SEAFISH
the authority on seafood

RASS scoring guidance

1. Introduction

RASS overview

Advice on 'which fish to eat or avoid' is currently available from many sources (notably from the NGO sector) allied with scoring systems. This advice can vary and be at differing levels of detail. Varying or conflicting advice has created confusion for the supply chain and consumers alike. There is a need from seafood buyers for robust, up-to-date, and structured information on the environmental risks when sourcing seafood. Depending on a buyer's needs this may encompass the risks to the health of a particular stock, or the risks associated with the wider environmental impacts of different fisheries.

The UK Seafish Industry Authority's Risk Assessment for Sourcing Seafood (RASS) will provide UK seafood buyers and processors with information on the biological status of fish stocks from which fish are either landed or imported into the UK, and the environmental impacts of fisheries catching these stocks. A key feature of RASS is that it will present risk scores for four themes: 1) stock status, 2) stock management, 3) habitat impact, and 4) bycatch impact (hereafter referred to as mechanisms).

Seafish have developed the RASS scoring mechanisms and an online tool for disseminating this information to our key stakeholders. In addition to informing the UK seafood industry's sourcing policies, it is envisaged that RASS will facilitate dialogue between the scientific community and industry, allowing prioritisation of future research to address high-risk uncertainties.

Scoring

The rationale behind scoring is that many seafood buyers who use RASS will not have the knowledge (or time) to make sense of quantitative and qualitative information from scientific, technical and legal sources. As such, Seafish have developed a risk assessment for translating information gathered from management advice and the broader literature into five risk categories (see Table 1). Supporting evidence in the form of a referenced narrative (and graphs where appropriate) will also be provided in addition to the score to provide context.

Table 1 Risk categories for RASS. Only five categories will be presented in the online tool.

Risk	Score
Very low	1
Low	2
Moderate	3
High	4
Very high	5

Scoring is perhaps least contentious for scoring stock status as the goal is relatively easy to define (i.e. to minimise the risk of a stock being outside safe biological limits), and there are a fairly limited number of criteria to score against this goal. Scoring stock management is trickier as it more difficult to define what actually constitutes 'good management', and the criteria used to assess good management are much more subjective, entailing some degree of judgement from the scorer. For bycatch and habitat risk, expert judgement will have to be excised on a patchy evidence base, and in some cases a generalisation will have to be made on the potential risk of impact of a given gear category.

We initially define a fishery at its broadest level as the stock area by main capture method. Though in the future there will be scope in RASS to make assessments of nested fisheries (Figure 1) if there is a need for such information. There will be subsequent scope for down-scoring[1] management, bycatch and habitat risk for nested fisheries if they can evidence that they are less risky than the broad-scale fishery profile to which they belong (see sections 2.2.3, 2.3.3, and 2.4.1). Such down-scoring will have to be evidenced by data, or sound argument that can be scrutinised by peer-review.

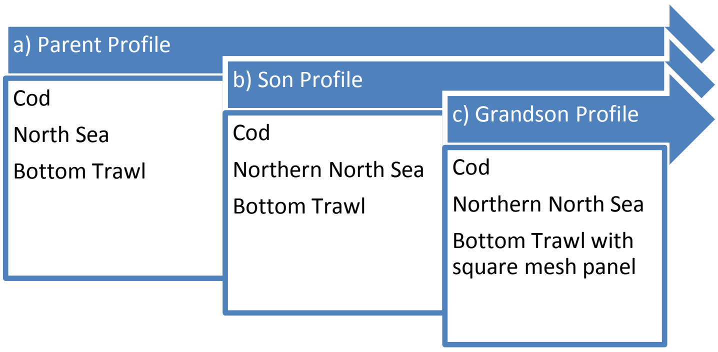

Figure 1 RASS fisheries assessments will initially be broadly defined at the scale of the stock (a). Though there will be scope to define nested fisheries at varying spatial scales (b) and/ or operating procedures (c).

Contents

[1] The stock score will be the same regardless of the scale of the RASS assessment.

