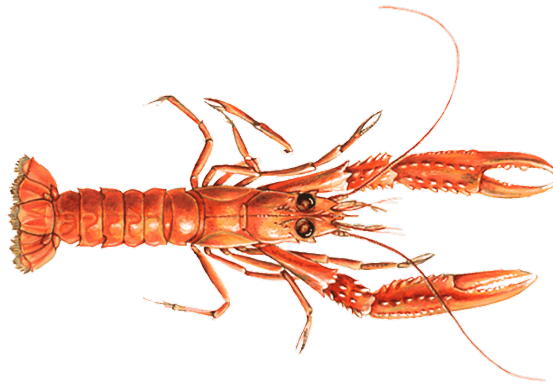


# Monterey Bay Aquarium Seafood Watch®

## **Nephrops (Norway lobster)**



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**Celtic Sea, Kattegat Bay, North Sea, Northeast Atlantic, Bay of Biscay**

## **Bottom trawls, Traps (unspecified)**

*Published October 6, 2014, Updated November 2, 2020*

*Seafood Watch Consulting Researcher*

### **Disclaimer**

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

Seafood Watch Standard used in this assessment: Standard for Fisheries vF2

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## **About Seafood Watch**

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from [www.seafoodwatch.org](http://www.seafoodwatch.org). The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

## **Guiding Principles**

Seafood Watch defines sustainable seafood as originating from sources, whether fished<sup>1</sup> or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch had developed four sustainability **criteria** for evaluating wildcatch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

**Best Choice/Green:** Are well managed and caught in ways that cause little harm to habitats or other wildlife.

**Good Alternative/Yellow:** Buy, but be aware there are concerns with how they're caught.

**Avoid/Red** Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

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<sup>1</sup> "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

## **Summary**

This report is for Norway lobster or *Nephrops* caught with creels (traps) and bottom trawls in the northeast Atlantic Ocean (excluding the Mediterranean Sea). We assess Norway lobster by the regional management units: Kattegat Bay/Skagerrak; North Sea; West Scotland; Celtic Seas; Bay of Biscay, France; Spain and Portugal waters. Trawl fisheries occur in all regions while creel fisheries occur in Kattegat Bay/Skagerrak and West Scotland.

Population assessments are conducted on a variety of discrete populations of Norway Lobster termed "functional units". In several regions, there are multiple Norway lobster functional units. For most populations abundance is unknown, but populations off the Spain and Portugal coasts are considered depleted. Fishing levels on Norway lobster are sustainable in Kattegat Bay/Skagerrak but are too high on some population in the North Sea, Celtic Seas, and West Scotland. In the Bay of Biscay, France, abundance and fishing levels on Norway lobster are uncertain.

The trawl fisheries typically have high bycatch levels and catch some species of concern (e.g. Atlantic cod, European hake, and whiting). The creel or trap fisheries have lower bycatch levels than the trawl fisheries, but they use a significant amount of fish to bait their traps. As a result, all Norway Lobster fisheries have a high impact on other species.

In all regions, management measures, such as annual catch limits, are in place for Norway lobster and other species caught in the fisheries, but management of the fisheries off Spain and Portugal has been insufficient to allow depleted Norway lobster to recover.

The trawl fisheries cause moderate damage to bottom habitats, while the creel fisheries cause a low amount of damage to bottom habitats.

The creel and trawl fisheries in Kattegat Bay/Skagerrak and the trawl fishery in the Bay of Biscay, France are rated "yellow" or "good alternative", while all other Norway lobster fisheries in the Northeast Atlantic are rated "red" or "avoid".

## Final Seafood Recommendations

SPECIES   FISHERY	CRITERION 1: Impacts on the Species	CRITERION 2: Impacts on Other Species	CRITERION 3: Management Effectiveness	CRITERION 4: Habitat and Ecosystem	OVERALL RECOMMENDATION
<b>Norway lobster</b> France/Bay of Biscay   Bottom trawls   France	Yellow (2.644)	Yellow (2.442)	Yellow (3.000)	Yellow (2.598)	<b>Good Alternative (2.663)</b>
<b>Norway lobster</b> Scotland/Northeast Atlantic   Traps (unspecified)   Scotland	Green (3.831)	Red (1.472)	Yellow (2.449)	Yellow (3.000)	<b>Good Alternative (2.537)</b>
<b>Norway lobster</b> /Celtic Sea   Bottom trawls	Yellow (2.644)	Red (1.272)	Red (1.732)	Yellow (2.598)	<b>Avoid (1.972)</b>
<b>Norway lobster</b> /Kattegat Bay   Bottom trawls	Green (3.318)	Red (1.272)	Red (1.732)	Yellow (2.598)	<b>Avoid (2.087)</b>
<b>Norway lobster</b> /Kattegat Bay   Traps (unspecified)	Green (3.318)	Red (1.835)	Red (1.732)	Yellow (3.000)	<b>Avoid (2.371)</b>
<b>Norway lobster</b> /North Sea   Bottom trawls	Red (1.732)	Red (1.272)	Red (1.732)	Yellow (2.598)	<b>Avoid (1.774)</b>
<b>Norway lobster</b> Scotland/Northeast Atlantic   Bottom trawls   Scotland	Green (3.831)	Red (1.343)	Red (1.732)	Yellow (2.598)	<b>Avoid (2.193)</b>
<b>Norway lobster</b> Spain/Northeast Atlantic   Bottom trawls   Spain	Red (2.159)	Red (1.732)	Red (1.732)	Yellow (2.598)	<b>Avoid (2.025)</b>
<b>Norway lobster</b> Portugal/Northeast Atlantic   Bottom trawls   Portugal	Red (2.159)	Red (1.732)	Red (1.732)	Yellow (2.598)	<b>Avoid (2.025)</b>

### Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
  - **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern<sup>2</sup>, and no more than one Red Criterion, and no Critical scores
  - **Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.
- 

<sup>2</sup> Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

# **Introduction**

## **Scope of the analysis and ensuing recommendation**

This report evaluates the sustainability of Norway Lobster (*Nephrops norvegicus*) caught with bottom trawls and creels (a type of trap gear) in the northeast Atlantic Ocean (excluding the Mediterranean Sea).

## **Species Overview**

Norway Lobsters are found in the northeastern Atlantic from Iceland to the Faeroe Islands and northwestern Norway, along the European coast, south to Morocco, and in the western and central areas of the Mediterranean Sea (FAO 1991). Adult Norway Lobster burrow in the sediment, which often provides some protection from fishing. There are several characteristics of this species which make assessing their abundance difficult, including the inability to age Norway Lobster, their burrowing behavior and differences in behavior and biology between the sexes (Bennet and Hough 2006).

Norway Lobster are managed by the European Commission (EC) and individual countries. The International Council for the Exploration of the Sea (ICES) assesses Norway lobster populations and provides scientific advice to these management bodies.

