how much to TAC should be change and a baseline, the previous TAC, which is not the direct result of a method but that of negotiations and carries divergences from advices over time. In this case, the UK method would result in a strong reduction in the TAC, because it relies solely on the advices and does not account for the previous TAC, which amounted to 9482 tonnes, whilst the sum of advices for 2021 and 2022 for the stocks covered by this TAC was 7492 tonnes.

The UK method presents the advantage of applying the ICES advice as directly as possible. However, during the past decade, sustained increases in several stocks were observed in several ecoregions although SRX TACs were larger than the sum of advices for the stocks covered. Suggesting that ICES advices may have been over precautionary. The weakness of the EC method is to apply the average of advice changes irrespective of the size and the ICES category of stocks.

Cat. 5-6 are overall smaller than Cat. 3 stocks, for which trend-based assessment are available. There is therefore little justification of applying the precautionary reduction recommended for Cat. 5-6 stocks to Cat.3 stocks. Further the EC method would probably not reduce the TAC quickly enough when Cat. 3 stocks are on a decreasing trend.

### 1.9.2.7 Alternative approach

An alternative approach to the current UK and EU methods was also proposed by Batsleer & Lorrance. This approach is further outlined in Section 7.

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# 3 TERM OF REFERENCE 2

*"2. To consider the appropriateness of using single species sub-TACs as an alternative to the current SRX group TACs."*

## 3.1 Introduction

Single-species TACs are the standard method of stock-management under EU, UK and other third-country management measures. While they are considered routine for other fish species, they have not been regularly used for skates and rays. They are also used for other elasmobranch stocks and for undulate ray which is subject to three separated TAC in the English Channel (rju.27.7de), the Bay of Biscay (rju.27.8) and West Iberia (rju.27.9a). There are some exceptions, particularly in the 27.7de, (English Channel) stocks. An example of a sub-TAC is small-eyed ray, *Raja microocellata*, where current fisheries legislation has a small sub-TAC in 7fg.

### 3.1.1 *Biology*

Skates and rays are considered to be slow-growing and have lower fecundity than other fish species. They mature later. It is therefore natural to expect that populations would react slower to changes in TAC e.g. it would take longer to observe a response to a change in TAC. This is one of the reasons why ICES advice for these stocks is on a biennenial or even greater cycle, rather than annual, as for most other stocks. If single-stock (sub) TACs are introduced, the frequency of advice could be re-examined.

### 3.1.2 *Mixed fishery issues*

There are known issues with multiple TAC for similar species, particularly in light of the Landing Obligation (LO). If TACs are restrictive, mis-reporting may become an issue. The possibility of one of these stocks becoming a choke-species increases, and therefore the effect on other fisheries would need to be considered. Nevertheless, this is not an issue for skates and rays under the current management as skates and rays are subject to exemption from the LO in all ICES areas.

### 3.1.3 *Sustainability*

Similar to issues mentioned under mixed-fisheries above, the effect of a low TAC on one species in a mixed fishery needs to be considered. Most skate and ray catches are bycatch rather than targeted catch. Discard estimates are considered unreliable by ICES (ICES 2022). Survivability estimates, while improving (see later sections) are not available for all species or stocks. The current issues with ICES Category 5 stocks (see below) also need to be considered. The long-term suitability of a TAC on a particular stocks would need to be considered, particularly where said stock is

- Recovering
- Data-deficient or
- Of international importance e.g. on a preservation list.

## 3.2 Category 5 stocks

ICES classifies several stocks as Category 5 (ICES 2022). These are stocks for which appropriate survey data are not available. Usually for these stocks, only landings data are available. An example stock is rjh.27.4a6 (Blonde ray in the North Sea and West of Scotland). While there are groundfish surveys in the area, they are not considered to catch this species in a representative manner due to their distribution not matching the survey coverage.

For these stocks, the ICES method for stock assessment and advice is the Precautionary Approach. The result of this is that every four years there is a precautionary reduction of 20% in the advised catch or landings advice. This -20% precautionary reduction is applied every three year to ICES

Category five stocks, as skates and rays are assessed biennially this result in the reduction to be applied every four years.
Without a survey that can upgrade these stocks to Category 3 or higher, there is no mechanism for increasing the advice, or even allowing status-quo advice. Over time, all advice for these stocks trends to zero catch advice in the medium term. While precautionary, this is not necessarily appropriate for the stock.

## 3.3 Setting an initial TAC after a period of prohibition

### 3.3.1 *Setting an initial TAC based upon knowledge of another stock*

***Robin Hood approach***

Whatever the means, completely halting fisheries is expected to allow depleted stocks to rebuilt. If implemented and enforced such measures (species introduced in a prohibited list, 0 TAC, closures...) should result in stock rebuilding so that fishing can resume. In this situation defining sustainable level of fishing may be challenging. If the stock can be assessed with a quantitative assessment model and reference points catches in line with a MSY approach can be defined. Unfortunately, data to carry out such assessment may be lacking for stocks of small biomass, such as many skate stocks. Moreover with no fishery, fishery-dependent data are even scarcer.
A method was proposed to calculate suitable catch levels in some such situation (ICES, 2020). For a skate stock which exploitation was halted or restricted (referred to as moratorium stock), is was suggested to calculate the level of catch at which fishing can resume by comparing biomass indices of the moratorium stock to biomass indices of another skate stock exploited sustainably in the same area (referred to as reference stock). This approach applies when survey indices are available for at least two stocks, or when biomass indices for stocks of two skate species are available from the same survey. The approach allows calculating the advised catch of the moratorium species from the advised catch of the reference species and the ratio of biomass indices and biological productivities of the two species. This method was first suggested from undulate ray in the English Channel, which is used here as a case study. This case study should be considered as an example, as the stock was subject to an ICES benchmark, using a production model, in 2022. Therefore this "Robin Hood" approach is no longer needed for this particular stock.
Method
Varied species cannot sustain the same exploitation rate, depending of their biological productivity. To account for this, the suggested approach calculates the advised catch of the moratorium species from the advised catch of the reference species and the ratios of biomass indices and biological productivities of the two species.
In the sampled area of one survey the advised catch level for the moratorium species was proposed to be calculated as:

$$Adv(mor) = \frac{B\ (mor)}{B(ref)} \times \frac{r(mor)}{r(ref)} \times Adv(ref) \qquad \text{(Eq. 1)}$$

Where: Adv is the advised catch. B are biomass indices and r intrinsic growth rates or productivity proxies, mor and ref stand for moratorium species and reference species.
Alternatively, when current landing are considered sustainable for the reference species, the calculation may be based on landings:

$$Lan(mor) = \frac{B\ (mor)}{B(ref)} \times \frac{r(mor)}{r(ref)} \times Lan(ref) \qquad \text{(Eq. 2)}$$

In ICES (2020) the inverse of the mean size at maturity of females was suggested as a proxy for r. The use of the median of the distribution of priors from demographic methods (McAllister et al., 2001) could be considered but may be sensitive to assumptions for rays where demographic parameters are uncertain.
Application to undulate ray in the Eastern English Channel
In the eastern Channel (Division 7.d) thornback ray, blonde ray, spotted ray and undulate ray are the main four Rajiformes species caught and landings have increased during the past decade (Table 1). As for most skates and rays stocks, landings are considered reliable from 2009. Reported landings prior to 2009 were not separated by species. Estimations of landings by species prior to 2009 have been made for a few stocks, including rju.27.7de back to 2005, but are not considered here. Landings of undulate ray were banned from 2009 to 2014 and a precautionary TAC was set from 2015. During the three last years, landings of undulate ray were more than 30 times less than

landings of thornback ray and one third of landings of blonde ray (Table 3.7).Thornback ray represented 86% of landings of the four species combined during the three last years (2019-2021), followed by blonde ray (9%) the two last species, spotted ray and undulate ray representing each 3%.

**Table 3.7: Time-series of landings of the four main skate species in the eastern Channel (Division 7d)**

| Year | rjc.27.3a47d<br>Thornback ray | rjh.27.4c7d<br>Blonde ray | rjm.27.3a47d<br>Spotted ray | rju.27.7de<br>Undulate ray |
|---|---|---|---|---|
| 2009 | 589 | 65 | 136 | 18 |
| 2010 | 652 | 69 | 36 | 3 |
| 2011 | 658 | 90 | 38 | 13 |
| 2012 | 935 | 84 | 33 | 4 |
| 2013 | 1132 | 93 | 33 | 1 |
| 2014 | 1186 | 90 | 35 | 2 |
| 2015 | 988 | 87 | 19 | 5 |
| 2016 | 1115 | 85 | 23 | 14 |
| 2017 | 1082 | 116 | 44 | 22 |
| 2018 | 1439 | 140 | 31 | 20 |
| 2019 | 1512 | 154 | 48 | 58 |
| 2020 | 1538 | 174 | 48 | 55 |
| 2021 | 1594 | 155 | 55 | 33 |
| Average of the Three last years | 1548 | 161 | 50 | 49 |

In the past decade, biomass indices of thornback ray, blonde ray and undulate ray in Division 7.d have increased to higher levels than in the previous two decades (Table 3.8). Biomass indices presented are swept area indices, calculated by raising swept area fished to the total sampled area, so in absolute values in tonnes, of the exploitable biomass (individual ≥ 50 TL) from the CGFS survey only. These swept area indices allow comparison between species.

**Table 3.8 Time-series of biomass indices from the FR-CGFS survey (swept area biomass in tonnes) in the eastern Channel (Division 7d)**

| Year | Thornback ray | Blonde ray | Spotted ray | Undulate ray |
|---|---|---|---|---|
| 1988 | 466 | 0 | 18 | 91 |
| 1989 | 4167 | 47 | 48 | 144 |
| 1990 | 2206 | 0 | 74 | 235 |
| 1991 | 711 | 0 | 29 | 138 |
| 1992 | 2192 | 0 | 8 | 210 |
| 1993 | 602 | 0 | 45 | 0 |
| 1994 | 1672 | 13 | 85 | 626 |
| 1995 | 1178 | 123 | 28 | 150 |
| 1996 | 113 | 0 | 0 | 29 |
| 1997 | 1462 | 61 | 25 | 146 |
| 1998 | 1659 | 147 | 24 | 357 |
| 1999 | 1252 | 82 | 0 | 71 |
| 2000 | 1669 | 13 | 12 | 97 |
| 2001 | 1340 | 100 | 10 | 143 |
| 2002 | 1707 | 85 | 4 | 61 |
| 2003 | 1235 | 232 | 7 | 0 |

| Year | Thornback ray | Blonde ray | Spotted ray | Undulate ray |
|---|---|---|---|---|
| 2004 | 1078 | 23 | 0 | 93 |
| 2005 | 3012 | 0 | 25 | 108 |
| 2006 | 2424 | 88 | 28 | 331 |
| 2007 | 3375 | 295 | 12 | 384 |
| 2008 | 3279 | 9 | 0 | 159 |
| 2009 | 3185 | 219 | 0 | 367 |
| 2010 | 3310 | 123 | 0 | 252 |
| 2011 | 2271 | 238 | 29 | 148 |
| 2012 | 3716 | 731 | 3 | 518 |
| 2013 | 7034 | 155 | 26 | 587 |
| 2014 | 7731 | 661 | 6 | 765 |
| 2015 | 6862 | 597 | 11 | 1306 |
| 2016 | 8873 | 645 | 0 | 1208 |
| 2017 | 5237 | 924 | 65 | 1716 |
| 2018 | 9181 | 464 | 8 | 1663 |
| 2019 | 11296 | 709 | 0 | 3507 |
| 2020 | 16244 | 63 | 24 | 3841 |
| 2021 | 14864 | 2108 | 5 | 3272 |

Application of the method
Size at maturity of species considered are presented in table 4. For undulate ray as moratorium species and thornback ray as reference species, the productivity ratio is:

$\frac{r(mor)}{r(ref)}$ = (1/83.8)/(1/73.7) = 0.88.

**Table 3.9: Length at maturity of female blonde, thornback and undulate ray used as proxies of biological productivity (as 1/Lmat) of each species.**

| **Species** | **Area** | **Female *Lmat* (cm)** | **Reference** |
|---|---|---|---|
| Undulate ray | English Channel (Gulf Normand-Breton) | 83.8 | Stéphan *et al*., 2014 |
| Undulate ray | Bay of Biscay | 83.8 | Stéphan *et al*., 2014 |
| Thornback ray | North Sea | 73.7 | McCully *et al*., 2012 |
| Thornback ray | Celtic Seas | 78.2 | McCully *et al*., 2012 |
| Blonde ray | North Sea and Celtic Seas Combined | 83.4 | McCully *et al*., 2012 |

The method was applied using landings (Eq. 2) because advices are provided for stocks in different areas (greater North Sea for thornback ray, stock rjc.27.3a47d; English Channel for undulate ray, rju.27.7de; English Channel and southern North Sea for blonde ray, rjh.27.4c7d).
Applying Eq.2, landings for undulate ray could be 341 to 362 tonnes, using or the length at maturity of thornback ray from the North Sea and the Celtic seas respectively. This is 10 times more than recent landings from Division 7.d, which are strongly constrained by a precautionary TAC.
For comparison blonde ray was treated as the "moratorium" species. Blonde ray is not subject to particular fishing restriction as it is fished under the same TAC and regulation as thornback ray. In that case landings calculated from Eq.2 may be compared to observed landings to appraise whether the two species (here blonde ray as "moratorium" and thornback ray as reference species) are exploited are similar levels relative to their biological productivity proxies and biomass indices. Landings which could be recommended for blonde ray were 93 and 99 tonnes, using or the length at maturity of thornback ray from the North Sea and the Celtic seas respectively. This is about 2/3

of recent landings of blonde ray. This imply that using this method, blonde ray is estimated to be exploited as a higher rate than thornback ray in recent year. This result is not surprising because the two species are submitted to the same SRX TAC and blonde ray has higher price because of its larger size.

Discussion

The calculation presented here for the Eastern English Channel are based on the assumption that recent landings of thornback ray are sustainable, which seem likely considering the large increase of the biomass index of this species in recent years. Calculated landings do not applying to ICES stocks units but to undulate and blonde ray in the Eastern Channel. One case where this approach could be useful in the near future is common skate, Dipturus batis, for which surveys indicate an increasing biomass and it is unlikely that quantitative assessment can be developed in the near future.

An implicit assumption of this approach is that the moratorium and reference species have similar catchabilities to the survey used for the biomass index. For skate species, it may be reasonable to assume that the probability to be caught of individuals present on the trawl path is similar among species owing to their similar shape, size and swimming capabilities. Nevertheless, the catchability of populations to surveys may depend on other factors such as spatial distribution and preferred habitats. If relative catchabilities were known these could be added as additional ratio in Eq. 1 and 2.

Swept area indices were calculated by raising the swept area fished to the total sampled area estimated as the marine area from the coastline (0 meter depth contour). Undulate ray being a coastal species, a larger proportion of the population may be distributed in shallow waters than for other species and therefore missed from the sampling. Nevertheless, in the eastern Channel the CGFS survey include hauls near the coast (Figure 1) so that the area of coastal habitat not sampled by the survey is small and estimated swept area biomasses could represent similar proportions of the actual biomass of the two species.