Mechanisms

2.1 Stock status

The goal for this component is that seafood is sourced from a stock that is harvested sustainably and within biological limits. Our definition of a stock is the unit used by managers for regulatory purposes. A "stock" may not always match the biological unit of a population which can pose problems for management (see section 2.2). The majority of stocks that will be initially input into RASS are from the NE Atlantic and are assessed by ICES. A smaller proportion of stocks are found in North American waters with assessments made predominantly through USA (NOAA, e.g. Alaska Pollock), Canadian (DFO, e.g. Atlantic cod) fisheries science institutions, and also the tuna RFMOs. Essentially the scoring scheme had to be developed to take into account different types of stock assessment, and the quality of information underpinning it (see ICES DLS Guidance Report 2012). For those stocks that are not assessed in any way we resort to using the resilience of the species to fishing which is defined on Fish Base (Cheung et al 2005).

Unlike management, bycatch and habitat risk scores there will be no room for manoeuvre in decreasing the risk score for stock status for nested fisheries, as this information will be treated independently regardless of the catch from a particular fishery (e.g. hand-lining will have significantly less impact on the mackerel stock than pelagic trawling/ seining).

2.1.1 Quantitative assessed stocks

Typically, the commercially most important fish stocks are fully assessed through statistical models that quantify the biomass of the stock and fishing mortality in relation to a target and/ or limit reference point. Generally speaking a target reference point refers to the Maximum Sustainable Yield (B_{MSY} and or MSYBtrigger and F_{MSY}) or proxies, and precautionary (pa) and limit (lim) reference points relate to the likelihood that stock recruitment is being impaired. The risk can be assessed according to how stock biomass and fishing mortality reference points fall in relation to one another in the matrix (Figure 2).

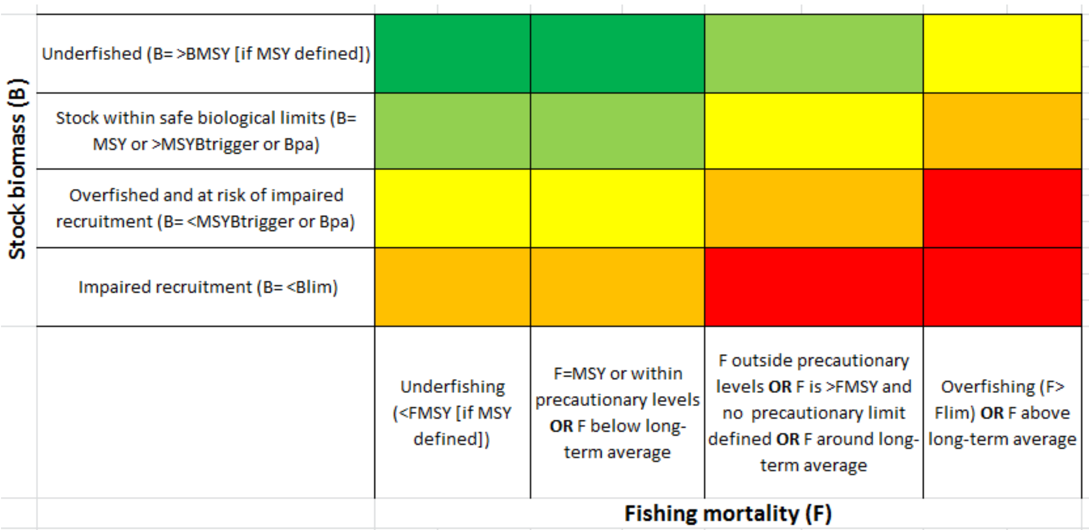

Figure 2 Matrix for scoring quantitatively assessed stocks. Note that for some stocks, biomass reference points may be explicitly defined, whereas fishing mortality may described as a range (see ICES advice 2015, Book 6), or be described more broadly in terms of where it lays in relation to a long-term average.