Norway Lobster are assessed by "Functional Unit" (FU), which are based on different population distributions and characteristics, but management occurs at the regional level. There can be several Functional Units within a region. We have evaluated Norway Lobster by the regional management units. These include: Kattegat Bay [includes Kattegat and Skagerrak] (ICES Division IIIa); North Sea (Division IV); West Scotland (Division VIa); Celtic Seas [includes Irish Sea, Celtic Sea, English Channel, and West Ireland] (Division VII); Bay of Biscay, French waters (VIIIa,b); Spain and Portuguese waters (Division VIIIc and IXa). In most locations, trawling is the primary gear type used to target Norway Lobster. Trap or creel fisheries occur in Kattegat Bay (Division IIIa) and West Scotland (Division VIa).





**Common and market names.**

Norway Lobster are also known as *Nephrops*, deep sea lobster and Norwegian lobster.

**Primary product forms**

Norway Lobster are sold live, chilled, frozen and as scampi.

## Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at <http://www.seafoodwatch.org>.

### Criterion 1: Impacts on the species under assessment

*This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown.*

*The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:*

- Score  $>3.2$ =Green or Low Concern
- Score  $>2.2$  and  $\leq 3.2$ =Yellow or Moderate Concern
- Score  $\leq 2.2$ =Red or High Concern

*Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical*

#### Criterion 1 Summary

NORWAY LOBSTER				
Region   Method	Inherent Vulnerability	Abundance	Fishing Mortality	Score
France/Bay of Biscay   Bottom trawls France	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)
Celtic Sea   Bottom trawls	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)
Kattegat Bay   Bottom trawls	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
Kattegat Bay   Traps (unspecified)	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
North Sea   Bottom trawls	2.00: Medium	3.00: Moderate Concern	1.00: High Concern	Red (1.73)
Scotland/Northeast Atlantic   Bottom trawls Scotland	2.00: Medium	4.00: Low Concern	3.67: Low Concern	Green (3.83)
Spain/Northeast Atlantic   Bottom trawls Spain	2.00: Medium	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

<b>Portugal/Northeast Atlantic   Bottom trawls</b> Portugal	2.00: Medium	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
<b>Scotland/Northeast Atlantic   Traps (unspecified)</b> Scotland	2.00: Medium	4.00: Low Concern	3.67: Low Concern	Green (3.83)

Norway lobster are assessed by "Functional Unit" (FU), which are based on different population distributions and characteristics. However, management occurs at the regional level. There can be several functional units within a region. In this report, we evaluate Norway lobster by the regional management units. These include: Kattegat Bay [includes Kattegat and Skagerrak] (ICES Division IIIa); North Sea (Division IV); West Scotland (Division VIa); Celtic Seas [includes Irish Sea, Celtic Sea, English Channel, and West Ireland] (Division VII); Bay of Biscay, French waters (VIIIa,b); Spain and Portuguese waters (Division VIIIc and IXa). Abundance conservation targets/reference points have only been defined for a few Norway lobster functional units. The abundance reference point that is used is Btrigger, which is typically defined as the lowest observed abundance in scientific surveys, unless the population has shown signs of stress at a higher abundance. More formal abundance targets, based on the abundance needed to ensure sufficient repopulation, like the biomass at maximum sustainable yield (BMSY), have not been determined. Because it is uncertain if the Btrigger reference point is set at an appropriate level to ensure the sustainability of Norway lobster populations and for many populations no abundance conservation goals have been defined, we consider the abundance or status of Norway lobster "unknown" and a "moderate concern" for most regions. However, the populations off the Spanish and Portuguese coasts have been declining and are considered depleted, so abundance for these regions is rated "high concern".

Fishing mortality targets have been defined for many Norway lobster functional units, but not all. Fishing mortality targets include various proxies (e.g. F0.1, Fmax, F35%SPR) for the fishing mortality at maximum sustainable yield (FMSY). The appropriate FMSY proxy is selected for each functional unit based on the specific dynamics of the populations (resilience to fishing, factors affecting recruitment, population density, knowledge of biological parameters) and the nature of the fishery (relative exploitation of the sexes and historical harvest rate). Fishing mortality rates are above sustainable levels in some areas, including the Celtic Seas region, North Sea, and West Scotland. Fishing levels are sustainable in Kattegat Bay. In the Bay of Biscay, France and around Spain and Portugal, fishing levels are uncertain.

## Criterion 1 Assessment

### SCORING GUIDELINES

#### Factor 1.1 - Inherent Vulnerability

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing).*

- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make it particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator). Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.*

## **Factor 1.2 - Abundance**

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

## **Factor 1.3 - Fishing Mortality**

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

## **NORWAY LOBSTER**

### **Factor 1.1 - Inherent Vulnerability**

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**CELTIC SEA**

Bottom Trawls

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Medium**

The maximum age of Norway lobster is unknown. Onset of sexual maturity ranges from 21-38 mm carapace (or shell) length for females and 26-33 mm for males or 4-4.5 years and 3-3.5 years, respectively (Marano et al. 1998)(Cetinic 1999) (Tuck et al. 2000)(ICES 2006). Female Norway lobster produce a single batch of eggs each year and carry their eggs under their tails for several months before hatching (Farmer 1975) (Sarda 1995) (Mori et al. 1998). The number of eggs produced by females has been found to range from 140 to over 4000 eggs. There is some evidence of density-dependence in Norway lobster populations (SG 2013). When the population size of Norway lobster becomes too large and overcrowding occurs, growth and survival rates are reduced and maturity occurs at a younger age (Kuris, A. 1991). However, it is unclear if Norway lobster display compensatory or depensatory dynamics at low population sizes. According to these life history characteristics, Norway lobster have a medium level of inherent vulnerability to fishing.

**Justification:**

Table 1: Results from Seafood Watch invertebrate vulnerability rubric (SFW criteria document, pg. 4). Attribute scores can range from 1-3 with higher scores signifying more resilient life history attributes. Species with average attribute scores between 1.85 and 2.45 are deemed to have a 'medium vulnerability'.

**Factor 1.2 - Abundance****FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**Moderate Concern**

In the Bay of Biscay, there are two Norway lobster functional units (FU 23 & 24), but they are assessed together. There are no abundance targets or reference points. A scientific trawl survey to estimate abundance began in 2006. Based on this survey, the average abundance of adult Norway lobster in 2012-2013 was 14% higher than from 2009-2011, although no real trend over the entire time series is evident (Casey et al. 2012) (ICES 2013g)(ICES 2014b). Because the abundance relative to sustainable abundance targets is unknown and Norway lobster has a medium vulnerability to fishing, abundance is rated moderate concern.