This approach may be suitable to resume fishing for a stock which has been subject to protection and has rebuilt. Where quantitative assessment are available this approach is not needed. It is of interest for stocks assessed based on trends (ICES stock data category 3) where, the new ICES advice is calculated as the previous advice multiplied by a ratio of indices and other proxies, an approach which is not suitable when previous advices have been zero catches.

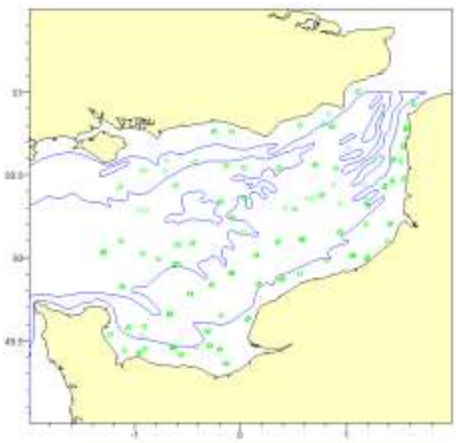

**Figure 7: Spatial distribution of FR-CGFS hauls carried out in 2018-2021 (green dots: mid-points of hauls) blue lines are depth contours 30 and 50 m.**

Overall the method could be useful to set the initial TAC level after a period of prohibition, in this sense, the criteria to classify skate and ray species as prohibited species (term of reference 5), should also include criteria to unlist species. It could also be used, to set a sub-TAC of one species previously included in an SRX TAC. Last but not least, the example given, suggests that the different species managed under an SRX TAC may not be exploited at similar harvest rate respective to their biological productivities.

*Setting an initial TAC based on life-history traits. Example of undulate ray in Division 7d*

When examining the possibilities for allocating a non-zero TAC, it was suggested during STECF 15-03 (STECF 2015) to consider exploring the outcomes of the application of approaches based on life-history traits citing Zhou *et al.* (2012) and Le Quesne and Jennings (2012).

The approximation $F_{MSY}$=M does not hold in case of density-dependent recruitment and was therefore considered non-precautionary. Zhou *et al.* (2012) assessed different relationships between reference points associated with fishing mortality (namely $F_{BRP}$: $F_{MSY}$, $F_{proxy}$, and $F_{0.5r}$) and natural mortality M using hierarchical models. The best model obtained for chondrichthyans was $F_{MSY}$ = 0.41xM (SD = 0.09). This article also mentions and uses another relationship based on the application of the Schaefer surplus production model (Quinn and Deriso 1999): $F_{MSY}$= $F_{0.5r}$= r/2.

Here, an example is presented of the utilisation of the two above-cited FMSY estimators to undulate ray (*Raja undulata*) in the English Channel. Landings of this stocks were prohibited between 2009 and 2014 and a separated precautionary TAC were introduced in 2015: 11 tonnes and 100 tonnes for ICES divisions 7.d and 7.e respectively. This simulation does not intend to assess the potential general character of the setting of TAC based on different $F_{MSY}$ estimators, but only provides estimations of what the 2015 TAC would have been in Division 7d for the stock of undulate ray in the English Channel, had they been fixed using this approach.

The catch corresponding to a fishing mortality equal to $F_{MSY}$ is:

$C_{div} = B_{div} \times (1 - \exp(-F_{MSY}))$,

Where $C_{div}$ is the catch and $B_{div}$ is the stock biomass in the ICES Division.

The stock biomass used here for Division 7.d is the average of the estimated of the swept area biomass from the GCGFS survey in three previous years (2012-2014). $C_{div}$ was only calculated for Division 7.d, assuming that the catchability of the exploitable fraction (individuals ≥ 50cm TL) of undulate ray by the FR-CGFS-Q4 survey was equal to 1. Although the UK-Q1-SWBeam survey in Division 7.e is also currently used in the assessment of this stock by ICES, the lower catchability of large skates by beam trawl entails that the estimated biomass departs too much from the actual exploitable biomass in Division 7e. For this reason, estimated 2015 catches corresponding to FMSY were only derived for Division 7d.

Like for most skate stocks, natural mortality (*M*) has not been directly estimated for undulate ray in the English Channel. Therefore, M was estimated using life-history correlates. Pauly (1980) established a relationship between natural mortality in fishes and parameters *k* and *Linf* of the von Bertalanffy growth model: $M = 4.118 \times K^{0.73} \times Linf^{-0.33}$, while Frisk et al. (2001) derived the following relationship for Rajidae: $M = exp(0.42 \times log(K) - 0.83)$. Both estimates of M were applied here. Growth parameters as estimated by Moura et al. (2007) were used.

A Leslie-matrix population model was built to derive estimates of the intrinsic rate of population increase *r*, which were then used to provide a prior for the surplus population model (SPiCT) used for stock assessment in 2022 (ICES 2022). This yielded a mean value of 0.186, while the median value of the posterior was 0.229. Both values were used to estimate a catch resulting from FMSY with the approach based on *r*.

**Table 10: Simulated 2015 catch for undulate ray in Division 7.d based on estimates of catches under F=FMSY. Cdiv_M and Cdiv_r correspond to estimates based on the relationships FMSY=0.41xM and FMSY=r/2, respectively.**

| ICES division | 2015 TAC | B 2012-2014 | Cdiv_M | | Cdiv_r | |
|---|---|---|---|---|---|---|
| | | | Pauly | Frisk et al. | Leslie | SPiCT |
| 7d | 11 t. | 623 t. | 51 t. | 64 t. | 55 t. | 67 t. |

Values of the simulated TACs were five to six times higher than the precautionary TAC, which was actually set for Division 7.d. There are notably limited discrepancies between the values estimated from the two approaches. This relative agreement between the various estimates suggests a certain level of robustness in the estimation of $F_{MSY}$ based on life-history traits for this stock. The hypothetical TACs derived here based on $F_{MSY}$ may not be directly applicable to set a TAC though, as ICES advice rules usually incorporate precautionary adjustments leading to target fishing mortality being set below $F_{MSY}$.

## 3.4 Recommendations

While the use of single-stock TACs is recommended, it is not proposed that this should be done overnight. This group recommends that this issue be looked at by an STECF or other international group such as ICES, with the intention of introducing single-species TACs or sub-TACs by 2025 alongside other management measures, e.g. spatial or temporal closed areas, where appropriate (See section 4).

## 3.5 References

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# 4 TERM OF REFERENCE 3

*"3. To consider the possibility of developing bespoke management plans as a replacement to SRX group TACs."*

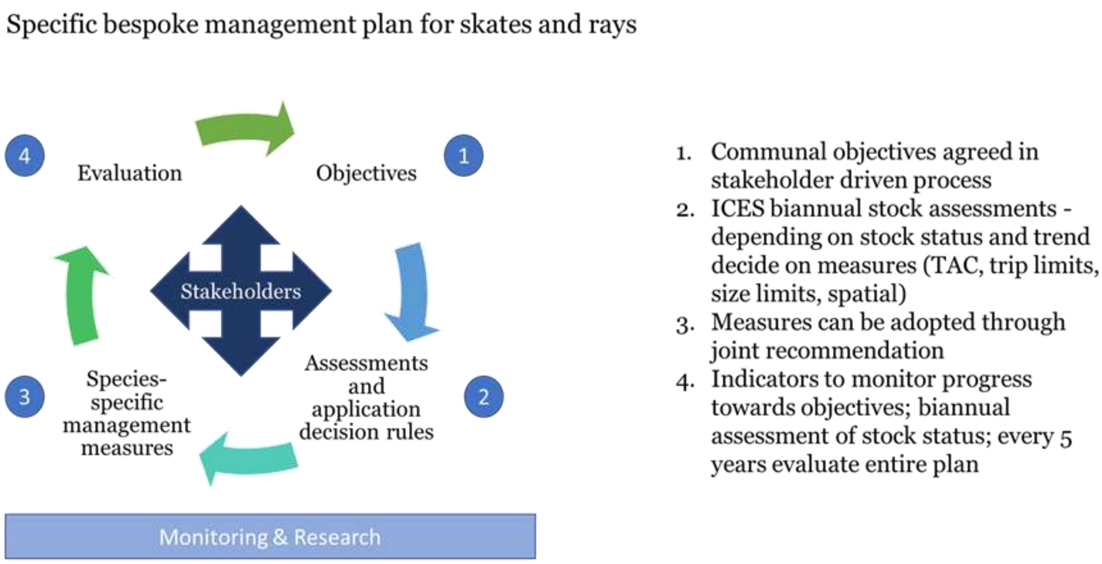
## 4.1 Introduction

A bespoke management plan gives the opportunity to revisit the current practice and can be a way to manage stocks and stock complexes for which the current TAC management or the use of prohibited species list are a bad fit. It creates new opportunities and allows for customised management measures not currently used such as spatio-temporal considerations for known aggregation areas and key life history traits such as egg laying grounds etc. as well as gear considerations and other technical measures. Importantly it makes it possible for long term management, as it is not renewed on a yearly basis and it includes stakeholder involvement from the start. In effect the EU multiannual plans (MAPs), such as the one developed for the North Sea[1], provide a framework in which to develop a bespoke management plan for skates and rays. See Annex X for the most relevant points from the North Sea multiannual plan. The implementation can be carried out within an existing framework, through a regional group and there is a mechanism already in place for conservation measures (joint recommendations by regional group). One example is the seabass management plan in the TAC & Quota Regulation.

## 4.2 Suggested management plan

A management plan will be cyclical and will be subject to an agreed evaluation process. The current EU MAPs as developed for the North Sea, Western waters and Iberian waters, provide a legislative framework to develop and implement a bespoke skate and ray management plan. For example REGULATION (EU) 2018/973 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL Multiannual plan for demersal stocks in the North Sea and the fisheries exploiting those stocks - see Annex. Member States can initiate a process to write a Joint Recommendation, which the EC can then adopt.

See the schematic below for what the management cycle might look like.




1. Contact detail Member States can initiate a process to write a Joint Recommendation which the EC can then adopt. Communal objectives are agreed upon in a stakeholder driven process

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0973&from=EN

2. ICES carries out stock assessments of 59 stocks of elasmobranchs in the NE Atlantic on a biannual or quadrennial basis. This information forms the basis of the management process. Depending on the stock status and trend a suite of measures can be deployed. For example stocks with an increasing of stable trend could be included in a group-TAC, whilst those that are decreasing might need a single stock TAC and species-specific management measures such as a landing trip limits; size limitations – minimum and/or maximum; and spatial management. For the stocks for which the status is unknown, for example the ICES Category 5 and 6 stocks, data needs should be identified and a process instigated to provide the necessary data in the mid-term.
3. The current EU multiannual plans as developed for the North Sea, Western waters and Iberian waters, provide a legislative framework to develop and implement a bespoke skate and ray management plan.
4. In order to evaluate the effectiveness of the management measures a suite of indicators should be developed which will take into consideration the stock status and which should include relevant biological and socio-economic parameters. For this, a monitoring programme should be developed. The stock status can be evaluated according to the cycle used by ICES (every 2 or 4 years) and the entire management plan can be evaluated every 5 years, according to the EC schedule.

The next evaluation of the North Sea MAP is in 2023.

## 4.3 Recommendation

The EWG recommends to explore the possibility of including skates and rays explicitly in the existing EU multiannual management plans as an alternative management approach to the current group-TAC and national measures.

Annex

16.7.2018 | EN | Official Journal of the European Union | L 179/1

I

*(Legislative acts)*

REGULATIONS

**REGULATION (EU) 2018/973 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL**

**of 4 July 2018**

**establishing a multiannual plan for demersal stocks in the North Sea and the fisheries exploiting those stocks, specifying details of the implementation of the landing obligation in the North Sea and repealing Council Regulations (EC) No 676/2007 and (EC) No 1342/2008**

*Article 1*

**Subject-matter and scope**

1. This Regulation establishes a multiannual plan ('the plan') for the following demersal stocks in Union waters of the North Sea (ICES divisions 2a, 3a and subarea 4), including the fisheries exploiting those stocks, and, where those stocks extend beyond the North Sea, in its adjacent waters:

4. This Regulation also applies to by-catches caught in the North Sea when fishing for the stocks listed in the first sub-paragraph of paragraph 1. However, where ranges of $F_{MSY}$ and safeguards linked to biomass are established for those stocks under other Union legal acts establishing multiannual plans, those ranges and safeguards shall apply.

*Article 3*

**Objectives**

1. The plan shall contribute to the achievement of the objectives of the common fisheries policy listed in Article 2 of Regulation (EU) No 1380/2013, in particular by applying the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce MSY.

2. The plan shall contribute to the elimination of discards, by avoiding and reducing, as far as possible, unwanted catches, and to the implementation of the landing obligation established in Article 15 of Regulation (EU) No 1380/2013 for the species which are subject to catch limits and to which this Regulation applies.

3. The plan shall implement the ecosystem-based approach to fisheries management in order to ensure that negative impacts of fishing activities on the marine ecosystem are minimised. It shall be coherent with Union environmental legislation, in particular with the objective of achieving good environmental status by 2020 as set out in Article 1(1) of Directive 2008/56/EC.

*Article 5*

**Management of by-catch stocks**

1. For the stocks referred to in Article 1(4), management measures including, where appropriate, fishing opportunities, shall be set taking into account the best available scientific advice and shall be consistent with the objectives laid down in Article 3.

2. Those stocks shall be managed under the precautionary approach to fisheries management as defined in point 8 of Article 4(1) of Regulation (EU) No 1380/2013 when no adequate scientific information is available.

3. In accordance with Article 9(5) of Regulation (EU) No 1380/2013, the management of mixed fisheries with regard to stocks referred to in Article 1(4) of this Regulation shall take into account the difficulty of fishing all stocks at MSY at the same time, especially in situations where that leads to a premature closure of the fishery.

*Article 8*

**Specific conservation measures**

When scientific advice indicates that remedial action is required for the conservation of any of the demersal stocks referred to in Article 1(4) of this Regulation, or when the spawning stock biomass and, in the case of Norway lobster stocks, the abundance of any of the stocks covered by Article 1(1) for a given year are below MSY $B_{trigger}$, the Commission is empowered to adopt delegated acts in accordance with Article 16 of this Regulation and Article 18 of Regulation (EU) No 1380/2013. Such delegated acts may supplement this Regulation by laying down rules regarding:

(a) characteristics of fishing gear, in particular mesh size, hook size, construction of the gear, twine thickness, size of the gear or use of selectivity devices to ensure or improve selectivity;

(b) use of the fishing gear, in particular immersion time, depth of gear deployment, to ensure or improve selectivity;

(c) prohibition or limitation to fish in specific areas to protect spawning and juvenile fish, fish below the minimum conservation reference size or non-target fish species;

(d) prohibition or limitation on fishing or the use of certain types of fishing gear during specific time periods, to protect spawning fish, fish below the minimum conservation reference size or non-target fish species;

(e) minimum conservation reference sizes, to ensure the protection of juveniles of marine organisms;

(f) other characteristics linked to selectivity.