Reference points can differ between different assessment areas (i.e. ICES vs NOAA) (Table 2). In the USA, stock biomass reference points relate to B_{MSY} or a proportion (usually 30, 35 or 40%) of the un-fished biomass with average long-term recruitment. Limit reference points for B are undefined. Advice on sustainable exploitation is given as fishing mortality rates calculated to move stock status towards B_{MSY}, which are in turn used to determine the corresponding acceptable harvest (or range of harvests) for a given stock, the Allowable Biological Catch (ABC), and also the overfishing level (OFL – defined as any amount of fishing in excess of a prescribed maximum allowable rate).

There are five tiers used to determine ABC for US ground fish stocks, based upon the status and dynamics of the stock, the quality of available information, environmental conditions and other ecological factors, and prevailing technological characteristics of the fishery.

Table 2 Table showing how scoring criteria for stock biomass and fishing mortality approximately relate to reference points in the ICES and North American systems.

Scoring criteria	**Assessment system**	
Stock biomass	**ICES**	**USA (NOAA)**
Underfished	>BMSY	>B35% (for Tier 3 stocks)
Stock within safe biological limits	Between BMSY and MSYBtrigger/ Bpa	
Overfished and at risk of impaired recruitment	Between MSY Btrigger/ Bpa and Blim	
Impaired recruitment	<Blim	
Fishing mortality		
Underfishing	>FMSY	
Fishing mortality within precautionary limits	Between FMSY and Fpa	F_{ABC} is set equivalent to the mean of F_{MSY}
Fishing mortality outside precautionary limits	Between FMSY and Fpa/ Flim	
Overfishing	>Flim	

2.1.2 Data limited stocks

Many data-limited stocks will have a biomass index (B) and harvest rate (F) defined. The language in ICES stock assessment advice (e.g. North Sea turbot) often relates to where B and F lie in relation to a long-term average. The various possibilities for the status of B and F (see first column Figure 3) will be weighted by a species biological resilience defined in Fish Base (Cheung et al 2005), or Sea Life Base. If B and F are not defined, the default position would be to use species resilience only to score (i.e. High 3, Medium 4, Low/ very low resilience 5). For some species (e.g. brown crab, lobster etc) only their vulnerability has been defined, therefore this metric will be used in the absence of information on resilience. If only a population trend is known, then Figure 4 will be used to score.

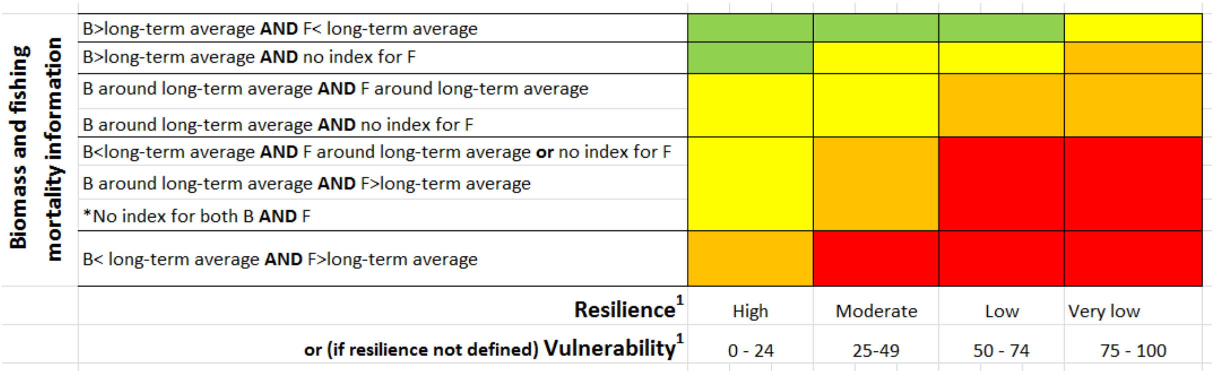

Figure 3 Matrix for scoring data-limited stocks. *This is to be used as the default score in the absence of any information on B and F. [1] Some species may be cited as bordering two categories, we suggest being conservative in this case, and assume the lower resilience score, or higher vulnerability score.