## **CELTIC SEA**

Bottom Trawls

### **Moderate Concern**

There are 8 Norway lobster functional units or populations in the Celtic Sea region, which includes the Irish Sea, Celtic Sea, English Channel, and West Ireland (FUs 14-22). Scientists have assessed abundance for seven of these functional units. Abundance is monitored using underwater TV surveys, in which Norway lobster burrows are counted by means of video analysis. Four functional units have abundance above MSYBtrigger, while FU17 and FU19 are below MSYBtrigger and FU16, 18 and 20-21 are unknown (ICES 2019a). MSYBtrigger is defined as the lowest observed abundance in the TV surveys. More formal abundance reference points, like the biomass needed to produce the maximum sustainable yield (BMSY) have not been determined and it is uncertain if the Btrigger reference point is set at an appropriate level to ensure the sustainability of the Norway lobster population. Because Norway lobster abundance relative to sustainable abundance targets/goals is largely unknown and Norway lobster have a medium vulnerability to fishing, abundance is rated moderate concern.

## **KATTEGAT BAY**

Bottom Trawls

## **KATTEGAT BAY**

Traps (Unspecified)

### **Moderate Concern**

There is considered to only be one Norway lobster population in this region, which includes the waters of Kattegat and Skagerrak. There are no defined abundance targets/reference points for Norway lobster. Catches have been stable and the size of lobsters caught in the fishery has also been stable. Landings (retained catches) per unit of fishing effort have been increasing since 1990. It should, however, be noted that increasing landings per unit of fishing effort may not directly correlate to abundance increases, as it can also be influenced by changes in catchability due to changing environmental conditions or increased gear efficiency. To more closely monitor abundance, an underwater TV survey has been conducted in recent years but the time-series is not yet long enough to evaluate abundance trends or determine an abundance target/reference point (Casey et al. 2012)(ICES 2013a)(ICES 2014a). We have awarded a moderate concern score because abundance in relation to abundance targets/reference points is unknown and because Norway lobster has a medium vulnerability to fishing.

## **NORTH SEA**

Bottom Trawls

### **Moderate Concern**

There are nine Norway lobster functional units in the North Sea. For most of the functional units that contribute to a significant proportion of the catches in this region, abundance is monitored using underwater TV surveys and a reference point, MSYBtrigger, has been defined. Btrigger is typically defined as the lowest observed abundance in the TV survey. When a population falls below MSYBtrigger, management action is initiated to protect the population. FUs 6, 7, and 9 were above MSYBtrigger; FUs 5 and 9 were below Btrigger; and FUs 8, 10, 32-34 had an unknown status with no abundance reference points identified (ICES 2019b). Since abundance varies by functional unit, abundance in relation to formal abundance reference points/targets (e.g., BMSY) is unknown, and Norway lobster has a medium vulnerability to fishing, we have rated this factor moderate concern.

**SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Low Concern**

There are three Norway Lobster functional units or populations in this region: North Minch (FU 11), South Minch (FU 12), and Firth of Clyde + Sound of Jura (FU 13). However, Firth of Clyde and Sound of Jura are separately assessed. Abundance is monitored using underwater TV surveys. All three functional units had abundances well above MSYBtrigger (equal to Blim and Bpa) in 2019 (ICES 2019c)(ICES 2019d)(ICES 2019e). MSYBtrigger is defined as the lowest observed abundance in the TV surveys and is the level used by ICES to determine when management action is needed to reduce fishing pressure with the aim of exploiting the stock at MSY. Although more conservative reference points (e.g., BMSY) were not available, the abundance was high enough to be considered low concern.

**SPAIN/NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**PORTUGAL/NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**High Concern**

There are no abundance targets/reference points for the Norway lobster functional units/populations off Portugal and Spain. There are two populations or functional units in northern Spain (Division VIIIc): North Galicia and the Cantabrian Sea. Although no abundance conservation goals have been developed, the available information indicates that these populations are at very low abundance levels (Casey et al. 2012) (ICES 2013e). In Division IXa (which includes the waters off Portugal and southern Spain), there are five Norway lobster functional units. The Norway lobster populations/functional units in north Portugal are considered to be at a very low abundance, while the populations/functional units in southern Portugal and Spain appear healthier and stable (ICES 2014g). A recovery strategy for Norway lobster and hake has been in place since 2006 for these regions. This plan is driven by the status of hake and does not set targets for Norway lobster (ICES 2014d). Because several of the Norway lobster populations off the Spain and Portuguese coasts are depleted, we have awarded a high concern score.

**Factor 1.3 - Fishing Mortality****FRANCE/BAY OF BISCAY**

Bottom Trawls | France

**Moderate Concern**

There are currently no defined fishing mortality targets/reference points for Norway lobster in the Bay of Biscay, France. Fishing effort and fishing mortality rates have been declining in recent years as a result of several decommissioning schemes. A quantitative assessment was attempted to evaluate the status of this population, but was not considered reliable. Further data is required. Since fishing levels in relation to sustainable levels are not known, we have awarded a moderate concern score (Casey et al. 2012)(ICES 2013g)(ICES 2014b).

**CELTIC SEA**

Bottom Trawls



## **Moderate Concern**

Fishing mortality for Norway lobster varies among the functional units (FU) in the Celtic Seas region, ranging from sustainable to unsustainable to unknown. Six of eight FUs were below FMSY in 2019, although some of these have been fluctuating around the reference point for several years (ICES 2019a). FU22 was above FMSY, and FU18 is unknown. Currently, managers set a single annual total allowable catch limit (TAC) for the region, but scientists have advised, that catch limits should be set at the functional unit level to adequately control fishing levels on each population. Because fishing levels in some FUs are unsustainable or unknown, but most areas were sustainable, fishing mortality is considered a moderate concern.

## **KATTEGAT BAY**

Bottom Trawls

## **KATTEGAT BAY**

Traps (Unspecified)

## **Low Concern**

In Kattegat Bay and Skagerrak, trawl fisheries account for around 92% of the catch and trap or creel fisheries 8% of the catch. Fishing mortality on Norway lobster was estimated to be well below the fishing mortality at maximum sustainable yield (FMSY) proxy in 2011, right around but slightly above FMSY in 2012, and below FMSY in 2013. The FMSY proxy is a harvest rate of 7.9%. The average harvest rate for 2011-2013 was 6.1%, well below FMSY. Prior to 2011, fishing mortality targets were undefined. The newly defined FMSY proxy is preliminary and may be modified when further data becomes available (ICES 2014a). High numbers of undersized Norway lobster are discarded (thrown back to sea) in this fishery. Discard estimates and survival of discards are included in the fishing mortality assessments. Decreasing fishing effort in this area (largely due to increasing restrictions put on the fishery to limit the catch of cod) and increasing catch rates also suggest the population is fished sustainably (ICES 2014a). Since it is likely that fishing levels on Norway lobster are sustainable, but there is some uncertainty with regard to the newly defined fishing target, we have awarded a low concern score.