*Article 14*

**Regional cooperation**

1. Article 18(1) to (6) of Regulation (EU) No 1380/2013 shall apply to measures referred to in Articles 8, 9 and 11 of this Regulation.

2. For the purpose of paragraph 1 of this Article, Member States having a direct management interest may submit joint recommendations in accordance with Article 18(1) of Regulation (EU) No 1380/2013 for the first time not later than 6 August 2019 and thereafter 12 months after each submission of the evaluation of the plan in accordance with Article 15 of this Regulation. They may also submit such recommendations when deemed necessary by them, in particular in the event of an abrupt change in the situation for any of the stocks to which this Regulation applies. Joint recommendations in respect of measures concerning a given calendar year shall be submitted no later than 1 July of the previous year.

3. The empowerments granted under Articles 8, 9 and 11 of this Regulation shall be without prejudice to powers conferred to the Commission under other provisions of Union law, including under Regulation (EU) No 1380/2013.

# 5 TERM OF REFERENCE 4

*"4. To consider progress made in underpinning the exemption to the landing obligation and next steps, by species and by gears, by assessing catch data, discard survival rates, methods for improving avoidance, selectivity and survival."*

## 5.1 Introduction

Previous STECF (STECF-14-19 and STECF-15-01) established a need for information on the discard survival estimates, given the fact that "Article 15 paragraph 2(b) of the landing obligation allows for the possibility of exemptions from the landing obligation for species for which "scientific evidence demonstrates high survival rates"".

In 2018, the regional groups for the North Sea and Northwestern waters submitted a joint recommendation requesting a high survival exemption for skates and rays from the landing obligation. The STECF and the Commission accepted the exemption but requested a roadmap to help enhance the knowledge on skates and rays. This resulted in the development of a Road Map which aimed to enhance evidence of discard survival of skates and rays and increase selectivity and survival of skates and rays (Figure 5.1).

With the continuation of work in relation the Road Map of Rays and Skates, progress on survival estimates and methods for improving the avoidance, selectivity and survival has been made, see sections below. Additional measures can further help working towards sustainable exploitation of rays and skates. An overview of these measures and further recommendations are explored in addition to previously mentioned progress reporting.

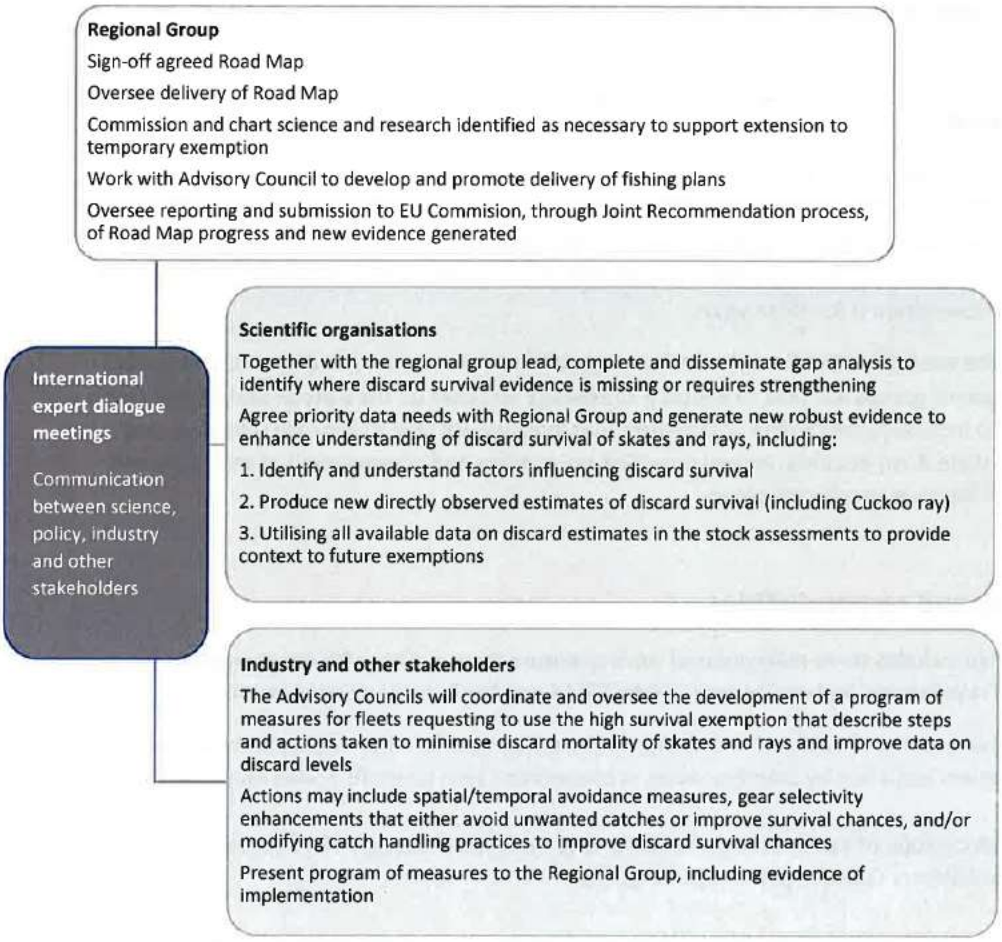



**Figure 5.8: Overview of the Road Map and associated stakeholder responsibilities.**

## 5.2 Overview of progress made with estimations of post-capture mortality, vitality

Since EWG-17-10 in 2017, several studies and research projects have continued to provide discard survival rates estimates for several species and metiers (See Table 5.1). In accordance with previously published reports and reviews on the subject (e.g., (Ellis et al., 2017)), these new studies continue to show that the observed at vessel mortality (AVM) is relatively small for all species and gears/metiers (0-25%) analysed so far. Nonetheless, the analysis of significant factors, shown that the observed AVM is not an informative proxy of the delayed mortality. New estimates for delayed mortality are also consistent with previous reports, with mortality rates ranging from 20 to 60% for most species and gears. As reported in the past (Catchpole et al., 2017), cuckoo rays seem to be more vulnerable to fishing as they consistently exhibit lower survival rates (10-20%) (Baulier et al., 2021; Oliver et al., 2021). Methods to assess discard survival by means of survival trials tend to be standardized by following the SUMARiS project framework.

AVM does not provide useful insights on the delayed mortality as it does not correlate with it. However, indicators of the fish condition (e.g., vitality class, RAMP vitality score, injury score) have shown to be significant in determining the likelihood of a fish to survival after discarding (Baulier et al., 2021; Knotek et al., 2020; Morfin et al., 2019; Noémi et al., 2020; Schram & Molenaar, 2018). Similarly, the time fish is exposed to air affects significantly its condition and leads to higher AVM. As fish in worse condition are more likely to die once released, management measures to increase overall discard survival should aim to reduce air exposure and sorting time. Different alternatives (e.g., water bucket, water sprays/mist, water flow on the conveyer belt) in experimental and real fishing conditions should be assessed through research and therefore will require financial support.

## 5.3 Data gaps

Large data gaps affecting the discard survival data by gear/species remain to be filled for EU waters and its fisheries. Nonetheless, that continuing with these to cover the large range of gears/metiers, areas and species is costly and time demanding, it is very unlikely that a complete overview of skates and rays discard survival in European fisheries will be ever finished. It is unrealistic to carry out overviews of skates and rays survival on a regular basis to continuously provide arguments for yearly or biannual landing obligation exemptions. Moreover, considering that most survival trials have already provided a multitude of more or less consistent estimates for ray and skates survival in European fisheries, this EWG proposes to explore transferability between discard survival estimation methods, ensuring that gaps can be filled in a cost and time efficient manner.

Most discard survival estimations are based on survival trials, in which fish are kept in survival tanks, fed and monitored for a determined period of time. Beyond the technical and economical constrains, these trials are however unlikely to represent real discard survival rates as these represent unnatural and stressful environment and at the same time does not provide estimates of discard-associated mortality, such as infections and predation. Capture and recapture studies using different types of tags could help to provide real discard survival estimate. Survival research using satellite and acoustic tags has already been used to provide robust estimations of the real fish survival (Knotek *et al*., 2020; Morfin *et al*., 2019) and is being used in ongoing projects. On the downside, although these do not require survival tanks and monitoring periods, hence less costly and time demanding, these studies are still limited in the number of fish that can be tagged and the tagging operation may also affect survival. On the other hand, using historic tag data from conventional tagging programmes may provide reliable estimations of the minimum discard survival under real conditions through the rate of recapture.

This EWG, does not mean to point out to a specific tagging method as recommendation for future discard survival studies, but rather proposes tagging methods as a whole as an integrated alternative to traditional survival trials, when possible. Herein, spatially coarse general minimum survival estimates obtained from conventional tagging programmes could as such be stunned by gear specific satellite and/or acoustic tag data.

## 5.4 Solutions/recommendations

In additional to the previously mentioned survival estimates using tagging data, the EWG would recommend targeting future research efforts to analyse particularly sensitive species (e.g., cuckoo ray) rather than species for which a high survival has already been consistently described, and to identify and develop technologies/methods to increase discard survival within the fishery industries. On the particular case of the cuckoo ray, although it would be ideal to corroborate the survival trial estimates with estimates from tagging experiments, it seems more or less clear that the species is more likely to die after being discarded compared to other and larger species (e.g., thornback ray). In addition, several studies have already pointed out key factors influencing rays and skates survival. It is therefore necessary to analyse how the effect of these factors could be mitigated to increase overall survival or sensitive, but also "more resistant" species. For instance, air exposure/sorting time have been linked to fish in worse conditions and increased delayed mortality. Reducing air exposure by means of relatively simple management measures, such as the implementation of mist sprays and/or water flow on the conveyer belts should be explored in experimental and fishing conditions.

Last but not least, models could help to raise the limited capacity of project-based research. However, their predictive capacity is still limited, hence the need of more robust models to assess discard survival from the fish vitality onboard. Herein, as said before, the vitality and other fish condition indices have been shown to provide significant insights on the survival probability. This would require continuing data collection through standardized regional data collection programmes to monitor discards and their survival. In the near future these models could be integrated into AI systems to estimate discard survival for a significantly larger number of fish from fish images onboard.

**Table 5.1: At vessel mortality (AVM) and delayed estimates published after the last STECF report (STECF 17-21, 2017)**

| SPECIES | GEAR | LOCATION | REFERENCE | OBSERVATION PERIOD | DELAYED SURVIVAL (%) | AT VESSEL MORTALITY (%) | TOW DURATION / SOAK TIME |
|---|---|---|---|---|---|---|---|
| *Raja clavata* | Beam trawl | 4.c and 7d. (Southern North Sea and Eastern English Channel) | (Noémi et al., 2020) | 21 days | 54.46 | 4.3 | 1.75h |
| | Combined gillnets-trammel nets | | | | NA | 4.2 | 1.25h |
| | Trammel nets | | | | 99.34 | 0.0 | 17h |
| | Otter trawl | | | | 71.56 | 6.4 | 3h |
| | | 4.c (Sourthern North Sea) | (Randall et al., 2018) | NA | NA | 3.0 | 1-3h |
| | | 7.a (Irish Sea) | (Oliver et al., 2019) | NA | NA | 0 | 3h |
| | Pulse trawl | 4.c (Sourthern North Sea) | (Schram & Molenaar, 2018) | 15-18 days | 53 (40-65 CI) | 13.0 | 1.83-2.42h |
| | Tangle net | 7e-d (English Channel) | (Ellis et al., 2018a) | NA | NA | 2.6 | 24-48h |
| | Tagging sampling | 3.a, 4 a-c, 6, 7a,d-g ( Skagerrak, North Sea, Rockall, Northwest Coast of Scotland and North Ireland, Irish Sea, English Channel, Cristol Channel and Celtic Sea). | (Bird et al., 2020) | Tag recapture | At least 15.62% (recaptured tags >50days) | NA | NA |
| *Raja brachyura* | Beam trawl | 4.c and 7d. (Southern North Sea and Eastern English Channel) | (Oliver et al., 2019) | 21 days | 66.58 | 5.6 | 1.75h |
| | Trammel nets | | | | 100* | 0.0 | 17h |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Otter trawl | | | | 86.36 | 0.7 | 3h |
| | | 7.a (Irish Sea) | (Oliver et al., 2019) | NA | NA | 0 | 3h |
| | | 7e-d (English Channel) | (Ellis et al., 2018a) | NA | NA | 0.5 | 1-4h |
| | Trammel nets | 9 (Portuguese Waters) | (Correia Castelo, 2021) | 21 days | 76 | | <10 / >10h |
| | Tagging sampling | 3.a, 4 a-c, 6, 7a,d-g (Skagerrak, North Sea, Rockall, Northwest Coast of Scotland and North Ireland, Irish Sea, English Channel, Cristol Channel and Celtic Sea). | (Bird et al., 2020) | Tag recapture | At least 14.53% (Recaptured tags >50days) | NA | NA |
| *Raja montagui* | Beam trawl | 4.c and 7d. (Southern North Sea and Eastern English Channel) | (Noémi et al., 2020) | 21 days | 26.55 | 3.0 | 1.75h |
| | Combined gillnets-trammel nets | | | | NA | 0.0 | 1.25h |
| | Trammel nets | | | | 100* | 0.0 | 17h |
| | Otter trawl | | | | 100* | 0.0 | 3h |
| | | 7.a (Irish Sea) | (Oliver et al., 2019) | NA | NA | 0.5 | 3h |
| | Tangle net | 7e-d (English Channel) | (Ellis et al., 2018) | NA | NA | 6.4 | 24-48h |
| | Pulse trawl | 4.c (Sourthern North Sea) | (Schram & Molenaar, 2018) | 15-18 days | NA | 5.2 | 1.83-2.42h |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Trammel nets | 9 (Portuguese Waters) | (Correia Castelo, 2021) | 21 days | 54 | NA | |
| | Tagging sampling | 3.a, 4 a-c, 6, 7a,d-g (Skagerrak, North Sea, Rockall, Northwest Coast of Scotland and North Ireland, Irish Sea, English Channel, Cristol Channel and Celtic Sea). | (Bird et al., 2020) | Tag recapture | At least 15.12% (Recaptured tags >50days) | NA | NA |
| *Raja undulata* | Tangle net | 7e-d (English Channel) | (Ellis et al., 2018a) | NA | NA | 0* | 24-48h |
| | Beam trawl | 4.c and 7d. (Southern North Sea and Eastern English Channel) | (Noémi et al., 2020) | 21 days | 57.86 | 10.1 | 1.75h |
| | Trammel nets | | | | 100* | 0 | 17h |
| | Otter trawl | | | | 92.64* | 0 | 3h |
| | | 4.c (Sourthern North Sea) | Randall, P et al. 2018 | NA | NA | 0 | 1-3h |
| | | 7e-d (English Channel) | (Ellis et al., 2018a) | NA | NA | 0.7 | 1-4h |
| | | 8.a (Bay of Biscay North) | (Morfin et al., 2019) | 14 days (VEMCO acoustic tag) | 49% | NA | 0.85-2.13h |
| *Leucoraja naevus* | Otter trawl | 7.a (Irish Sea) | (Oliver et al., 2021) | 21days | 16% (after 15 days) / 11% (after 21 days) | NA | 2.15 - 4 h |
| | | | (Oliver et al., 2019) | NA | NA | 2.7 | 3h |
| | | 7.h and 8.a (Celtic Sea and Bay of Biscay North) | (Baulier et al., 2021) | - | 11.7-21.7 | 21.3-23.7 | 2.66-7.75h |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Tagging sampling | 3.a, 4 a-c, 6, 7a,d-g (Skagerrak, North Sea, Rockall, Northwest Coast of Scotland and North Ireland, Irish Sea, English Channel, Cristol Channel and Celtic Sea). | (Bird et al., 2020) | Tag recapture | At least 8.25%<br>(Recaptured tags >50days) | NA | NA |
| *Amblyraja radiata* | Tagging sampling | 3.a, 4 a-c, 6, 7a,d-g (Skagerrak, North Sea, Rockall, Northwest Coast of Scotland and North Ireland, Irish Sea, English Channel, Cristol Channel and Celtic Sea). | (Bird et al., 2020) | Tag recapture | At least 20.99%<br>(Recaptured tags >50days) | NA | NA |
| | Bottom trawl | Coastal waters off northern Massachusetts | (Knotek et al., 2020) | 28 days (PSAT tags) | 75.5-83.5 | NA | 0.5-4h |

## 5.5 Progress made with methods for improving avoidance, selectivity and survival

NWWAC/NSAC Focus Group Skates and Rays provides an annual overview of measures taken by the fishing sector to address best practices as agreed in the Road Map and as stated in the Joint Recommendation. This overview is presented to the relevant Regional Groups annually in April/May for their reporting on the implementation of the Landing Obligation.