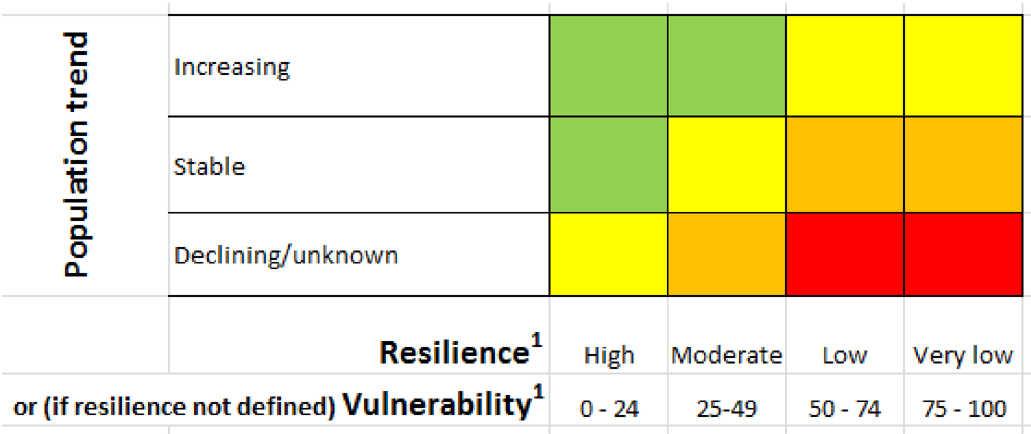

Figure 4 Matrix for scoring data-limited stocks if only a population trend is known.

2.2 Stock management

The goal for this component is that seafood is sourced from a stock that is responsibly managed. Here we define responsible management as reflecting the extent to which the stock harvest strategy is known to be precautionary, and secondly, what is known about the general surveillance of the fishery and extent of infringements (Figure 4, see row headers). In contrast to scoring stock status, descriptors of these two dimensions are difficult to define objectively. Scoring management is inherently subjective as different assessors may have divergence in opinion on the choice of scoring criteria that best describe the same fishery. Special attention will need to be spent on quality assurance to mitigate this subjectivity and ensure consistency in scoring.

Assessments of management will initially be made for the stock area. However, for some species (i.e. scallops, nephrops) management will typically be assessed at the scale that the main capture fishery operates (e.g. scallop dredging in the Celtic Sea), and not individual beds/ grounds. Generally, fisheries management in the developed world has improved considerably over the past fifty years (Hilborn & Ovando 2014), and typically it is going to be straddling/ high seas stocks, and fisheries operating in the jurisdiction of developing countries where there will be more risk associated with management, I.e. where there is no agreed harvest strategy, limited surveillance, and limited law enforcement.

2.2.1 Stock harvest strategy

This dimension captures the quality of information that underpins the Management Controls (MCs) and their implementation. In reality, MCs can take a variety of forms as appropriate to the stock. Instruments used include total allowable catches (TAC), rules to limit fishing effort and spatial-temporal distribution of fishing, and technical measures specifying gear types and selectivity devices. Although in fisheries management emphasis is put on the collection of data to inform the setting of the TAC, there are also some fisheries that are not TAC managed, for example, the Faroe Islands effort based management system (Hegland & Hopkins 2014). Spatial and size based limits also play a part in controlling harvesting strategy, our scheme recognises this, so that a wide range of strategies can be scored.

The evidence used to score this dimension will be found in fisheries management plans and stock assessment advice, or inferred from the rules set out by the management body. Many commercially important stocks will have an agreed management plan, and it will often be explicitly stated in the stock assessment advice whether this is precautionary. However, for most fish stocks an inference will have to be made to score against the criteria shown in first column of Figure 5. It should be noted that regardless of the quality of information underpinning the assessment, for those stocks where implementation of MCs is not consistent with advice (i.e. mismatching scales between management and stocks [e.g. nephrops functional units], TACs being set higher than range specified by management plan, effort inadequately managed) the lowest possible score for management would be a moderate risk.