## **NORTH SEA**

Bottom Trawls

## **High Concern**

According to the latest stock assessments for Norway lobster in the North Sea, fishing mortality in 2018 was above FMSY in FU6, below FMSY in FUS 7-9 (although fluctuating around FMSY in FUs 8 and 9), and unknown for FUs 32-34 (ICES 2019b). Fishing mortality rates are close to FMSY in areas with high catches; in the only FU still above FMSY (FU6), fishing mortality has been declining and was near FMSY in 2018. Currently, managers set a single annual total allowable catch limit (TAC) for the region, but scientists have recommended that TACs be set at the functional unit level to adequately control fishing on individual populations. Based on this information, we have awarded a moderate concern score.

## **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

## **SCOTLAND/NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

## **Low Concern**

According to the latest population assessment for Norway Lobster in the West Scotland region, fishing

mortality for all three functional units (FUs) was below FMSY in 2018 (ICES 2019c)(ICES 2019d)(ICES 2019e). This indicates overfishing is not occurring on the stocks. About 20% of the catches are taken with creels or traps in North and South Minch and 80% with trawls (ICES 2013h2). Currently, managers set a single annual total allowable catch limit (TAC) for the West Scotland region, but scientists have advised that TACs should be set at the FU level to ensure fishing is adequately controlled on individual populations. Because current fishing levels are at sustainable levels, we have awarded a low concern score.

#### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

#### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **Moderate Concern**

There are no fishing mortality targets/reference points for the populations off Portugal or Spain, but catch and fishing levels have been declining and are considered low. A recovery strategy has been in place since 2006 with the aim of reducing fishing mortality. However, so far there have been no signs of recovery in the functional units that are depleted, which may suggest fishing levels have not been reduced enough (Casey et al. 2012)(ICES 2013e)(ICES 2014g)(ICES 2014d). Currently, a single annual total allowable catch limit is set for Division VIIIc (northern Spain) and a single TAC is set for Division IXa (Portugal and southern Spain), but scientists have advised that TACs should be set at the functional unit level to ensure fishing levels on individual populations are adequately controlled. We have awarded a moderate concern score.

## Criterion 2: Impacts on other species

All main retained and bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing.

To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch. The Criterion 2 rating is determined as follows:

- Score >3.2=Green or Low Concern
- Score >2.2 and ≤3.2=Yellow or Moderate Concern
- Score ≤2.2=Red or High Concern

Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical

### Criterion 2 Summary

Only the lowest scoring main species is/are listed in the table and text in this Criterion 2 section; a full list and assessment of the main species can be found in Appendix A.

NORWAY LOBSTER					
Celtic Sea   Bottom Trawls					
Subscore:	1.414	Discard Rate:	0.90	C2 Rate:	1.272
Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore	
Atlantic cod	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.414)	
European whiting	2.00:Medium	2.00:High Concern	1.00:High Concern	Red (1.414)	
Haddock	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	Red (1.732)	
European plaice	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.159)	
Megrim	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)	
European hake	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.053)	

NORWAY LOBSTER					
France/Bay Of Biscay   Bottom Trawls   France					
Subscore:	3.053	Discard Rate:	0.80	C2 Rate:	2.442

Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
European hake	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.053)

## NORWAY LOBSTER

Kattegat Bay | Bottom Trawls

Subscore:	1.414	Discard Rate:	0.90	C2 Rate:	1.272
Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore	
Atlantic cod	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.414)	
European dover sole	3.00:Low	2.00:High Concern	2.33:Moderate Concern	Red (2.159)	
Witch flounder	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.159)	
Common dab	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)	
European plaice	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)	
European whiting	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)	
European hake	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.053)	
Haddock	2.00:Medium	3.00:Moderate Concern	5.00:Very Low Concern	Green (3.873)	

## NORWAY LOBSTER

Kattegat Bay | Traps (Unspecified)

Subscore:	2.159	Discard Rate:	0.85	C2 Rate:	1.835
Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore	
Finfish	2.00:Medium	2.00:High Concern	2.33:Moderate Concern	Red (2.159)	
Benthic inverts	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	Green (3.318)	

NORWAY LOBSTER					
North Sea   Bottom Trawls					
<b>Subscore:</b>	<b>1.414</b>	<b>Discard Rate:</b>	<b>0.90</b>	<b>C2 Rate:</b>	<b>1.272</b>
Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore	
Atlantic cod	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.414)	
Monkfish (unspecified)	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.159)	
Witch flounder	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.159)	
European whiting	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)	
European hake	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.053)	
Haddock	2.00:Medium	3.00:Moderate Concern	5.00:Very Low Concern	Green (3.873)	

NORWAY LOBSTER					
Portugal/Northeast Atlantic   Bottom Trawls   Portugal					
<b>Subscore:</b>	<b>1.732</b>	<b>Discard Rate:</b>	<b>1.00</b>	<b>C2 Rate:</b>	<b>1.732</b>
Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore	
Megrim	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	Red (1.732)	
European hake	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)	
Monkfish (unspecified)	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.318)	

NORWAY LOBSTER					
Scotland/Northeast Atlantic   Bottom Trawls   Scotland					
<b>Subscore:</b>	<b>1.414</b>	<b>Discard Rate:</b>	<b>0.95</b>	<b>C2 Rate:</b>	<b>1.343</b>
Species   Stock	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore	
Atlantic cod	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.414)	
European whiting	2.00:Medium	2.00:High Concern	3.67:Low Concern	Yellow (2.709)	

Haddock	2.00:Medium	3.00:Moderate Concern	5.00:Very Low Concern	Green (3.873)
Megrim	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.000)

NORWAY LOBSTER								
Scotland/Northeast Atlantic   Traps (Unspecified)   Scotland								
Subscore:		1.732	Discard Rate:		0.85	C2 Rate:	1.472	
Species   Stock		Inherent Vulnerability		Abundance		Fishing Mortality		Subscore
Benthic inverts		2.00:Medium		3.00:Moderate Concern		1.00:High Concern		Red (1.732)

NORWAY LOBSTER								
Spain/Northeast Atlantic   Bottom Trawls   Spain								
Subscore:		1.732	Discard Rate:		1.00	C2 Rate:		1.732
Species   Stock		Inherent Vulnerability		Abundance		Fishing Mortality		Subscore
Megrim		2.00:Medium		3.00:Moderate Concern		1.00:High Concern		Red (1.732)
European hake		2.00:Medium		3.00:Moderate Concern		2.33:Moderate Concern		Yellow (2.644)
Monkfish (unspecified)		1.00:High		3.00:Moderate Concern		3.67:Low Concern		Green (3.318)

We used information from the latest ICES Advice (2013) and Jansson (2008) to identify other 'main species' to include in this report. Other species caught in the trawl fisheries for Norway lobster can include cod, hake, plaice, sole, haddock, whiting, megrim, dab, witch flounder and monkfish, but the species composition varies by location. The amount of discards (fish thrown back to sea) in the trawl fisheries also varies by region, ranging from <20% to >100% of the retained catch. Atlantic cod is the lowest scoring bycatch species in the Celtic Sea, Kattegat Bay, the North Sea, and West Scotland regions due to their low population size and continued high fishing levels on this species. European hake is the lowest scoring species in the Spain and Portuguese fisheries due to high fishing levels on this species. In the Bay of Biscay fishery, European hake was the only prominent bycatch species, and concern was moderate due to reduced fishing pressure and population increases.