BEST PRACTICE OVERVIEW MEASURES FOR SKATES AND RAYS

**GLOSSARY**

| | | |
|---|---|---|
| JR Best Practices | Avoidance | Spatial methods to avoid catching individuals and/or aggregations |
| | Selectivity | Technical measures to prevent individuals being caught in the net |
| | Handling on board | Methods to increase survival on board |
| | Training / Communication | Ways to increase knowledge of skate and ray species and their ecological role in the ecosystem, throughout the supply chain |
| Approach | Measure | 1 line description aligned with the exemption text - can be general (e.g. improving ID-skills) |
| | Projects | Description of the project, can add links to web content here |
| | Applicable metier/species | For which species or metier has the measure been trialed or is being implemented |
| | Applied in country | Where is the measure or project being carried out |
| | Comments | Extra information relevant for reporting on progress in the implementatio of best practices |
| Categories | Currently in use | What methods/measures are being implemented by the fishing industry |
| | Could be implemented | What information/method/protocol is available that is not currently being used |
| | Trials ongoing | What is currently being trialed or tested in fisheries |
| | Proposed research | Potential measures that could be trialed but no research projects have been formulated |
| | Survival studies | Overview of studies being carried out to determine surival of skates and rays in fisheries |

Glossary | Currently in use | Could be implemented | Trials ongoing | Proposed research | Surviv ...

The organisation of the international expert dialogue meetings was not formalised in the Road Map. However, it is part of an EMFF project in the Netherlands, where new approaches for avoidance, selectivity and survival have been explored. The results will be available in 2023.

**New approaches to avoidance, selectivity and survival**

A promising approach to improve avoidance and selectivity is linking the particular sensory biology of elasmobranchs, including skates and rays, to technologies which could influence their behaviour in and around fishing gear. Jordan *et al*. (2013) have made a review of the potential application of new and existing bycatch reduction technologies for different fishing gears, according to the sensory modality of elasmobranchs (Table 1 below).

Potential applications of new and existing bycatch reduction technology by fishing gear and elasmobranch sensory modality. Source: Jordan *et al.,* 2013.

**Table 1.** Potential applications of new and existing bycatch reduction technology by fishing gear and elasmobranch sensory modality

| Sensory modality | Baited hook and line (longline) | Gill net | Trawl | Purse seine |
|---|---|---|---|---|
| Olfaction | Surfactants, semiochemicals<br>Bait type<br>Dead sharks | Surfactants, semiochemicals | | Remote attraction/bait stations |
| Hearing | Not recommended | | | |
| Vision | Light sticks: wavelength and flicker<br>Bait colour<br>Leader type/colour<br>Dead sharks | Net illumination<br>Net colour<br>Predator models | Flashing lights | |
| Mechanosensory lateral line/pit organs | | | Water jets | |
| Electrosensory | Magnets, lanthanide metals, battery-powered electric devices | Powered electric field 'barrier'<br>Magnetic field 'barrier' | Electric pulse generators | |
| Other | | Pre-net fence (tactile) | | |

Some of these may potentially be applied to other gear types, and all require additional research and development.

Trials are ongoing with net illumination to reduce bycatch in small scale coastal gillnet fisheries, which often result in high discarded capture of non-target organisms (Senko et al., 2022). During controlled experiments along Mexico's Baja California peninsula, gillnets were illuminated with green LED lights, which is an emerging technology originally developed to mitigate sea turtle bycatch. In this case the lights significantly reduced the mean rates of total discarded bycatch biomass by 63%, with significant decreases in elasmobranch (95%), Humboldt squid (81%), and unwanted finfish (48%) bycatch. Illuminated nets significantly reduced the mean time required to retrieve and disentangle nets by 57% and there were no significant differences in target fish catch or value (Senko et al., 2022).

As yet unpublished research is ongoing on behaviour of skates and rays in trawls (Batsleer pers com.) and results are expected in the next year. For onboard survival, the research on survivability has shown some promising results. For example, during the Sumaris project it was shown that survival was linked to the time out of water, so identifying technical measures that could limit the amount of time individuals are out of the water could increase survival.

Species-specific measures based on the biology and behaviour of skates and rays are a promising ways forward to improve avoidance, selectivity and survival and could be included in a bespoke management plan.

## 5.6 **Are there relevant socio-economic data available –**

Under Regulation No 2017/1004, a EU multi-annual programme for the collection of fisheries and aquaculture data was introduced for the collection of social variables of the EU fishing fleet under the Data Collection Framework (EU MAP).

The social variables, to be collected every three years from 2018 onwards, are: Employment by gender; Full Time Employment (FTE) by gender; Unpaid labour by gender; Employment by age; Employment by education level; Employment by nationality; Employment by employment status; Total FTE National (cf Table. 5.2 below).

| Variable group | Variable | Variable code (=acronym) | Segmentation | Unit | Years | Reporting level | Template | Other requested fields |
|---|---|---|---|---|---|---|---|---|
| Social | Employment | socemploy | by gender | Number | 2017 | Male / Female / Unknown | map_socio | Sampling strategy<br>Total population<br>Sample population<br>(by vessels or fishers) |
| | | | by age | Number | 2017 | <15 / 15-24 / 25-39 / 40-64 / >64 / unknown | | |
| | | | by education level | Number | 2017 | Low (Level 0-2) / Medium (Level 3-4) / High (Level 5-8) / Unknown | | |
| | | | by nationality | Number | 2017 | National / EU / EEA / Non-EU-EEA | | |
| | | | by employment status | Number | 2017 | Owner / Employee (includes unpaid labour): *full-time / * part-time | | |
| | FTE | socfte | by gender | Number | 2017 | Male / Female / Unknown | | |
| | Unpaid labour | socunlab | by gender | Number | 2017 | Male / Female / Unknown | | |

*Table 11: EU MAP data requirements for social Data - 2017*

A first analysis of this data call was done in 2019 under STECF (EWG 19-13), which performed an analysis at national scale. However this scale of information would not be relevant in the context of the better understanding of the fishing communities involved in catching Rays and Skates.

The EWG 19-03 made a range of recommendations and improvements for data collection including the potential benefit of defining a finer scale collection or provision of data as it was done on a voluntary by some member states or within the presentation of different pilot studies such as SECFIFH research project.

EWG 22-15 agrees in accordance with STECF EWG 18-15 (Expansion of CFP indicators report) that community or fleet segment level would be very relevant to better estimate social processes and allow a more accurate vision of the stakeholders.

The group notes that a second social meeting is scheduled to be held in November 2022 (STEFC EWG 22-14) which is expected to bring more knowledge on social aspect of EU fleets.

In term of economical data, the annual economic data call is checked and analysed throughout 2 EWGs of STECF in a yearly basis. The corresponding data base is afterward made publicly available for any research. Within the time of the EWG 22-15 an extraction of the data involving fleet segments which landed Skates and Rays was made available to allow the group checking the validity of the data in regards to ICES WGEF while detailing the situation of cuckoo ray. The folder was deposit on the FTP server and could allow an analysis per year, sub-region and species in both weight (kg) and value (EUR) for a time series 2008-2019. The group notes that these economical analysis would be very valuable to respond to the different local situation linked to Skates & Rays exploitation.

## 5.7 **Additional measures influencing landings**

Alongside with avoidance, selectivity, and survival improvements, additional measures help working toward sustainable exploitation of Rays and Skates: several national Producer Organisations (PO) measures are currently being applied and further influence Rays and Skate Fisheries. PO-measures are implemented through national agreements.

PO-measures in EU and the UK indicate that the implementation of a minimum landings size (MLS) is the most applied measure, and the table further shows that the MLS still varies between countries. The MLS can be decided based on minimum weight, body length or disc width. Besides the MLS, catch limits, protected species, etc. further regulate landings of rays and skates.

### 5.7.1 *Size restriction*

The Interreg 2 Seas SUMARIS project developed a Joint cross-border strategy for the management of rays and skate's fisheries ((Sustainable Management of Rays and Skates | 2 Mers Seas Zeeën, 2020), for which an MLS was identified as an effective measure. The Project concluded that MLS are understandable, relatively easy to implement and to enforce, whilst also influencing the sector equally throughout (SUMARIS Management Options for Skate and Ray Stocks, 2020).

The SUMARIS project indicated how a shift in the MLS to more biologically sound lengths could further help the management of Elasmobranchs. At the present moment, MLS lengths are mostly determined by economic factors, but adjusting the MLS towards "length at 50% maturity (L50)" and help controlling the juvenile fishing mortality (*SUMARIS Management Options for Skate and Ray Stocks*, 2020).

Similarly, can the implementation of a maximum landings size further work towards sustainable management of the rays and skate fisheries. Influence of maximum landings sizes is explored in lesser amounts within the EU (Wiegand et al., 2011). This measure aims at protecting mature fishes, allowing only juvenile and subadults to for exploitation. Restricting the maximum landing size will furthermore have economical consequences and would require adequate compensation for implementation.

Implementing through stakeholder engagement, gradual implementation and regional coordination is further suggested in the SUMARIS project (SUMARIS Management Options for Skate and Ray Stocks, 2020). This implementation would help avoiding economic and social implications of the regulation, whilst allowing time for further scientific research if needed. Additionally, regional coordination of the PO-measures could avoid an imbalance in the impacts on the sector. This would ensure that rays and skates would undergo protection over a larger area, whilst avoiding international economic conflicts due to regulation differences.

### 5.7.2 *Landing restriction*

Other PO-measures, such as landing limitations are further applied within European waters. (Bycatch) landing limitations are however implemented to avoid exceeding national quotas and are not aimed towards ecological goals.

### 5.7.3 *Seasonal Closure*

A last and direct PO-measure is the seasonal closure of certain areas, as is implemented in Portuguese waters (Defeso Por Espécies e Períodos de Interdição Da Utilização de Artes de Pesca Continente - Águas Oceânicas e Interiores Marítimas, 2022).

Seasonal closure as such is also considered effective measures (Wiegand et al., 2011), but has more practical issues. With rays and skates being bycatch, seasonal closure with a focus on rays would have significant consequences on other fisheries.

Because the implementation of the seasonal closures can have significant impacts on other fisheries, size restrictions are commonly considered as a straightforward, effective alternative.

## 5.8 **Recommendations**

With the continuation of fundamental and applied research on rays and skates, further recommendations can be made. These recommendations further build upon previous projects, such as the Interreg 2 Seas SUMARIS project and indicate the need for improved management of rays and skates. Recommendations are given below:

- PO-measures (such size restrictions, seasonal closures, …) have shown effectiveness in the management of skates and rays. These are however not uniformly applied over geographical areas. Ensuring PO-measures are uniformly applied on larger geographic scales, avoids economic advantages and internal competition, and ensures regulation yield the most effective results on a larger scale.
- Minimum landings size (MLS) has been applied throughout EU/UK but is mainly applied with economic purposes. Adjusting the MLS so it's biologically (length at 50% maturity) and economically sound works towards protecting skates and rays in a simple, yet effective matter.
- Maximum Landings Length restrictions are applied in lesser amounts but show indications of being a valuable approach, although further work to demonstrate its effectiveness is required.
- Applying size restrictions gradually and through stakeholder engagement, as suggested in the SUMARIS project, helps avoiding stakeholders' conflicts whilst continuing the improvement of the fishery.
- Other methods, such as seasonal regulations, landings restrictions, etc., are further implemented differently throughout EU/UK waters. These show further potential to work towards sustainable management but can be more complicated in the implementation.
- For all suggested management approaches, it remains important to include all relevant stakeholders in the decision making and that it's coordinated on a larger scale. This ensures that regulation is applied fairly, that the best decision for all stakeholders is made and that implementation can correctly be executed.