2.2.2 Surveillance and enforcement

This dimension captures the extent to which there is surveillance of a fishery to ensure that MCs are complied with, and whether infringements will compromise the stock harvest strategy. Through technological advances (i.e. satellite monitoring, electronic logbooks etc) the capacity of most developed countries to carry out surveillance of their fleets has increased since the turn of the century. However, infringements will continue to happen in most fisheries, therefore expert judgement should be made on the extent to which infringements (e.g. widespread misreporting of fish catches in the Baltic Sea (Hentati-Sundberg et al. 2014)) are likely to compromise the objectives of the harvest strategy.

2.2.3 Scoring management of nested fisheries

A fishery may have scored a ≥moderate risk either because of an ineffective stock harvest strategy and/ or surveillance and enforcement. In certain circumstances a nested fishery (see Figure 1 for definition) may be implementing local management measures that are contributing to the conservation of the stock and/ or is better managed than the parent fisheries profile in terms of surveillance and enforcement (e.g. fully documented fisheries).

There will be scope in RASS to recognise best practice in such fisheries by creating tailored profiles, and potentially down-score risk if management of the stock is deemed less risky in these fisheries compared to the parent, with an assessment made against the same criteria in Figure 5. To do this in a way that is defensible, the nested fishery would have to provide evidence of local stock management measures that distinguish it from the general parent fishery, and are acknowledged to be consistent with a precautionary harvest strategy. Such profiles would also need to be quality assured to ensure that there is a reasoned argument for down-scoring the risk.

Stock harvest strategy (Decreasing monitoring of stock, and risky harvest strategy)	Surveillance and enforcement		
	Management controls (MCs) are routinely enforced and independently verified through surveillance of fishing activities (e.g. VMS, logbooks, dockside monitoring, vessel inspections etc). Infringements happen only very occasionally and unlikely to compromise harvest objectives.	Compliance can be patchy (i.e. misreporting of catches officially stated to be a problem), and infringements may compromise harvest objectives.	Lack of surveillance prevents confirmation of whether fishing vessels are complying with MCs; **OR** there is widespread non-compliance and no capacity to enforce infringements. Harvest objectives (if they exist) will likely be compromised.
Management controls[1] (MCs) are derived from analytical stock assessments and known to be precautionary; **AND** Actual MCs within range specified by science advice.			
MCs are advised using analytical stock assessments though found not to be precautionary (OR tested without implementation error); **OR** Simpler data-limited approaches (e.g. ICES data-limited methods) are used for setting MCs, and which are based on knowledge of the fisheries and the biology of the stock, but unknown whether they are precautionary; **AND** A fishery has implemented MCs for the stock, and these are consistent with science advice.			
MCs are derived from data, though compromised by mismatching scale of assessment unit and management (e.g. some *Nephrops* functional units, and where there is a combined TAC for overlapping stocks); **OR** catches or effort too high (i.e. outside range specified by science advice) and may not lead to a sustainable pattern of exploitation.			
A fishery has implemented MCs that are rational in relation to the life-history of the species/ stock, but lack of monitoring means efficacy is not verifiable.			
Data are too limited to develop any form of MCs to adjust fishing opportunities on the stock **BUT** there are management measures in place to control effort in the fishery.			
Data are too limited to develop any form of MCs to adjust fishing opportunities on the stock **AND** no effort control.			

Figure 5 Matrix for scoring management.

2.3 Bycatch impacts

The goal for this component is that seafood is sourced from a fishery that minimises the quantity of bycatch caught, and the impact on populations of protected, endangered, and threatened (PET) (including vulnerable resource) species. The term “bycatch” has different meanings in different jurisdictions. Bycatch is defined here as fisheries-related mortality or injury other than the retained catch, and is congruent with the Marine Stewardship Council’s definition. Examples of bycatch include discards, the incidental mortality of megafauna (e.g. marine mammals, seabirds, turtles), gear encounter mortality and ghost fishing. All discards, including those released alive, are considered bycatch unless there is robust scientific evidence of high post-release survival. Here, an assessment of bycatch risk will be made for two dimensions[2] that will be scored independently of each other; the percentage quantity of bycatch in weight, and the impact on Endangered Threatened and Protected (ETP) species populations. The final risk will reflect the dimension that is scored highest.