Creel or trap fisheries, which occur in the western Scotland region and Kattegat and Skagerrak, have lower bycatch compared to Norway lobster trawl fisheries and most of the bycatch is able to be released alive (Jansson 2008). For creel fisheries, we included a 'benthic invertebrates' category to represent other 'main species' in those fisheries. Benthic invertebrates reported to be landed in the Scottish trap fishery include: edible (brown) crab (*Cancer pagurus*), velvet crab (*Necora puber*), European lobster (*Homarus gammarus*) and whelk (*Buccinum undatum*) (Nimmo et al. 2019). A 'finfish' category was also included for the Kattegat Bay trap fishery, which includes species like Atlantic cod and dab. The finfish group was the lowest scoring group for the

Kattegat Bay trap fisheries because the abundance of Atlantic cod is very low and any fishing mortality is a concern. The benthic invertebrates group was the lowest scoring group in the Scotland trap fishery due to concerns about the over-exploitation of at least three species (Mesquita et al. 2017). Although dead discards in trap fisheries are likely relatively low, a significant amount of other fish is used to bait the lobster traps.

## Criterion 2 Assessment

### SCORING GUIDELINES

#### **Factor 2.1 - Inherent Vulnerability**

*(same as Factor 1.1 above)*

#### **Factor 2.2 - Abundance**

*(same as Factor 1.2 above)*

#### **Factor 2.3 - Fishing Mortality**

*(same as Factor 1.3 above)*

### ATLANTIC COD

#### **Factor 2.1 - Inherent Vulnerability**

##### **CELTIC SEA**

Bottom Trawls

##### **KATTEGAT BAY**

Bottom Trawls

##### **NORTH SEA**

Bottom Trawls

##### **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

#### **High**

According to FishBase, Atlantic cod have a high inherent vulnerability to fishing (score of 71/100) (Froese and Pauly 2013). Atlantic cod reach sexual maturity between 31 and 60 cm and between 2-9 years of age, with coastal populations reaching sexual maturity at an earlier age (FAO 2004). Atlantic cod are broadcast spawners (FAO 2004). A maximum length of 100 cm and age of 25 years have been reported (Froese and Pauly 2013). Within the food chain, they are considered top predators (Froese and Pauly 2013).

#### **Factor 2.2 - Abundance**

##### **CELTIC SEA**

Bottom Trawls

##### **KATTEGAT BAY**

Bottom Trawls

##### **NORTH SEA**

Bottom Trawls

##### **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

#### **High Concern**

Abundance of Atlantic cod is very low in several areas and populations are considered depleted throughout most of their range in the Northeast Atlantic. In Kattegat, the abundance of Atlantic cod was at a historically low level in 2020, although a reference point has not been developed to assess stock status (ICES 2020a). In the North Sea and Skagerrak, Atlantic Cod abundance has been declining in recent years and was well below Bpa, Blim and MSYBtrigger in 2020 (ICES 2020b). The abundance of Atlantic cod West of Scotland remains well below Bpa, Blim and MSYBtrigger, and thus remains depleted (ICES 2020c). The abundance of Atlantic cod in the southern Celtic Sea and Western English Channel has been declining in recent years and was well below Bpa, Blim and MSYBtrigger in 2020 (ICES 2019f). We have awarded a high concern score for all areas due to the depleted state of Atlantic cod populations.

## Factor 2.3 - Fishing Mortality

### CELTIC SEA

Bottom Trawls

### KATTEGAT BAY

Bottom Trawls

### NORTH SEA

Bottom Trawls

### SCOTLAND/NORTHEAST ATLANTIC

Bottom Trawls | Scotland

#### High Concern

Atlantic Cod are caught in a range of bottom fisheries in the Northeast Atlantic, including the Norway lobster trawl fisheries (Casey et al. 2012)(ICES 2013d). In Kattegat there is insufficient information to determine the current fishing mortality on Atlantic cod, but relative mortality has been increasing in recent years and the population is low and not showing signs of recovery (ICES 2020a). In the North Sea, Skagerrak, West Scotland, and the Celtic Sea, fishing mortality on Atlantic cod was above FMSY, Fpa and Flim in 2019, therefore overfishing was occurring (ICES 2020b)(ICES 2020c)(ICES 2019f). The contribution of Norway lobster fisheries to cod mortality varies among regions. In West Scotland and the North Sea/Skagerrak, the Norway lobster fisheries account for around 5-10% of the total cod catch (ICES 2013n)(ICES 2013h). Whereas, in the Irish Sea, Norway lobster fisheries account for 48% of the cod catch (ICES 2014i), and in other areas of the Celtic Sea region, 68% of the catch is taken in fisheries for mixed demersal fish and Norway lobster (ICES 2014h). However, because cod are depleted, and in some cases fishing mortality is well above sustainable levels, the Norway lobster fisheries in all regions are considered substantial contributors to cod mortality. A cod recovery plan has been in place since 2004 for the North Sea, Kattegat, Skagerrak, eastern Channel, Irish Sea, and West Scotland. The plan was updated in 2008 and again in 2012 (EC 2014). However, this plan has not proved sufficient to control fishing mortality. Because fishing levels on cod are too high, but management is in place, we have awarded a high concern score.

## Factor 2.4 - Discard Rate

### CELTIC SEA

Bottom Trawls

#### 40-60%

Within the Celtic Seas region, discard rates (amount of fish thrown back to sea) vary by area. During 2011 and 2012, discards of Norway lobster in the fisheries in this region have ranged from negligible amounts to 28% of the catch (16,150 t landed/retained in 2011 and 18,400 t in 2012) for the various populations where discards have been quantified (ICES 2012b)(ICES 2013o)(ICES 2013b2)(ICES 2013c2)(ICES 2013d2)(ICES 2013e2)(ICES 2013f2)(ICES 2013g2). In the west Irish Sea, the area that accounts for the largest Norway



lobster catches in this region, the discard to retained catch ratio for Norway lobster was 18% in 2012 (ICES 2013g2). Discard rates for other species vary. In the Irish Sea, where bycatch of plaice is high, 70% of all plaice caught or 1152 t were discarded in 2012 (ICES 2013q). Discards of whiting are also known to be high, though they cannot be quantified (ICES 2013r)(ICES 2013u). In the Irish Sea, 68% of all haddock caught were discarded in 2012 (722 t), while in other areas of the Celtic Sea region 36% of all haddock caught were discarded (10,332 t) (ICES 2013s)(ICES 2013t). However, it is unknown how much of these species are discarded specifically in the Norway lobster fisheries. Discards of cod, hake, and megrim appear to be lower (ICES 2014h)(ICES 2014j). Given the range of discard to total catch estimates for species in this region, we have rated the discard/retained catch factor as 40-60%.