**Table 5.4: PO Measures affecting uptake of Group-TAC for skates and rays**

| Country/area | PO measures – include species-specific information | Other (inter)national agreements | Used resources |
|---|---|---|---|
| France (subareas 6,7 8) | (Main PO) Minimum landing weight of 1kg for all skates (corresponds to e.g., a MLS of 50 cm for RJH and 55 cm for RJN) | / | Provided by STECF EGW expert |
| France | / | • National regulation: MLS of 45 cm for Rajidae (expect RJU)<br>• National regulation: MLS of 78 cm for RJU | Provided by STECF EGW expert |
| France (subareas 7 and 8) | / | • National regulation: RJU: trip limit of 300 kg per week and 100 kg per day.<br>• Only full and gutted fish may be landed, landing wings is prohibited | Provided by STECF EGW expert |
| Belgium | • Protected species: Starry ray (RJR) VIId, Common skate species complex (IV, VII and VIII), tope shark (IV, VII, VIII), porbeagle, whale shark, spiny dogfish (IV, VII, VIII), scaly dogfish (IV), Portuguese ice shark (IV), black shark (IV), beaked whale shark (IV), great lantern shark (IV).<br>⇨ Above-mentioned species are not kept on board and should be returned, preferably alive, and immediately transferred overboard<br>• Directed ray fishing with fixed gear is prohibited throughout 2022.<br>• The catch of skates by fishing vessels in ICES areas II, IV, VIId and VIIa-c, e-k shall be limited per sea trip to a number of kilograms, expressed as product weight, multiplied by the number of sailing days of that sea trip in the areas concerned as follows[2]: | • "Rog fish of the year (*Rog vis van het jaar)*. Only landings of RJC, RJH, RJM (agreement introduced in 2021, but this will continue in 2022)<br>• MLS: 50 cm | (Departement Landbouw en Visserij, 2022) |

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| | | | |
|---|---|---|---|
| | ⇨ <u>A. For small fleet segment fishing vessels:</u><br>○ a maximum of 125 kg per sailing day in II, IV<br>○ a maximum of 75 kg per sailing day in VIId<br>○ a maximum of 350 kg per sailing day in VIIa-c, e-k<br>⇨ <u>B. For large fleet segment fishing vessels</u><br>○ a maximum of 250 kg per sailing day in II, IV<br>○ a maximum of 150 kg per vessel day in VIId<br>○ a maximum of 700 kg per vessel day in VIIa-c, e-k | | |
| Netherlands | Since 2019, the weekly landings were capped to 160 kg rays per trip (RJC, RJH, RJM) | • In 2013, Dutch Producer Organisations introduced an MLS of 55 cm (total length) for skates and rays.<br>• In addition, to keep landings within the national quota, the POs have implemented landing restrictions which may varying throughout the year to control the quota uptake. Restriction can vary between 40 and 250 kg dead weight. | Provided by STECF EGW expert |
| England/Wales | / | Although there is no EU regulation, individuals' length <40 cm tends to be discarded. E in England and Wales have the option of establishing by-laws for the fisheries operating in the inshore waters (extending to 6nm from shore). Within the North Sea area, the Kent and Essex Sea Fisheries Committee has established a minimum size of 40 cm disc width for skates | (*Minimum Fish Landing Sizes*, 2022; *Thornback Ray Raja Clavata Family Rajidae*, n.d.) |

- Quantities allocated in the North Sea are doubled for those vessels equipped only with the boards.
- In the North Sea, the by-catch rule for skate catches as introduced in 2011 has been retained: skate catches for vessels with an L.O.A. greater than 15 m may not exceed 25 per cent of the total live-weight catches retained on board per fishing trip.
- Quantities of skate caught more than the allocated quantities must be discarded for high survival in accordance with the provisions of the discard plans North Sea and Western Waters.

| | | | |
|---|---|---|---|
| | | and rays (disc width being used because the tails are often cut before landing) | |
| Portugal | Seasonal closure for RJU, from May to July | • Minimum conservation reference size: 52 cm except for RJU which is 78 cm<br>• Species subject to TAC / quota<br>• The capture of several species is prohibited<br>• Rules applicable to Trawl fishing: target species with mesh size ≥ 70 mm<br>• Rules applicable to gillnet fishing: target species with mesh size ≥ 100 mm | (*Defeso Por Espécies e Períodos de Interdição Da Utilização de Artes de Pesca Continente - Águas Oceânicas e Interiores Marítimas*, 2022; *Fish - DGRM*, 2018) |

## 5.9 **Synthesis and recommendations**

A large number of species-metiers have been studied in past few years and the same pattern of 'high'survival (> 60%) is seen across the board. Only exception is cuckoo ray, which shows survivability of around 15%. It should be determined if this is 'high' or 'low' for the species by taking the stock status and trends into account. Improving survivability for this species should have priority.

It is suggested to keep exemption in place for the coming 3 years and to concentrate research efforts on increasing the survival of skates and rays, especially cuckoo ray, by better researching methods for avoidance, selectivity and survival (on-board and post-release).

There is good engagement by the fishing industry, and stakeholder dialogues are an essential way to ensure that the knowledge and expertise from the sector helps define the way forward.

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# 6 TERM OF REFERENCE 5

"To consider transparent criteria to classify skate and ray species as prohibited species."

## 6.1 Introduction

The Expert Working Group was asked to provide advice on what would be a sensible method for incorporating skates and rays on the prohibited species list that is part of the TAC& Quota regulation and/or that is an annex to the Technical Measures regulation, and also criteria for taking them off again.

As the prohibited species list and the technical measures regulation apply to all EU waters and by EU vessels fishing in other areas, the scope of these lists goes beyond the remit of this EWG. We can however provide recommendations for criteria for listing of skates and rays that can be reviewed for their relevance for all species.

## 6.2 Background

The Prohibited species list has been a feature of the TAC & Quota regulation since 2007 and was added as an annex to the Technical measures regulation in 2016. At no point were there clear criteria established for to add species or stocks to the list, additions seemed to follow need based. The rationale for adding species was adapted several times to reflect these needs.

The meeting reviewed possible legal and management reasons for placing species in the prohibited list as follows:

*Convention on Migratory Species (CMS)*

A list of species that are prohibited to catch appears to have been first introduced in the TAC & Quota regulation in 2007. In this first iteration it contained two species, Great White shark (*Carcharinus carcharias*) and Basking shark (*Centorhinus maximus*). There is no rationale given in the regulation but it is in all likelihood linked to the listing of Basking shark on Appendix I of the Convention on Migratory Species (CMS, Bonn convention) which occurred in 2005.

As a signatory to CMS the EU is legally obliged to take appropriate measures for species for which it is a range state:

*"Parties that are a Range State to a migratory species listed in Appendix I shall endeavour to strictly protect them by: prohibiting the taking of such species, with very restricted scope for exceptions; conserving and where appropriate restoring their habitats; preventing, removing or mitigating obstacles to their migration and controlling other factors that might endanger them."*

Before 2007 Basking shark had been under a 0-TAC, white shark never appeared in the TAC&quota regulation before it first appeared on the List.

Species that were added to CMS appendix I in later years (angel shark, manta rays, devil rays, common guitarfish) were consistently added to the prohibited list.

This was explained in the preamble to the TAC&quota regulation of the relevant year, for example from 2018:

*"At the 12th Conference of the Parties of the Convention on the Conservation of Migratory Species of Wild Animals, held in Manila from 23 to 28 October 2017, a number of species were added to the lists of protected species in Appendices I and II of the Convention. Therefore, it is appropriate to provide for the protection of those species with respect to Union fishing vessels fishing in all waters and non-Union fishing vessels fishing in Union waters."*

Community plan of Action for the Conservation of Sharks (CPOA-Sharks)

Apart from the CMS listed species, from 2010 onwards more species were added to the prohibited list, these were all severely depleted species that were only caught as incidental bycatch. This can be directly linked to the adoption of the Community Plan of Action for the Conservation and Management of Sharks which was adopted in 2009 and which has aspirations for the protection of threatened shark and ray species. At this time a rationale for this expansion of the prohibited species list was added to the preambles of the TAC & Quota regulation:

*"For certain species, such as certain species of sharks, even a limited fishing activity could result in a serious conservation risk. Fishing opportunities for such species should therefore be fully restricted through a general prohibition on fishing those species"*

Species for which this applies are:

- Common skate
- Norwegian skate
- Starry ray

In a particularly puzzling action was when the tope shark was added to the list, but only for longline gears, where previously gear had not been a specification in the list, and in this case, is not a gear commonly used to target tope.

Skate and Ray Group TAC and December council negotiations

The introduction of the group TAC for Skates and Rays in 2008 and the incremental reductions of the TAC with up to 20% per year in the years directly after the introduction led to this TAC being an important negotiation point in the December council. As far as the experts in the working group are aware there was no scientific or conservation rationale for these listings.

Stocks to which this applied are:

- Thornback ray in area 3a (to increase catchable thornback ray in area 4)
- Undulate ray in areas 6, 7 and 10 (removed for area 7 in 2014)
- Small eyed ray in Bristol channel (briefly added in 2015)

Landing obligation

The introduction of the Landing Obligation gave another use to the prohibited list. Under a landing obligation it would no longer be possible to have 0-TAC or very low TACs for species that were bycatch in other fisheries. Before the LO came into effect these species would be discarded once the TAC was filled but under a discard ban this would create problems for fishers who would have to avoid all catches of 0-TAC species or risk having to close the fishery. The prohibited species list was seen as a solution for this problem since fishers are under an obligation to throw back all catches of these species, including dead bycatch. By moving species and/or stock to the prohibited list it thus created a license to keep discarding. In the 2019 pre-amble to the TAC & quota regulation this was worded as follows:

*"For some years, certain TACs for stocks of elasmobranchs (skates, sharks, rays) have been set at zero, with a linked provision establishing an obligation to immediately release accidental catches. The reason for that specific treatment was the poor conservation status of those stocks and the assumption that discarding, because of high survival rates, would not raise fishing mortality rates and would be beneficial for the conservation of those species. As of 1 January 2019, however, catches of those species have to be landed, unless they are covered by any of the derogations from the landing obligation provided for in Article 15 of Regulation (EU) No 1380/2013. Point (a) of Article 15(4) of that Regulation allows such derogations for species in respect of which fishing is prohibited and which are identified as such in a Union legal act adopted in the area of the CFP. Therefore, it is appropriate to prohibit the fishing of those species in the areas concerned."*

Species for which this rationale was applied were"

- Piked dogfish
- Porbeagle shark
- All deep sea sharks

Technical measures regulation

In addition to the prohibited list in the TAC & quota in 2016 the list was copied into the Technical Measures Regulation (EC no. 2016/0074) as an annex. There is no rationale provided with in the Regulation why this list is in there or which criteria are used to put species or stocks on the list. The Annex also contains non-elasmobranch species (salmon, berried lobsters and date shell. The list in the Annex appears to be static and has only been updated in the revision of the Technical Measures regulation in 2019. At this time several species were removed from the annex (common skate, starry ray, piked dogfish, thornback ray in 3a, undulate ray) it is unclear which criteria were used for decided on which species to keep on the annex and which to take off. The species taken off Annex 1 in the Technical Measures regulation have remained on the prohibited species list in the TAC & Quota regulation.

Advisory council request

From 2017 onwards the North Sea and North Western Waters Advisory councils have send several requests to the European Commission to ask for a revision of the prohibited setting out clear criteria for both listing and taking off species and/or stocks. These request were supported by both the fishing industry and other interest groups in the ACs as both from a commercial and a conservation perspective the current situation was viewed as potentially detrimental for both.

## 6.3 **Existing international treaties for which the EU is a signatory**

The EU is a signatory of several international treaties on the protection of species that include elasmobranchs, Table I provides an overview of the listing criteria in the most relevant treaties:

**IUCN** Red List of threatened species is a list of species and their status providing a comprehensive information source on the extinction risk of animals, fungi and plants. Assessors place species into one of the IUCN Red List Categories, based on a series of assessment criteria. For each species, The IUCN Red List provides information about its range, population size, habitat and ecology, use and/or trade, threats and conservation actions. The red list assessment are part of listing criteria for many other treaties.

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

**CMS** - Convention on the Conservation of Migratory Species of Wild Animals is an environmental treaty of the United Nations, and provides a global platform for the conservation and sustainable use of migratory animals and their habitats. Migratory species threatened with extinction are listed on Appendix I of the Convention, and migratory species that need or would significantly benefit from international co-operation are listed in Appendix II.

**CMS MoU Sharks** - The Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU) aims to achieve and maintain a favourable conservation status for migratory sharks throughout their range.

**OSPAR** - The Convention for the Protection of the Marine Environment of the North-East Atlantic is the regional sea convention for the North-East Atlantic, in which 15 Governments and the EU cooperate to protect the marine environment of the North-East Atlantic.

**SPAW** - Specially Protected Areas and Wildlife protocol, is a regional agreement for the protection and sustainable use of coastal and marine biodiversity in the Wider Caribbean Region.

**GFCM**

**HELCOM** - The Baltic Marine Environment Protection Commission or Helsinki Commission, is the regional sea convention covering the Baltic Sea area. This intergovernmental organisation develops environmental policy to protect the marine environment of the Baltic Sea from all sources of pollution, preserve biological diversity and promote sustainable use of marine resources.

**ASCOBANS** - The Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas was established under the auspices of the Convention on Migratory Species (CMS or Bonn Convention), and aims to promote close cooperation between countries so as to achieve and maintain Favourable Conservation Status for small cetaceans throughout the Agreement Area.

## 6.4 **EU internal legislation**

EU environmental legislation also aims to tackle incidental bycatch. The Birds (2009/147/EC) and Habitats (92/43/EEC) Directives set out obligations to monitor and prevent bycatch, while the Marine Strategy Framework Directive MFSD (2008/56/EC) has developed a specific criterion on the bycatch of sensitive marine species groups, namely that the mortality rate per species from incidental bycatch is below levels which threaten the species, such that its long- term viability is ensured.

Regulation (EU) 2019/1241 of the European Parliament and of the Council on the conservation of fisheries resources and the protection of marine ecosystems through technical measures (Technical Conservation Measures Regulation).

### TAC & Quota

This is the existing method of management.

### Productivity-Susceptibility Analysis (PSA)

The productivity-susceptibility analysis (PSA) is a semi-quantitative approach that assigns relative risks for species (low-medium-high) according to their biological sensitivity and susceptibility to capture in a particular fishing gear, in order to prioritize management actions for a fishery or species group (REFS;). McCully et al. (2013) developed a PSA for elasmobranchs caught in four mixed fisheries in northern European shelf seas. This information can be informative in the decision tree for identifying species for the prohibited species list.