2.3.1 Quantity

Typically the quantity of bycatch caught will depend on the gear and fishery (i.e. a few species, or mixed), marketability of species, and regulations in place (e.g. historically in the EU regulatory discarding of over-quote catch (Sigurðardóttir et al 2015)). All these factors mean that for a given gear type bycatch can vary significantly between different regions. In the EU at least, a discard ban is in the process of being implemented that will likely reduce the amount of bycatch caught by fishermen. The quantity of bycatch caught in some fisheries has been directly documented (e.g. European Discards Atlases), or in many cases a general inference will have to be made drawing on evidence from similar fisheries operating elsewhere (Figure 5a). When an inference can’t be made from existing evidence, a default stance on the potential bycatch risk will have to be taken for a given category of gear.

2.3.2 Protected, endangered and threatened (PET) species

A species will be categorised as PET if it is legally protected in conservation law, or the population is known to be outside or at risk of being outside safe biological limits, this also including commercial fish stocks. Preferably, a judgement on risk will take into account evidence on the potential biological removal (PBR) rate, or the population status of the PET species. If there is no information on this, an inference will be made on whether there is mitigation in place across the fishery that will likely reduce the impact of the fishery on the PET species/ population in question. If there is ambiguity over the extent to which mitigation is taking place in the fishery, a precautionary stance will be taken, with this dimension being scored a high risk (Figure 5b).

2.3.3 Scoring bycatch of nested fisheries

In certain circumstances an argument may be made by a nested fishery (see Figure 1) that the incidence and impact of bycatch is significantly less compared to the parent fishery which may have been scored a ≥moderate risk. For example vessels in the nested fishery may have universally

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[2] Ghost-fishing and pre-capture mortality were considered to be beyond the scope of RASS assessments.

adopted a code of practice and or gear modifications to reduce either the quantity of bycatch, or impact on ETP species when compared to the parent fishery. The same criteria defined in Figure 5 will be used to assess the bycatch risk in such fisheries; and any down-scoring will have to be evidenced by data or sound argument that can be scrutinised by peer-review.

a) Total quantity (by weight of total catch)	Risk
<1% discards **OR (in the absence of discard rate)** Fishing gear very unlikely to catch bycatch (e.g. hand gathering).	Green
1% ≤ <10% discards **OR** Bycatch low % level of the catch (e.g. pelagic fisheries, rod and line).	Light green
10%≤ <30% discards **OR** Bycatch potentially moderate % weight of the catch (e.g. gillnetting). **OR** High discarding though likely to be high post-release survival of the majority of catch (e.g. crustaceans).	Yellow
30%≤ <50% discards **OR** Bycatch potentially high % weight of the catch (e.g., bottom trawling in a mixed fishery).	Orange
50%< discards **OR** Bycatch potentially very high % weight of the catch (e.g. some shrimp trawl fisheries).	Red

b) PET species	Risk
Capture of PET species over the course of a fishing season is very unlikely.	Green
Capture of PET species is likely (≥1 per year). Impact on the population is unlikely to be significant because: Population status of PET species is healthy **OR** Removal < PBR[1] rate.	Light green
Capture of PET species is likely and population status is unknown or declining. However, mitigation (including high post-release survival) in fishery is likely to significantly reduce impact.	Yellow
Capture of PET species is likely. Impact on the population may be significant because: Population status of PET species is declining **OR** Removal > PBR[1] rate **AND** Effect of any mitigation is questionable or not well documented.	Orange
Capture of PET species likely and population status is critical. Removals very likely to be having a significant impact on the population.	Red

Figure 5 Quantity of discards (a), and threat to PET species (b). The risk scored in RASS will be the dimension that is scored the highest. [1]Potential biological removal rate.