## **KATTEGAT BAY**

### Bottom Trawls

#### **40-60%**

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j) (ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## **NORTH SEA**

### Bottom Trawls

#### **40-60%**

In the North Sea, around 25% of Norway lobster caught were discarded between 2007 and 2011 (Seafish 2012)(ICES 2013d). In mixed species fisheries throughout this region (including Skagerrak and the Eastern Channel), the total discards (81,000 t) to retained catch (265,000 t) ratio for all main species caught (cod, haddock, plaice, saithe, sole, whiting, and Norway lobster) was 31% in 2012 (ICES 2013z). High discards of haddock and whiting can be an issue in Norway lobster fisheries in some areas. Discards of hake and anglerfish, which may also be caught along with Norway lobster in this region, are relatively low. To account for the likely discards of species in addition to those mentioned above, we have scored this factor as 40-60%.

## **SCOTLAND/NORTHEAST ATLANTIC**

### Bottom Trawls | Scotland

#### **20-40%**

Over the last 5 years, the average discards of Norway lobster in the region have been <20% of the retained catches or landings. In 2012, 14,300 t of Norway Lobster were landed or retained in this region, while around 1,400 t were discarded (~10% of landings) (ICES 2013h2). However, discards of whiting and haddock can be high in Norway lobster fisheries in West Scotland (ICES 2013b)(Heywood 2009). For example, between 1987 and 2012 discard rates (discards/catch) of whiting ranged from 40-80% and discards rates for haddock can also be as high as 80% (Fernandes et al. 2010). In 2012, total whiting catches in all fisheries in West Scotland

were 1,041 t, with 728 t (70%) discarded and 312 t (30%) retained (ICES 2013w). In 2012, 919 t of haddock were caught in the Norway lobster fishery in this region, and of this 40% or 376 t were discarded, while 543 t were retained (ICES 2013b). Other species caught in the Norway lobster fisheries in this area include Atlantic cod and megrim. Discards of Atlantic cod for all fisheries in West Scotland were 1,159 t or 70% of the total cod catches (1632 t) in 2012, but the Norway lobster fishery accounts for only a small proportion (5-10%) of cod catches in this region and cod discards in the Norway lobster fishery are reported to be low (ICES 2013h) (Fernandes et al. 2010)(ICES 2013h2). 15% of all megrim were discarded in fisheries in West Scotland and the North Sea in 2012, but the proportion of megrim caught in the Norway lobster fishery is not known (ICES 2013c). In recent years many fisheries in West Scotland have begun to utilize bycatch mitigation measures to reduce interactions with bycatch species and subsequently discards (Heywood 2009). In addition, there is the Scottish Conservation Credits Scheme, which has been put into place to reduce Atlantic cod catches (ICES 2012c). This has likely contributed to reduced discards in recent years. In 2012, catch information for the main species caught in the fishery indicate a discard to retained catch ratio of around ~17% for these species. However, to account for likely additional discards of other species and varying discard rates among years, we have increased the score to 20-40%.

## **BENTHIC INVERTS**

### **Factor 2.1 - Inherent Vulnerability**

#### **KATTEGAT BAY**

Traps (Unspecified)

#### **SCOTLAND/NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

#### **Medium**

Common invertebrate bycatch in creel fisheries includes edible crabs, spider crabs, swimming crabs, whelk and hermit crabs. The life history characteristics of these species typically indicate a medium level of vulnerability to fishing. For example, edible crabs reach sexual maturity around 10 years of age and can live up to 20 years (Hayward et al. 1996)(MarLin 1998). Females carry the eggs and then disperse them into the water column as larvae (Bennet 1995). Whelk reach sexual maturity between 4-9 years. Females have internal fertilization but carry the eggs on their shells before distributing them into the water column (Power and Keegan 2001). Hermit crab growth, fecundity and life span can be affected by the availability of shells. Sexual maturity of hermit crabs can be reached within the first year and females carry their eggs (Lancaster 1990). Hermit crabs can live up to 10 years (Hayward and Ryland 1995).

### **Factor 2.2 - Abundance**

#### **KATTEGAT BAY**

Traps (Unspecified)

#### **Moderate Concern**

Edible crab populations in Kattegat are estimated to be around 4-8 million crabs, but their status relative to abundance targets/reference points is unknown (Ungfors 2008). Population assessments do not appear to have been conducted for whelk or hermit crabs in this region. Spider and swimming crabs have not been identified to the species level, so their status is unknown. According to the Seafood Watch criteria, a moderate concern score is awarded for "unknown" invertebrate species caught with this type of gear. There is no information available to contradict this scoring.

**SCOTLAND/NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Moderate Concern**

Marine Scotland Science conducts assessments for edible crabs along the Scottish coast. However, abundance targets/conservation goals have not been determined. An exploratory trend analysis has been conducted and indicated the size of large crabs had decreased since the early 1990's (Mesquita et al. 2011). Whelk have not yet been assessed in Scotland (SG 2013b). Hermit crabs have not been assessed either. Spider and swimming crabs have not been identified to the species level, so their status is unknown. According to the Seafood Watch Criteria, a moderate concern score is awarded for "unknown" invertebrate species. There is no information available to contradict this scoring.

**Factor 2.3 - Fishing Mortality****KATTEGAT BAY**

Traps (Unspecified)

**Low Concern****SCOTLAND/NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**High Concern**

The latest assessments of edible crab (i.e. brown crab), velvet crab, and European lobster in Scotland indicated each of these stocks are fished above the FMSY proxy, FMAX (fishing mortality rate that maximizes the yield per recruit), in West Scotland (Mesquita et al. 2017). Each of these species, along with whelk, comprise >5% of landings for this fishery and edible crab landings were greater than Norway lobster (Nimmo et al. 2019). Harvest of several other benthic invertebrate species caught in the creel/trap fisheries do not exceed 5% of landings per species. Based on the most recent fishing mortality data, we have awarded a high concern score.