Metier 1 = ; Metier 2 =

| Scientific Name | Common Name | FAO Species Code | Status | Biological Sensitivity Score | Fishery Susceptibility (Metier 1) | Fishery Susceptibility (Metier 2) | Overall Score (both metiers) | Overall Rank UK |
|---|---|---|---|---|---|---|---|---|
| *Lamna nasus* | Porbeagle shark | POR | CR | 21 | 16 | 14 | 51 | 1 |
| *Isurus oxyrinchus* | Shortfin mako | SMA | VU | 21 | 16 | 14 | 51 | 1 |
| *Squalus acanthias* | Spurdog | DGS | CR | 20 | 14 | 17 | 51 | 1 |
| *Raja brachyura* | Blonde ray | RJH | NT | 17 | 16 | 17 | 50 | 4 |
| *Alopias vulpinus* | Thresher shark | ALV | VU | 21 | 15 | 13 | 49 | 5 |
| *Gadus morhua* | Cod | COD | VU | 13 | 18 | 17 | 48 | 6 |
| *Raja clavata* | Thornback ray | RJC | NT | 17 | 15 | 16 | 48 | 6 |
| *Xiphias gladius* | Swordfish | SWO | LC | 15 | 18 | 15 | 48 | 6 |
| *Prionace glauca* | Blue shark | BSH | NT | 20 | 15 | 12 | 47 | 9 |
| *Galeorhinus galeus* | Tope shark | GAG | VU | 20 | 12 | 15 | 47 | 9 |
| *Leucoraja circularis* | Sandy ray | RJI | VU | 18 | 13 | 15 | 46 | 11 |
| *Leucoraja fullonica* | Shagreen ray | RJF | NT | 18 | 13 | 15 | 46 | 11 |
| *Raja undulata* | Undulate ray | RJU | EN | 18 | 11 | 17 | 46 | 11 |
| *Thunnus alalunga* | Albacore tuna | ALB | NT | 12 | 18 | 15 | 45 | 14 |
| *Raja microocellata* | Small-eyed ray | RJE | NT | 17 | 11 | 17 | 45 | 14 |
| *Dicentrarchus labrax* | Bass | BSS | LC | 11 | 15 | 18 | 44 | 16 |
| *Sebastes viviparus* | Norway redfish/haddock | SFV | na | 18 | 14 | 12 | 44 | 16 |
| *Pollachius virens* | Saithe | POK | na | 14 | 16 | 14 | 44 | 16 |
| *Raja montagui* | Spotted ray | RJM | LC | 16 | 13 | 15 | 44 | 16 |
| *Mustelus asterias* | Starry smooth hound | SDS | LC | 18 | 13 | 13 | 44 | 16 |
| *Dipturus batis* | Common skate | RJB | CR | 19 | 11 | 13 | 43 | 21 |
| *Melanogrammus aeglefinus* | Haddock | HAD | VU | 11 | 17 | 15 | 43 | 21 |
| *Merlangius merlangus* | Whiting | WHG | na | 11 | 17 | 15 | 43 | 21 |
| *Anarhichas lupus* | Wolfish | CAA | na | 16 | 15 | 12 | 43 | 21 |
| *Leucoraja naevus* | Cuckoo ray | RJN | LC | 15 | 13 | 14 | 42 | 25 |
| *Merluccius merluccius* | Hake | HKE | na | 12 | 15 | 15 | 42 | 25 |
| *Scyliorhinus canicula* | Lesser-spotted dogfish | SYC | LC | 15 | 14 | 13 | 42 | 25 |
| *Solea solea* | Sole | SOL | na | 10 | 15 | 17 | 42 | 25 |
| *Psetta maxima* | Turbot | TUR | na | 12 | 15 | 15 | 42 | 25 |
| *Scomber scombrus* | Mackerel | MAC | LC | 10 | 14 | 17 | 41 | 30 |
| *Lophius piscatorius* | Anglerfish | MON | na | 13 | 14 | 14 | 41 | 30 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

## 6.5 **Stocks at risk**

The STECF has a process by which fish stocks can be identified as 'being at risk' from overexploitation. According to STECF EWG 14-12 / 14-21, the Stock-at-Risk indicator is defined, for each fleet segment, the stocks at risk indicator is the number of stocks for which, according to the advice of international scientific bodies, are:

- EITHER assessed as being below the Blim;
- OR subject to an advice to close the fishery, to prohibit directed fisheries, to reduce the fishery to the lowest possible level, or similar advice from an international advisory body, even where such advice is given on a data-limited basis;
- OR subject to a fishing opportunities regulation which stipulates that the fish should be returned to the sea unharmed or that landings are prohibited;
- OR a stock which is on the IUCN ‘red list’or is listed by CITES

A number of elasmobranch stocks are on this list as can be seen in the Table below

**Table 12: Stock-at-Risk (SAR) List 2021,Skates & Rays in Balance EWG 2022 in prep.**

| | | | | |
|---|---|---|---|---|
| Starry Ray | 2020 | rjr-23a4 | RJR | 27.234 |
| Comon skate Complex | 2016 | rjb-celt | RJB | 27.celt |
| Thornback Ray | 2018 | rjc.27.3a47d | RJC | 27.3.a |
| Undulate ray | 2018 | rju.27.7de | RJU | 27.8de |
| Norvegian Skate | 2018 | JAD | JAD | 27.6ab7a-7e-hk |
| White Skate | 2020 | rja-nea | RJA | 27 |
| Maltese Ray | 2014 | jam-med | JAM | 37 |
| Spiny butterfly ray | 2014 | rgl | RGL | 27.8c, 27.9, 34.1.1, |
| Bull Ray | 2014 | mpo-med | MPO | 37 |
| Sandy ray | 2012 | rji-med | RJI | 37 |
| Undulate ray | 2018 | rju.27.8.ab | RJU | 27.8ab |
| Undulate ray | 2020 | rju.27.7.bj | RJU | 27.7bj |
| Undulate ray | 2020 | rju.9a | RJU | 27.9.a |
| Undulate ray | 2020 | rju.8c | RJU | 27.8.c |
| Cuckoo ray | 2019 | rjn.27.3a4 | RJN | |
| Bull Ray | 2020 | mpo-nea | MPO | 27, 34, 47 |
| Common Stringray | 2020 | jdp.atl | JDP | 27,37, 34, 47 |
| Starry Ray | 2020 | rjr.natl | RJR | 21,27 |
| Common Eagle Ray | 2021 | myl.atl | MYL | 27, 37, 34, 41, 51 |
| Marbled torpedo ray | 2020 | ttr.all-areas | TTR | 27-37-34-47 |

Decision Tree for determining if a species should be on the Prohibited Species List

## 6.6 Review and recommendation

The timeline presented of the different iterations of the prohibited species list, as well as the critiques that the list has received, highlight some issues with the way it was originally constructed that should be addressed in any revision of the list:

1. It was never defined what the scope or purpose of the list is and the pre-ambles that explain the rationale behind it changed over time from initially having a pure focus on the conservation of elasmobranchs to later being a tool to avoid having to land all catches under the landing obligation
2. The process for listing relies heavily on the member states input towards the December council negotiations, this gives a lack of transparency which in the past has resulted in confusing situations with last minute listings that seemed to serve no conservation purpose
3. The discrepancies noted between the lists in the TAC&Quota regulation and the Technical measures regulation should be addressed.
4. The annex in the Technical measures regulation is static, and cannot be adapted. The regulation does not provide a rationale of the process for the listing of species and stocks, which means that new listings on international treaties, progressing insights on conservation status of species or new scientific information on stock/species status cannot be reflected in that list
5. It is called a species list but contains sub-populations / stocks of species. For management purposes having the option to manage at stock level can be relevant, for example to protect vulnerable life stages or known aggregation sites

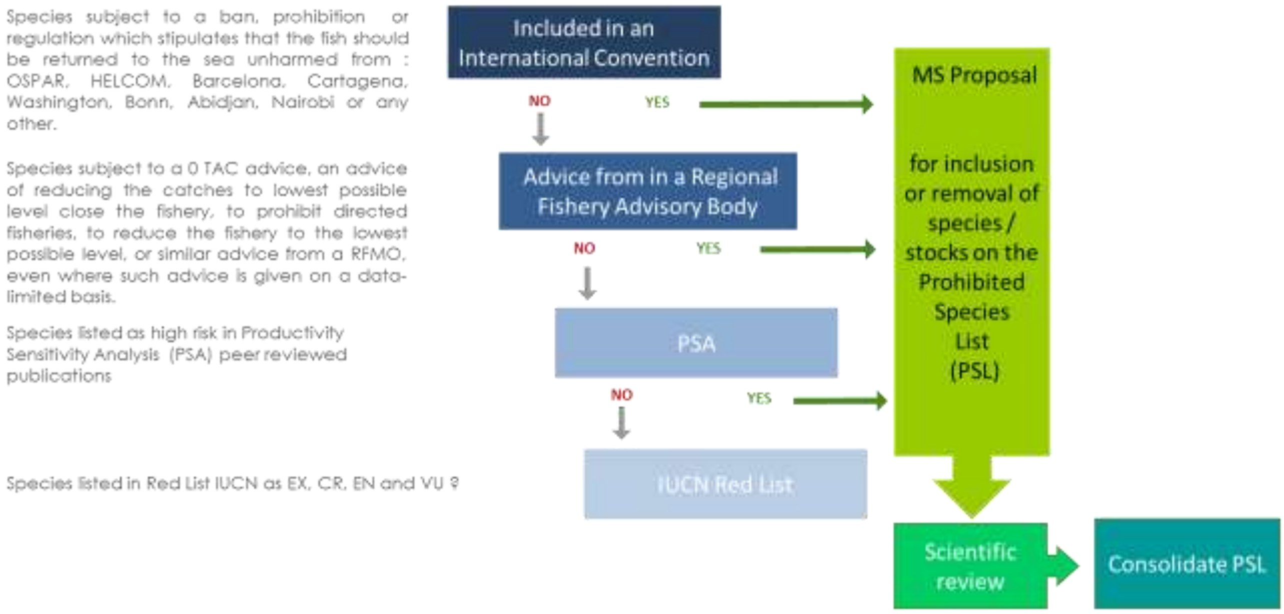
6. There are some stocks that have prohibitions in certain gears only, this creates complications in enforcement and we would recommend not using this in future

The EWG was asked to only consider the prohibited species list in the context of skates and rays only. However we feel it is warranted to give some overarching recommendations for the listing process and criteria.

For the criteria we propose a decision tree containing the following steps:

1. Listing on international legislative treaties
2. Assessment in relevant scientific fishery advisory body (ICES, ICCAT etc)
3. Risk assessment such as Productivity-Susceptibility Analysis (PSA)
4. Species listed in IUCN Red List as 'extinct', critically endangered, endangered or vulnerable

Once a process is formalised, the addition or removal of species and/or stocks can be discussed between the Member States according to an agreed timeline and protocol. See schematic below.




The EWG suggests that the decision tree and further information presented in this report is used as a starting point, by a dedicated group, for an evaluation of the current prohibited species list in order to scientifically underpin the inclusion and removal of species from the list. The EWG further recommends in this context that a clear timeline is provided for parties (MS) to propose additions or removals from the list and that these proposals are reviewed by an independent scientific panel (STECF/ICES?)

## 6.7 References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## 6.8 **Overview of existing criteria**

Table XIII - Characteristics of the international conventions/treaties analyzed regarding their criteria do classify species.

| **Convention/ treaty** | **Categories** | **Criteria** | **Ranges of criteria for listing** | **Criteria for removal** | **Links** |
|---|---|---|---|---|---|
| **IUCN red List** | – Critically Endangered<br>– Endangered<br>– Vulnerable<br><br>– Near threatened<br>– Least concerned | A. Population reduction<br>B. Restricted geographic range<br>C. Small pollution size & decline<br>D. Very small or restricted population<br>E. Extinction probability analysis | **A** reduction observed and causes are clearly reversible, understood and ceased (≥90%, 70%, 50%); reduction observed and causes may not be reversible, understood or ceased; reduction predicted; reduction observed or predicted and causes may not be reversible, understood or ceased (≥80%, 50%, 30%) | | https://www.iucnredlist.org/resources/summary-sheet |
| | | | **B** Extent of occurrence (<100 $km^2$, <5,000 $km^2$, <20,000 $km^2$) or area of occupancy (<10 $km^2$, <500 $km^2$, <2,000 $km^2$) and 2 out of 3: severely fragmented or number location (1,≤5,≤10), continue decline observed or extreme fluctuations in occurrence or occupancy or number of subpopulations or mature individuals | | |
| | | | **C** Number of mature ind. (<250, <2,500, <10,000) and 1 out of 2: observed or projected decline (25% in 3 yrs/1GT, 20% in 5 yrs/2GT, 10% in 10 yrs/3GT) and 1 out of 3: mature ind (≤50, ≤250, ≤1,000) in each subpopulation, % mature ind in one subpop (90-100%, 25-100%, 100%), extreme fluctuations in mature ind. | | |
| | | | **D** Number mature ind (<50, <250, <1,000) | | |
| | | | **E** Indicating the probability of extinction in the wild (≥50% in 10 yrs/3G, ≥20% in 20 yrs/5G, ≥10% in 100 yrs). | | |

| | | | | | |
|---|---|---|---|---|---|
| **CITES** | – Appendix I<br>– Appendix II<br>• Article II Annex 2(a)<br>• Article II Annex 2(b) | – Appendix I: small wild population, restriction in distribution, marked decline in population size<br>– Appendix II<br>• Annex 2(a): regulation in trade necessary to prevent inclusion in Appendix I in the near future; or regulation in trade is required to ensure harvest from the wild is not reducing the wild population to a level at which its survival might be threatened by continuing harvesting or other influences<br><br>Annex 2(b): the specimens resemble those included in Appendix II 2(a) or Appendix I; other compelling reasons to ensure that effective control of trade in currently listed species is achieved | A general guideline for a marked historical extent of decline is a percentage decline to 5%-30% of the baseline, depending on the biology and productivity of the species There are separate criteria for commercially exploited marine species in which the level of decline has a smaller range (5-20%) than that for other species stated above. | None | https://cites.org/sites/default/files/document/E-Res-09-24-R17.pdf |

| | | | | | |
|---|---|---|---|---|---|
| **CMS** | – Appendix I for migratory species that are endangered. shall endeavour to strictly protect them by: prohibiting the taking of such species, with very restricted scope for exceptions; conserving and where appropriate restoring their habitats; preventing, removing or mitigating obstacles to their migration and controlling other factors that might endanger them.<br>– Appendix II covers species with an unfavourable conservation status that require international agreements for their conservation | For Appendix I<br>A. Best available science<br>B. IUCN listing Critically endangered or endangers<br>C. Special consideration<br><br>For Appendix II<br>D. IUCN listing Vulnerable or Near threatened<br>And/Or<br>E. Need for international cooperation | A. No definition provided<br>B. In the context of CMS, endangered refers to a species or regional population that has been assessed as Extinct in the Wild, Critically Endangered, or Endangered using the IUCN Red List.<br>C. If a species has been assessed in a lower IUCN Red List threat category (e.g. Near Threatened, Vulnerable), a special consideration can be made for an Appendix I listing if its status is deteriorating and the listing is beneficial to the conservation and management<br>D. Species which have an unfavourable conservation status and which require international agreements for their conservation and management<br>E. Species which have a conservation status which would significantly benefit from the international cooperation" | A migratory species may be removed from Appendix I when the Conference of the Parties determines that:<br><br>A. reliable evidence, including the best scientific evidence available, indicates that the species is no longer endangered, and<br><br>B. the species is not likely to become endangered again because of loss of protection due to its removal from Appendix I. | [https://www.cms.int/en/species/appendix-i-ii-cms](https://www.cms.int/en/species/appendix-i-ii-cms) |
| **CMS MoU Sharks** | – Annex 1 of the Sharks MOU lists species that have an unfavorable conservation status and which require international agreements for their conservation and management (not necessarily the same sp. as the CMS appendixes) | The Shark MoU secretariat provides a format which has to be filled in and is reviewed by the standing scientific committee of the CMS MoU Sharks | Format has the following criteria:<br>– Ecological data<br>– Threat data<br>– Protection status and needs<br>– Range states | | [https://www.cms.int/sharks/en](https://www.cms.int/sharks/en) |