2.4 Habitat impacts

The goal for this component is that seafood is sourced from a fishery that has minimal impact on seafloor habitats. Typically, it is going to be mobile bottom gears that have the greatest impact on the seafloor; however, effects can vary considerably between gear types and according to the environmental context in which they are fished. The effects of disturbance can be relatively minor and last a few days in some habitats, though in others, severe and much longer-lasting, especially in biogenic habitats. The latter we define as vulnerable habitats.

To make a completely objective assessment of the impact of a given fishery would ideally require high resolution information on where fishing is taking place in relation to vulnerable seafloor habitats. However, fishing footprints have only been comprehensively mapped for a few sea areas. In the absence of this level of evidence, generalisations will have to be made on the impact of a gear category (Figure 6), with mobile bottom gears having the greatest potential to damage the seafloor.

2.4.1 Scoring habitat impact of nested fisheries

As with management and bycatch, an argument could be made that habitat impact is significantly less compared to the parent fishery which may have been scored a ≥moderate risk. For example, the fishing footprint of the nested fishery may have been comprehensively mapped and found not to overlap with vulnerable marine habitats. Or in the absence of comprehensive spatial data, an argument can be made that the footprint of mobile bottom gears is adequately managed to significantly reduce damage to vulnerable habitats.

Impact criteria	**Risk**
No interaction of the gear with seafloor habitats (e.g. pelagic seining longlines and handlines, pelagic gillnets, pelagic trawling [e.g. mackerel, herring])	
Gear touches the seafloor, though significant interaction with vulnerable habitats is very unlikely **IF mapping data to assess[1]:** Gear touches the seafloor, but there is no significant overlap with the habitat feature of interest. **IF data poor:** Pelagic trawling, demersal longlines, pots and traps, demersal gillnets (though see caveat for moderate risk category where static gear is used over biogenic habitats)	
Potential interaction with vulnerable habitats (marginal overlap of the fishery's footprint with vulnerable habitats) **IF mapping data to assess[1]:** The fishing pressure (FP) impact interval is likely < longevity of the longest lived species, but > half the longevity of the longest lived species. This assumes that the organism will have reached reproductive maturity before successive FP impacts occur.	

IF data poor: In the absence of comprehensive spatial data, an argument can be made that the footprint of mobile bottom gears is adequately managed to significantly reduce damage to vulnerable habitats. **OR** Static bottom gears/ demersal longlines are being used over biogenic reef habitats where possible entanglement can occur.	
Likely interaction with vulnerable habitats (significant overlap of the fishery's footprint with vulnerable habitats) **IF mapping data to assess[1]:** The FP impact interval is likely < half the longevity of the longest lived species, but > than the time for the longest lived individuals to reach reproductive maturity. **IF data poor:** Bottom trawling/ dredging/ seining	
Highly likely interaction with vulnerable habitats over a large proportion of the fishery's footprint **IF mapping data to assess[1]:** The FP impact interval is < half the longevity of the longest lived species, and is < the time for the organism to reach reproductive maturity. **IF data poor:** Bottom trawling off continental shelf/ deep-sea areas	

Figure 6 Habitat scoring criteria. [1] Use these statements when high resolution mapping data is present.

2.5 Outlook

The outlook section will provide a forecast for each risk component of the fishery, and according to the assessor's expert judgement whether the risk is going to 'improve', remain 'stable' or 'deteriorate' for each of the four components. For example:

	Current risk status	Outlook	Reason
Stock	Very high	Improving	The risk will likely decrease. Catches are in-line with the EU-Norway management plan and the stock is slowly increasing. However, warmer sea temperatures will likely affected the long-term productivity of the stock.
Management	Very low	Stable	The CFP is going through reform and thus there is some uncertainty on how this will impact fisheries management in the North Sea. However, management risk is likely to remain stable.
Bycatch	High	Improving	Technical and spatial management measures are being developed that will likely further reduce these risks.
Habitat	High	Improving	