**Factor 2.4 - Discard Rate****KATTEGAT BAY**

Traps (Unspecified)

**SCOTLAND/NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**60-80%**

Although information is lacking, creel (trap) fisheries in Scotland and Kattegat Bay are generally reported to have low levels of both bycatch and discards (Macher et al. 2010)(EC 2011)(ICES 2012c). The survival rate currently used by ICES for discarded Norway lobster from traps is 25%, although some estimates suggest it may be greater than 50% (Wileman et al. 1999)(Bennet and Hough 2009)(ICES 2019c). Discards of nephrops were previously very high in the Kattegat Bay fishery (>50%) (Ziegler 2006)(Jansson 2008). However, discards of nephrops have been greatly reduced to roughly 10% in recent years due to a reduction to the legal landing length for nephrops in 2016 for the Kattegat Bay fishery (ICES 2019g). Discard rates for nephrops in the Scotland trap fishery were not available but overall discard rates were not as high for West Scotland nephrops fisheries and have declined slightly in recent years (ICES 2019c)(ICES 2019d)(ICES 2019e). Bait use (herring)

is high in these fisheries (roughly 20% of nephrops harvest) and species aside from nephrops are also discarded, although the amounts were not available. Some studies have suggested up to 3 individual fish are used per trap as bait (Panfil et al. 2007)(Adey et al. 2008). Other studies have indicated that the amount of bait used is higher than the amount of Norway lobster caught (Ziegler 2006). Research conducted in other lobster fisheries also indicate that large amounts of bait are used in lobster traps (Harrish and Willison 2009) (Ryan et al. 2010). We have awarded a score of 0.85 to account for the large amounts of bait needed in lobster trap fisheries as well as reduced discards.

## EUROPEAN HAKE

### **Factor 2.1 - Inherent Vulnerability**

#### **FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

#### **CELTIC SEA**

Bottom Trawls

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

#### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

#### **Medium**

Fishbase assigned a high inherent vulnerability to fishing score of 65 out of 100 to European hake (Froese and Pauly 2013). European hake reach sexual maturity between 20-70 cm in size and 2-4 years in age. They are broadcast spawners. The maximum length is around 140 cm and they live a reported 20 years. However, recent studies indicate that ageing hake is difficult and often inaccurate. As well, recent work indicates that European hake grow faster than previously thought (de Pontual et al. 2006). Within the food chain, they are top predators (Froese and Pauly 2013). The life history characteristics of European hake suggest a medium vulnerability to fishing score is likely more appropriate. Thus we have rated this factor medium based on the life history method for evaluating vulnerability (see below).

#### **Justification:**

Table 1: Results from Seafood Watch fish vulnerability rubric (SFW criteria document, pg. 4). Attribute scores can range from 1-3 with higher scores signifying more resilient life history attributes. Species with average attribute scores between 1.80 and 2.43 are deemed to have a 'medium vulnerability'.

### **Factor 2.2 - Abundance**

#### **FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

#### **CELTIC SEA**

Bottom Trawls

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

### Low Concern

The northern hake population includes Kattegat Bay/Skagerrak, the North Sea, the Celtic Seas region, and the Bay of Biscay, France. Although there is a lack of more informative reference points such as BMSY, the abundance of adult hake for the northern population has been generally increasing since 1998 and was well above MSYBtrigger in 2020 (ICES 2020d). Because the current status of hake is healthy, we have awarded a low concern score.

#### **PORTUGAL/NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SPAIN/NORTHEAST ATLANTIC**

Bottom Trawls | Spain

### Moderate Concern

The southern population of hake includes the waters off the Spanish and Portuguese coasts. Abundance was increasing in the early 2000s but has been declining since 2015 (ICES 2020e). Abundance in relation to abundance targets/reference points is unknown. A recovery plan for hake was established in 2005 for the southern population (ICES 2014j)(ICES 2014k). Because the current status of hake is unclear and they have a moderate vulnerability to fishing, we have awarded a moderate concern score.

## Factor 2.3 - Fishing Mortality

#### **FRANCE/BAY OF BISCAY**

Bottom Trawls | France

#### **CELTIC SEA**

Bottom Trawls

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

### Moderate Concern

European hake are caught along with Norway Lobster, anglerfish, and megrim in mixed species fisheries in trawl fisheries in these areas. Fishing mortality on northern hake was below FMSY in 2019 but was above FMSY in 2017 and 2018 (ICES 2020d). Because fishing mortality is fluctuating around the reference point in recent years, we awarded a score of moderate concern.

#### **PORTUGAL/NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SPAIN/NORTHEAST ATLANTIC**

Bottom Trawls | Spain

### Moderate Concern

Fishing mortality for the southern hake population was unknown in the most recent stock assessment (ICES 2020e). Relative fishing pressure has been fairly stable in recent years. Based on this information, we awarded a score of moderate concern.

## Factor 2.4 - Discard Rate

## FRANCE/ BAY OF BISCAY

Bottom Trawls | France

### 80-100%

In the Bay of Biscay, discards of Norway lobster relative to retained catches may range from 35% to 65% (Casey et al. 2012)(Cornou et al. 2013)(Dube et al. 2012). In 2012, dead discards were 1,520 t, while retained catches/landings were 2,380 t (Cornou et al. 2013). Hake is the main bycatch species in this fishery and limited at-sea observer coverage of this fishery indicates that around 40-50% of all hake caught may be discarded back to sea (ICES 2013g)(Cornou et al. 2013)(Dube et al. 2012). Numerous other species are also caught, but only in low amounts. The at-sea-observer data indicates that total discards are about 90-95% of the retained catches (Cornou et al. 2013)(Dube et al. 2012). Seasonally, there may be high discards of blue whiting and horse mackerel. Discard mortality rates are reported to be high (70%) (Macher et al. 2010). We have therefore rated the discard to retained catch ratio as 80-100%.

## CELTIC SEA

Bottom Trawls

### 40-60%

Within the Celtic Seas region, discard rates (amount of fish thrown back to sea) vary by area. During 2011 and 2012, discards of Norway lobster in the fisheries in this region have ranged from negligible amounts to 28% of the catch (16,150 t landed/retained in 2011 and 18,400 t in 2012) for the various populations where discards have been quantified (ICES 2012b)(ICES 2013o)(ICES 2013b2)(ICES 2013c2)(ICES 2013d2)(ICES 2013e2)(ICES 2013f2)(ICES 2013g2). In the west Irish Sea, the area that accounts for the largest Norway lobster catches in this region, the discard to retained catch ratio for Norway lobster was 18% in 2012 (ICES 2013g2). Discard rates for other species vary. In the Irish Sea, where bycatch of plaice is high, 70% of all plaice caught or 1152 t were discarded in 2012 (ICES 2013q). Discards of whiting are also known to be high, though they cannot be quantified (ICES 2013r)(ICES 2013u). In the Irish Sea, 68% of all haddock caught were discarded in 2012 (722 t), while in other areas of the Celtic Sea region 36% of all haddock caught were discarded (10,332 t) (ICES 2013s)(ICES 2013t). However, it is unknown how much of these species are discarded specifically in the Norway lobster fisheries. Discards of cod, hake, and megrim appear to be lower (ICES 2014h)(ICES 2014j). Given the range of discard to total catch estimates for species in this region, we have rated the discard/retained catch factor as 40-60%.