| | | | | | |
|---|---|---|---|---|---|
| **SPAW** | – Annex I flora<br>– Annex II fauna species which require the highest level of protection. For those species the any shape of destruction, disturbance is forbidden. Are also prohibited their possession, trade or those of their seeds or eggs. It's the same for products stemming from these species. Any activity touching their housing environment is particularly regulated<br>– Annex III are the ones for which the exploitation is authorized but regulated so as to ensure and maintain population at an optimal level. | 1. Evidence of decline<br>2. Precautionary approach<br>3. Use and management at national level<br>4. IUCN criteria in regional context<br>5. CITES listing<br>6. Usefulness of regional cooperation<br>7. Not for endemics at country level<br>8. Taxonomic unit, not sub-species<br>9. Population status at regional level<br>10. Ecosystem protection by proxy | 1. based on the following factors: size of populations, evidence of decline, restrictions on its range of distribution, degree of population fragmentation, biology and behavior of the species, as well as other aspects of population dynamics, other conditions clearly increasing the vulnerability of the species, and the importance of the species to the maintenance of fragile or vulnerable ecosystems and habitats.<br>2. the lack of full scientific certainty about the exact status of the species is not to prevent the listing of the species on the appropriate annex.<br>3. particular reference to listing in Annex III, the levels and patterns of use and the success of national management programmes should be taken into account<br>4. particular reference to listing in Annex III, the levels and patterns of use and the success of national management programmes should be taken into account<br>5. whether the international trade of the species under consideration is regulated under CITES or other instruments<br>6. the importance and usefulness of regional cooperative efforts on the protection and recovery of the species.<br>7. not considered appropriate to include in the lists species which are endemic to a single country. Any Contracting Party may however, request the inclusion on the lists of a species that is endemic to its territory, if regional cooperation is clearly important for its recovery.<br>8. The lists should be prepared at the level of species; is taken to include all subspecies. Exceptionally, higher taxa can be utilized in listing when there are reasonable indications that the lower taxa are similarly justified in being listed, or to address problems of misidentification caused by species of similar appearance.<br>9. the status of the population at the regional level should be | Areas and species may be removed from the area listing or Protocol annexes by the same procedure by which they were incorporated. | https://www.car-spaw-rac.org/IMG/pdf/cop8_2014_._procedure_for_species.eng.pdf |

| | | | | | |
|---|---|---|---|---|---|
| | | | the starting point for its evaluation.<br>10. Species essential to the maintenance of such fragile and vulnerable ecosystems/habitats, as mangrove ecosystems, seagrass beds and coral reefs, may be listed if the listing of such species is felt to be an "appropriate measure to ensure the protection and recovery" | | |
| **OSPAR** | OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Agreement 2008-06) | 1. Global importance<br>2. Regional importance<br>3. Rarity<br>4. Sensitive<br>5. Keystone species<br>6. Decline | 1. a high proportion (>75%) of a species at any time of the life cycle occurs in the OSPAR area | Species may be excluded during the review process by the same procedure by which they were incorporated. | https://www.ospar.org/documents?v=40948 |
| | | | 2. high proportion (>90%) of the total population of a species for any part of its life cycle is restricted to a small number of locations (50 km x50 km grid squares) in the OSPAR area. | | |
| | | | 3. total population size is small. For sessile or restricted mobility species, if it occurs in a limited number of locations (50 km x50 km grid squares) and in relatively low numbers. | | |
| | | | 4. "very sensitive" when it has very low resistance (it is very easily adversely affected by human activity); and/or has very low resilience (after an adverse effect from human activity, recovery is likely to be achieved only over a very long period (>25 years), or is likely not to be achieved at all). "sensitive" when it has low resistance; and/or it has low resilience (recovery is likely to be achieved only over a long period (5-25 years)). | | |
| | | | 5. a species which has a controlling influence on a community. | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | 6. observed or indicated significant decline in numbers, extent or quality (life history parameters):<br><br>- extirpated: occurring in the past but last individuals have since died or moved away, or surveys fail to record for 10 years.<br><br>- severely declined: an extremely high and rapid decline, or species has already disappeared from the major part of<br><br>its former range in the area; or if individual numbers are at a severely low level due to a long continuous and distinct<br><br>general decline in the past.<br><br>- significantly declined: means a considerable decline in number, extent or quality.<br><br>- high probability of a significant decline in number, extent or quality in the future.<br><br>a. "currently threatened" is a species where the decline is "clear and present", and can be linked directly or indirectly to human activity;<br><br>b. "potentially threatened" is a species where there is a high probability of significant decline linked directly or indirectly to human activity, or if the species satisfies criterion 3 (rarity) or 4 (sensitivity) with a lower threshold of probability. | | |

# 7 ALTERNATIVE APPROACH

## Alternative Management options

The first Term of Reference focuses on aligning the various methodologies to arrive at a group TAC for skates and rays. Irrelevant of the methodology applied, management of stocks in a multi-species context is complex and prevents effective control of the single species exploitation rates. Such consideration was already included within ICES advice on fishing opportunities for species such as turbot and brill, as well as lemon sole and witch flounder which are currently managed under a combined TAC. For skates and rays this consideration is being included in most recent ICES advice on fishing opportunities for skates and rays stating that: "Management of the catches of skates and rays under a combined TAC prevents effective control of single-stock exploitation rates and could lead to overexploitation of some species." (ICES, 2022). In this context, STECF was requested to explore alternatives for the group TAC.

As ICES is providing single stock advice for skates and rays, a single-stock TAC could be a more appropriate way forward. From a biological perspective, such approach would allow more effective control on the exploitation rates by species, preventing the possibility of overexploiting the more vulnerable skate and ray species and align the TAC area with the stock distribution. In contrast, single species TACs would disturb the fixed allocation key used to divide the TAC for skates and rays between countries, i.e. affecting the Relative Stability. Assuming fishing activities are commensurate with current fishing opportunities, an adjustment of the Relative Stability could result in a change in the share of each species for each country and thus potentially disrupt fishing activities within a country. As adjusting the Relative Stability is not achievable in the short term, an intermediate option based on ICES stock assessment classification was proposed. The rationale to base the calculation of two group TACs is that one group TAC would include the ICES category 2 and 3 stocks which have a biomass index, so that the change in the advice comes from a quantitative and trend-base assessments. The other TAC would include the other skates and rays which are category 5 and 6 stocks for which the advice is only based a precautionary rule, which basically results in decreasing the advice over time.

## Group TAC separating by ICES stock category

In this section, the methodology of setting separate group-TACs by ICES stock category is explored. The stocks included per stock category differed per TAC area and can be found in Table 7.1. A simple simulation on the North Sea using the EC and UK method was applied to evaluate the effects (variability) on the resulting TAC numbers in each TAC area for the period 2016-2020. For the North Sea, starry ray (*Amblyraja radiata*), common skate complex (*Dipturus spp.*), and thornback ray in Division 3.a were not included in the calculations as these are on the prohibited species list. Undulate ray (*Raja undulata*) is not included in Division 7.d as it has a separate TAC.

Table 7.1: Stocks included by TAC area separated by ICES stock category

| TAC area | Category 3 | Category 5 and 6 |
|---|---|---|
| **Greater North Sea (ecoregion, Subarea 4, and Divisions 3.a and 7.d)** | rjc.27.3a47d; rjh.27.4c7d; rjm.27.3a47d; rjn.27.3a4; rjn.27.678abd | raj.27.3a47d; rjh.27.4a6; rjf.27.67; rji.27.67; rje.27.7de |
| **2.a and 4** | rjc.27.3a47d; rjh.27.4c7d; rjm.27.3a47d; rjn.27.3a4 | raj.27.3a47d; rjh.27.4a6 |
| **3.a** | rjm.27.3a47d; rjn.27.3a4 | raj.27.3a47d |
| **7.d** | rjc.27.3a47d; rjh.27.4c7d; rjm.27.3a47d; rjn.27.678abd | raj.27.3a47d; rjf.27.67; rji.27.67; rje.27.7de |
| **6.a, 6.b, 7.a-c and 7.e-k** | rjc.27.6; rjc.27.7afg; rjm.27.67bj; rjm.27.7ae-h; rjn.27.678abd | raj.27.67a-ce-k; rjc.27.7e; rje.27.7de; rjf.27.67; rjh.27.7afg ; rjh.27.7e; rji.27.67; |
| **8 and 9** | rjc.27.8; rjc.27.9a; rjh.27.9a ; rjm.27.8; rjn.27.8c; rjn.27.9a ; rjn.27.678abd | raj.27.89a; rjb.27.89a; rjm.27.9a; |

**North Sea case study**

The Greater North Sea Ecoregion is split into three separate management and thus TAC units (i.e. SRX/03A-C, SRX/2AC4-C, and SRX/07D), while advice for most stocks cover several management units (e.g. Thornback ray (*Raja clavata*) in Subarea 4, divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)). Both the EC and UK methods were applied at ecoregion and TAC area level to demonstrate some the issues and concerns when moving to an ICES stock category approach. Analysis was done for all stocks combined, category 3 stocks only, and category 5 & 6 stocks only.

**EC method**

The EC method calculates the average percentage of the ICES advice changes per advice year, and applies a -20% advice change in the calculations for those stocks for which ICES does not provide advice as a precautionary measure. For the North Sea ecoregion and separate TAC areas, this precautionary measure only applies to the other skates and rays stock (raj.27.3a47d).

A split of the groups-TAC by ICES stock category has a major impact on the TAC values in the category 5 and 6 group TAC. In the ICES process these stocks are, due to applying the precautionary buffer, set downwards by 20% every four years. In addition, the Rajidae stock, being part of the category 5 & 6 group would biennially receive a -20% adjustment. Consequently, the TAC advice will always result in a downward revision and thus a continuous decline of the TAC over time (Figures 7.1 and 7.2). The effect on TAC advice when grouping category 5 and 6 stocks is most evident in TAC area 3.a where the category 5 & 6 group-TAC would only consist of the Rajidae stock. Hence, a biennial -20% would be applied, shifting to a zero catch over time. The speed in which the TAC advice for this group-TAC would decline much depends on the stocks within the group-TAC calculations. In a given advice year, some stocks may have a status quo advice (0% change) whereas other stocks will be revised downward with 20% due to the application of the precautionary buffer.

A group TAC of Category 3 stocks only will be more subject to fluctuations. Category 3 stocks are assessed biennially and advice may change up or down. In this context, there is no sliding slope downward as for a Category 5 and 6 group TAC. In addition, the EC method is based on advice changes and does not account for the size of the stocks . As such, every stock has the same weight in the TAC advice and increases or decreases in advice change in a large stock can be levelled out. Combining all stocks, regardless of their stock category, often produces a middle ground TAC advice as negative advice changes in stocks in categories 5 and 6 can be offset by somewhat more positive advice changes in stocks in category 3. As such, fluctuations as observed in a category 3 group TAC would still occur, but will be less pronounced (Figure 7.2 (cumulative effect)).

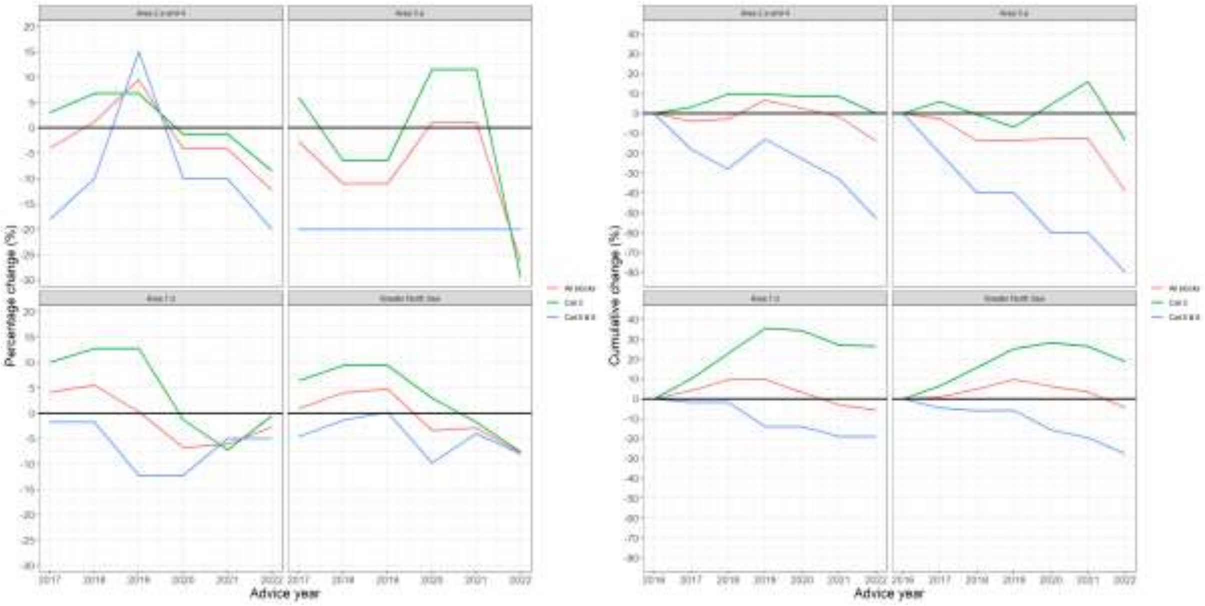


Figure 7.2: Percentage change (left panels) and cumulative change (right panel) in TAC advice over time using the EC method in the three North Sea TAC areas and Greater North Sea area.

**UK method**

The UK method makes use of the actual ICES advised tonnages. For the different advice years the tonnages relevant to the TAC ecoregions are summed. In contrast to the EC method, the UK method can account for the mismatch between TAC area and stock distribution by calculating the representative fraction of the advice based on historic landings for those stocks straddling an ecoregion. In addition, the UK method requires a calculation of the tonnage for skates and rays that have not been allocated to stocks for which ICES provide advice (i.e. Rajidae stocks).

For the North Sea ecoregion, the split to different TAC areas can be made by using an historic TAC distribution or by using the historic distribution of landings for each stock in each of the specific TAC areas (i.e. SRX/03A-C, SRX/2AC4-C, and SRX/07D). Below we provide an outline on how the UK method is applied to calculate the group TAC for either category 3 stocks and category 5 & 6 stocks.

Category 3

1. Historic TAC distribution (method 1)

For all category 3 stocks, the sum of advice is taken to calculate the TAC for the entire ecoregion. The overall category 3 TAC is split into the specific TAC areas by using a historic TAC distribution.

2. Distribution of landings over ecoregion (method 2)
   For each category 3 stock, the proportion of landings within the specific TAC area is determined and applied to the stock specific ICES advice. Consequently, the advice is split over the different TAC areas of which the stock is part of. All shares of the relevant stocks are then summed, resulting in a single TAC advice for each TAC area.

Category 5 & 6

1. Historic TAC distribution (method 1)
   - For all category 5 & 6 stocks, the sum of advice is taken to calculate the TAC for the entire ecoregion.
   - For the Rajidae stock, for which no ICES advice is given, the average proportion of the total skate and ray landings in the ecoregion is estimated. For the Greater North Sea about 10% of landings consist of Rajidae. Consequently, if total advice for all stocks, excluding Rajidae, would be 3000t, the total TAC advice for the ecoregion would need to be increase with 300t to account for the Rajidae stock.
   - To obtain the total advice for category 5 & 6 stocks, the Rajidae share would then be summed with the total advice for other category 5 & 6 stocks. This is then split into the specific TAC areas by using the historic TAC distribution.

2. Distribution of landings over entire ecoregion (method 2)
   - For each category 5 & 6 stock, the proportion of landings within each TAC area is determined. The proportions are applied to the ICES advice, splitting the advice into the different TAC areas that the stock is part of.
   - To account for the Rajidae stock, the same calculation as in the historic TAC distribution applies. However, the final step to divide the Rajidae share among the TAC areas is different. Instead of using the TAC distribution, the distribution is based on the proportion of Rajidae landings taken in each area, i.e. 33% in 3.a, 61% in 2a. and 4 and 6% in 7.d. For example if the total advice for Rajidae in the Greater North Sea ecoregion equals 300t, and applying the proportions by TAC area, the advice will be split into 99t in 3.a, 183t in 2a and 4 and 18t in 7.d..
   - Then, for each TAC area, the share of advice is summed for all category 5 & 6 stocks, including the Rajidae share.

3. Distribution of landings with specific TAC area (method 3)
   - For all relevant stocks, excluding Rajidae, the proportion of landings within each TAC area is determined. The proportions are applied to the ICES advice, to split the advice into the different TAC areas that the stock is part of.
   - The share of advices for each separate TAC area are summed to get a total advice excluding Rajidae. For example; 18 t in area 3a.

- Then the proportion of Rajidae landings within the TAC area is estimate. This means, of all landings in 3.a. 70% consist of the Rajidae stock, whereas the remaining 30% are landings of other stocks. To account for Rajidae in the advice, the total advice in area 3.a is calculated as follows: 18t (i.e. *known advice)* / (1 – 0.703 (*proportion of Rajidae landings*)) = 62t *total advice for all stocks including Rajidae in TAC area 3.a*.
- The Rajidae share can be derived by taking its share (e.g. 70% in area 3a) of the total advice. For the example of area 3.a this would result in 44t Rajidae advice.
- To obtain the total advice for category 5 & 6 stocks, the Rajidae share would then be summed with the total advice for other category 5 & 6 stocks within the TAC area.

As demonstrated here, the UK methods allow for different ways of allocating advice to a specific TAC area. Each of these methods have their own pro and cons, and each produce a different outcome in terms of group-TAC values. Effects are predominantly visible for the category 5 & 6 group-TAC values. We have only applied the different methods to the North Sea case as this ecoregion is the most complex consisting of three separate TAC management areas.

**Table 7.2:** TAC values in 2022 for all stocks combined, category 3 stocks, and category 5 and 6 stocks, inferred from the historic TAC distribution in 2021.

| TAC Area | Ecoregion spilt | All stocks | Category 3 | Category 5 and 6 |
|---|---|---|---|---|
| Greater North Sea | 100% | 3307 | 2974 | 333 |
| SRX/03A-C | 1.45% | 48 | 43 | 5 |
| SRX/2AC4-C | 53.31% | 1762 | 1585 | 177 |
| SRX/07D | 45.23% | 1496 | 1345 | 151 |

Using a historic TAC distribution is a relatively straight-forward approach. By apportioning the advised landing using a historic distribution of the TACs there is a much lower risk in changing the relative fishing opportunities (Table 7.1). Splitting the group TAC by ICES category results in much lower TAC for category 5 and 6 stocks. The TAC for this category 5 and 6 TAC is about 11% of the TAC calculated for a category 3 TAC. Also, compared to the other methods the annual change in the TAC advice will not differ between both group-TACs as the apportioning over TAC areas is defined by the historic TAC distribution (Figure 7.2). Furthermore, this method deems more precautionary for category 5 and 6 stocks in TAC areas 3.a and 2a and 4 compared to method 2. These areas combined entail about 90% of the Rajidae landings in the Greater North Sea area. Also, the Rajidae stock would constitute the main stock in the category 5 and 6 group-TAC.

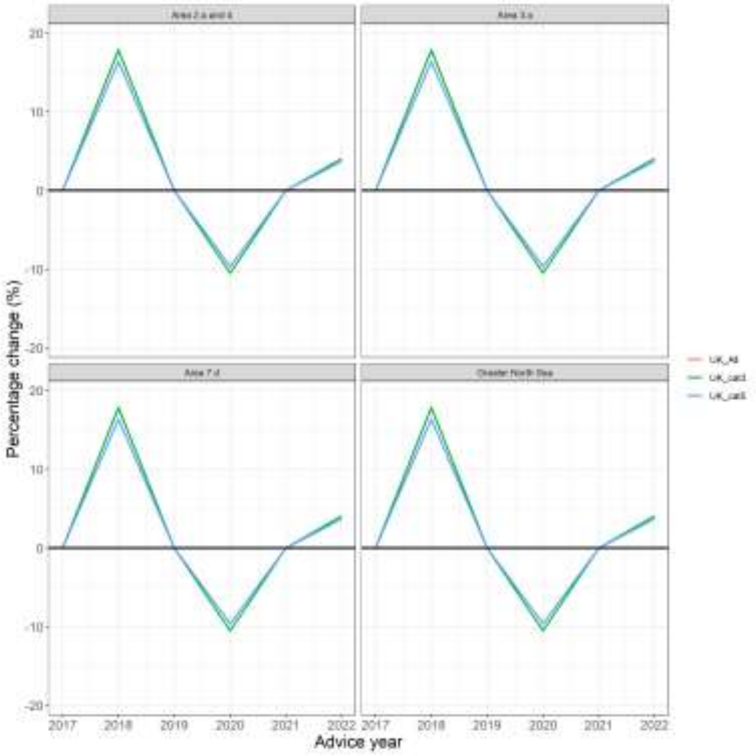


**Figure 7.2**:Percentage change in advice by year.

Method 2 (Table 7.3) shows that the TAC values for both group-TACs are more aligned with actual landings values. This is logical, because the apportioning of the advices is based on an average distribution of the landings within a TAC area for each stock. Consequently, this method appear less precautionary in its advice for category 5 and 6 stocks in TAC areas 3.a. and 2.a and 4.

Table 7.3: TAC values in 2022 for all stocks combined, category 3 stocks, and category 5 stocks, inferred from the average distribution (2017-2020) of landings over entire ecoregion.

| TAC Area | All stocks | Category 3 | Category 5 and 6 |
|---|---|---|---|
| Greater North Sea | 3307 | 2974 | 333 |
| SRX/03A-C | 116 | 13 | 103 |
| SRX/2AC4-C | 1368 | 1179 | 189 |
| SRX/07D | 1822 | 1782 | 40 |

Outcomes of method 3 are mainly influenced by the Rajidae distribution of landings (Table 7.4). The difference with method 2 is the proportion used to apportion the Rajidae within the TAC area. Whereas method 2 uses the overall ecoregion as a basis, method 3 uses the contribution of Rajidae within the specific TAC area. For example, 33% of the overall Rajidae landings are coming from 3.a (method 2), but within area 3.a 70% of landings belong to the Rajidae stock (method 3). Figure 7.3 shows the influence of both methods on the percentage change of the advice. The choice of method will mainly affect the percentage change in the category 5 and 6 group-TAC, whereby method 3 still takes all relevant stocks in the TAC area into account and method 2 looks at the stock-specific distribution of landings. As a result, in method 3 the changes in advice over time for both category 3 and category 5 and 6 group-TAC follow a similar pattern. In contrast, method 2 may cause larger deviations between both group-TACs.

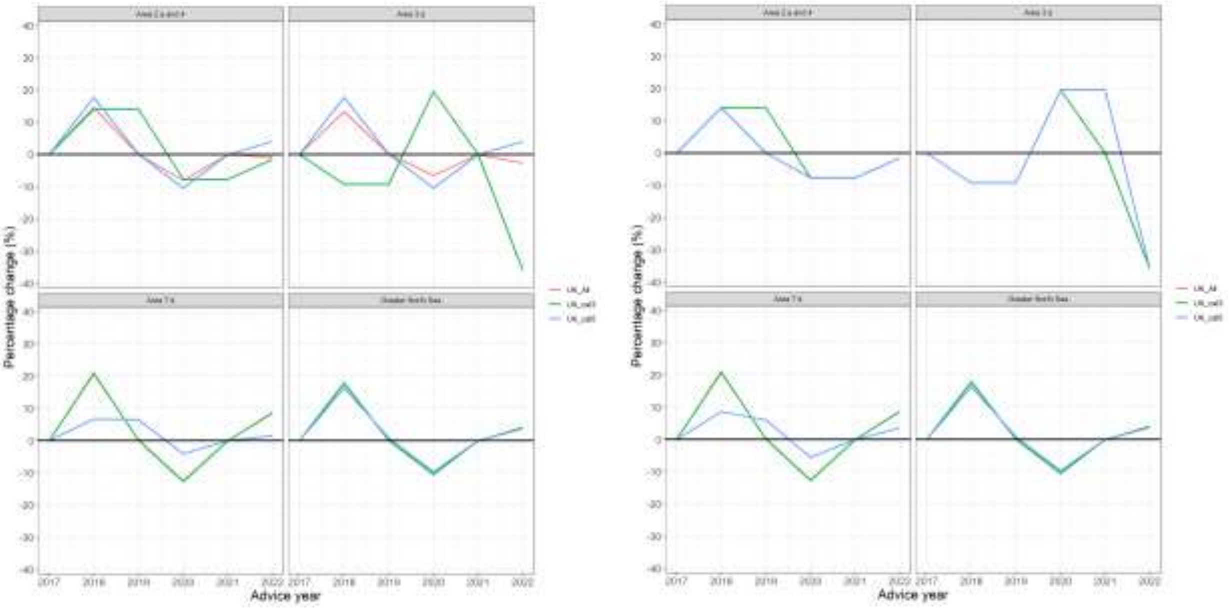


**Figure 7.3**: Percentage change in the advice using method 2 (left panels) and method 3 (right panels) for all stocks combined, category 3 group-TAC and category 5 and 6 group-TAC.

**Table 7.4:** TAC values in 2022 for all stocks combined, category 3 stocks, and category 5 stocks, inferred from the average distribution (2017-2020) of landings within a specific TAC area (SRX/03A-C, SRX/2AC4-C, and SRX/07D).

| TAC Area | All stocks | Category 3 | Category 5 and 6 |
|---|---|---|---|
| Greater North Sea | 3241 | 2974 | 267 |
| SRX/03A-C | 43 | 13 | 30 |
| SRX/2AC4-C | 1372 | 1179 | 193 |
| SRX/07D | 1826 | 1782 | 44 |

Overall, a split of the group TAC based on ICES stock categories could be a first step. However, the current EC method would result in a continuous decline in advice of category 5 & 6 Group-TAC to eventually lead to a zero TAC over time. Yet, such an approach would be an incentive to increase data collection and monitoring of these stocks allowing them to be upgraded to ICES category 3 stocks over time.

# 8 CONCLUSIONS

There are both pros and cons to both the EU and the UK methodologies for setting TACs. A summary of these is listed below. Overall, it is the opinion of the EWG that the use of combined TACs for skates and rays should be discontinued in the medium term and that approaches to the setting of individual stock-based TACs begin. It is believed that this should be possible for no later than the 2025 TACs. It is not expected or recommended that this be done at once. Rather, discussions should take place between scientists, managers and stakeholders on setting in place a process that may include e.g. species or stock-based management plans, individual TACs for ICES Category 2 and higher stocks, etc. See Recommendations (Section 9).

While the ICES advice for all elasmobranch stocks was not released until after the EWG met, it is noted that advice methodology changed considerably in 2022 and has lead to a change in perception of cuckoo ray and undulate ray stocks. ICES has benchmark assessments of North Sea stocks scheduled for 2023. This may also lead to changing perceptions of other stocks. It is recommended that the future use of single-stock TACs for these stocks in particular be considered, as an interim to single-stock management across the board.

## 8.1 UK Method

Pros:

The UK method takes the individual stock status of each species in the assemblage into account. For vulnerable stocks with decreasing survey trends and associated catch advice, the advice translates directly to the catch advice for each stock.

Cons:

As currently implemented by the UK, catches of *Dipturus* species are used in the calculations. As these species are on the Prohibited Species List, or have zero catch advice, this is not considered appropriate.

Does not take TAC overshoots into consideration.

## 8.2 EU Method

Pros

The EU method is straightforward to calculate. It can be consistently applied even with changes in the ICES stock or advice cycle.

Where large stocks are on the increase, this method is more precautionary for smaller stocks.

Cons

This approach is not considered precautionary for vulnerable stocks. For stocks with decreasing survey trends and associated decreasing catch advice, this method may not protect these stocks by decreasing at the same rate.

Where large stocks are decreasing, this method is less precautionary for smaller stocks.

Does not take TAC overshoots into consideration.

## 8.3 **Alternative models**

The primary alternative method analysed was a potential hybrid mechanism where TACs would be based on the advice for Category 3 and Category 5/6 groupings. It was initially thought that this would be a practical compromise that would take stock status better into account when providing the advice, particularly for more vulnerable or data deficient stocks. However analysis (Section 2) showed that this approach is highly sensitive to the starting conditions of the two stock-groupings. Both the UK and EU methods have flaws depending on whether the larger stock is increasing or decreasing. The EU method is also biased by being driven by previous TACs rather than stock status.

In this situation, it is not recommended that this approach be followed as a hybrid or interim step towards single-stock TACs.

# 9 RECOMMENDATIONS

The EWG recommends to explore the possibility of including skates and rays explicitly in the existing EU multiannual management plans as an alternative management approach to the current group-TAC and national measures.

While the use of single-stock TACs is recommended, it is not proposed that this should be done overnight. This group recommends that this issue be looked at by an STECF or other international group such as ICES, with the intention of introducing single-species TACs or sub-TACs by 2025 alongside other management measures, e.g. spatial or temporal closed areas, where appropriate (See section 4).

With the continuation of fundamental and applied research on rays and skates, further recommendations can be made. These recommendations further build upon previous projects, such as the Interreg 2 Seas SUMARIS project and indicate the need for improved management of rays and skates. Recommendations are given below:

- PO-measures (such size restrictions, seasonal closures, …) have shown effectiveness in the management of skates and rays. These are however not uniformly applied over geographical areas. Ensuring PO-measures are uniformly applied on larger geographic scales, avoids economic advantages and internal competition, and ensures regulation yield the most effective results on a larger scale.
- Minimum landings size (MLS) has been applied throughout EU/UK but is mainly applied with economic purposes. Adjusting the MLS so it's biologically (length at 50% maturity) and economically sound works towards protecting skates and rays in a simple, yet effective matter.
- Maximum landings size restrictions are applied in lesser amounts but show indications of being a valuable approach.
- Applying size restrictions gradually and through stakeholder engagement, as suggested in the SUMARIS project, helps avoiding stakeholders' conflicts whilst continuing the improvement of the fishery.
- Other methods, such as seasonal regulations, landings restrictions, … are further implemented differently throughout EU/UK waters. These show further potential to work towards sustainable management but can be more complicated in the implementation.
- For all suggested management approaches, it remains important to include all relevant stakeholders in the decision making and that it's coordinated on a larger scale. This ensures that regulation is applied fairly, that the best decision for all stakeholders is made and that implementation can correctly be executed.

## 10 LIST OF EWG-22-08 PARTICIPANTS

[1] - Information on EWG participant's affiliations is displayed for information only. In any case, Members of the STECF, invited experts, and JRC experts shall act independently. In the context of the STECF work, the committee members and other experts do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members and experts also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: http://stecf.jrc.ec.europa.eu/adm-declarations

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## 13 List of Background Documents

Background documents are published on the meeting's web site on:
https://stecf.jrc.ec.europa.eu/web/stecf/ewg08

List of background documents:

EWG-22-08 – Doc 1 - Declarations of invited and JRC experts (see also section 10 of this report – List of participants)

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