## KATTEGAT BAY

Bottom Trawls

### 40-60%

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j)(ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## **NORTH SEA**

Bottom Trawls

### **40-60%**

In the North Sea, around 25% of Norway lobster caught were discarded between 2007 and 2011 (Seafish 2012)(ICES 2013d). In mixed species fisheries throughout this region (including Skagerrak and the Eastern Channel), the total discards (81,000 t) to retained catch (265,000 t) ratio for all main species caught (cod, haddock, plaice, saithe, sole, whiting, and Norway lobster) was 31% in 2012 (ICES 2013z). High discards of haddock and whiting can be an issue in Norway lobster fisheries in some areas. Discards of hake and anglerfish, which may also be caught along with Norway lobster in this region, are relatively low. To account for the likely discards of species in addition to those mentioned above, we have scored this factor as 40-60%.

## **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

## **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

### **< 20%**

In 2012, 353 t of Norway lobster were landed/retained in the Spain/Portugal region. Discards of Norway lobster in this region are very low, as low as 0-1% (ICES 2014g)(ICES 2013e). Discards of other species caught in Norway lobster fisheries in this region are a little higher. The discard rate (discards/retained catch) for hake was 13% (2,100 t discarded) for all fisheries in the southern region of its range (ICES 2014k). Discard rates for anglerfish are unknown in this region, although discarding is known to happen (ICES 2014t) (ICES 2014s). The discard rate for megrim in their southern range (where the majority of catch is taken in mixed fisheries for Norway lobster and other species) was 11% (31 t discarded) in 2012 (ICES 2014q). Because discards of species caught in the Norway lobster fisheries in this region appear to be low, we have awarded a score of <20%.

## EUROPEAN WHITING

### **Factor 2.1 - Inherent Vulnerability**

## **CELTIC SEA**

Bottom Trawls

## **KATTEGAT BAY**

Bottom Trawls

## **NORTH SEA**

Bottom Trawls

## **SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

### **Medium**

Fishbase assigned a medium inherent vulnerability score of 37 out of 100 for European whiting (Froese and Pauly 2013). This species reaches sexual maturity at around 30 cm in length and 1-4 years of age. They are broadcast spawners. The maximum length and age are 70 cm and 20 years respectively. Within the food web, they are top predators (Froese and Pauly 2013).

### **Factor 2.2 - Abundance**

**CELTIC SEA**

Bottom Trawls

**SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**High Concern**

Assessments of European whiting have been conducted in some areas within the northeast Atlantic, although some areas lack enough information to determine the population status. In the area West of Scotland, the population is below the limit abundance reference point, and thus this population is considered overfished or depleted. While abundance has increased in recent years from an all-time low in 2005, it is still very low compared to historical estimates (ICES 2013w). In the Celtic Sea, the population has been above established abundance reference points (limit and precautionary) since 2009, and abundance has continued to increase through 2013 (ICES 2013u). However, in the Irish Sea (also part of the Celtic Sea region), the status is uncertain but it appears that abundance is very low and the population is likely overfished/depleted (ICES 2013v). We have therefore awarded a high concern score for both the West Scotland and Celtic Sea regions.

**KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**Moderate Concern**

The abundance of European whiting in Kattegat Bay/Skagerrak and in the North Sea is unknown with regard to sustainable abundance targets/reference points (Casey et al. 2012)(ICES 2013x)(ICES 2013t). Because European whiting has a medium vulnerability to fishing, we have awarded a moderate concern score.

**Factor 2.3 - Fishing Mortality****CELTIC SEA**

Bottom Trawls

**High Concern**

High bycatch and discards of European whiting are an issue in several Norway Lobster fisheries(Casey et al. 2012). In the Celtic Sea, fishing mortality rates have recently fallen to below sustainable levels. In both 2011 and 2012 fishing mortality was below the fishing mortality at maximum sustainable yield (FMSY) proxy (ICES 2013u). In the Irish Sea, FMSY has not been defined, but fishing mortality is considered to likely be above sustainable levels and abundance is very low (ICES 2013v). We have therefore awarded a high concern score.

**KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**Moderate Concern**

High bycatch and discards of European whiting occur in Norway lobster fisheries in several areas, including the North Sea and Kattegat Bay/ Skagerrak (ICES 2013d). Fishing mortality rates with regard to target/sustainable reference points in the North Sea are undefined, but fishing mortality has been stable since 2003 (ICES 2013t). In Kattegat Bay/Skagerrak there is insufficient information to determine fishing mortality rates (Casey



et al. 2012) (ICES 2013x). Because fishing mortality relative to sustainable levels is unknown, we have awarded a moderate concern score.

## **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

### **Low Concern**

Bycatch of European whiting in Norway Lobster fisheries is high in some areas of the West Scotland region (Casey et al. 2012). However, overall fishing mortality on European whiting in the West Scotland region is considered to be very low and sustainable, although the fishing mortality at maximum sustainable yield has not been estimated (ICES 2013w). We have therefore awarded a low concern score.

## **Factor 2.4 - Discard Rate**

### **CELTIC SEA**

Bottom Trawls

#### **40-60%**

Within the Celtic Seas region, discard rates (amount of fish thrown back to sea) vary by area. During 2011 and 2012, discards of Norway lobster in the fisheries in this region have ranged from negligible amounts to 28% of the catch (16,150 t landed/retained in 2011 and 18,400 t in 2012) for the various populations where discards have been quantified (ICES 2012b)(ICES 2013o)(ICES 2013b2)(ICES 2013c2)(ICES 2013d2)(ICES 2013e2)(ICES 2013f2)(ICES 2013g2). In the west Irish Sea, the area that accounts for the largest Norway lobster catches in this region, the discard to retained catch ratio for Norway lobster was 18% in 2012 (ICES 2013g2). Discard rates for other species vary. In the Irish Sea, where bycatch of plaice is high, 70% of all plaice caught or 1152 t were discarded in 2012 (ICES 2013q). Discards of whiting are also known to be high, though they cannot be quantified (ICES 2013r)(ICES 2013u). In the Irish Sea, 68% of all haddock caught were discarded in 2012 (722 t), while in other areas of the Celtic Sea region 36% of all haddock caught were discarded (10,332 t) (ICES 2013s)(ICES 2013t). However, it is unknown how much of these species are discarded specifically in the Norway lobster fisheries. Discards of cod, hake, and megrim appear to be lower (ICES 2014h)(ICES 2014j). Given the range of discard to total catch estimates for species in this region, we have rated the discard/retained catch factor as 40-60%.

### **KATTEGAT BAY**

Bottom Trawls

#### **40-60%**

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j) (ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## **NORTH SEA**

### Bottom Trawls

#### **40-60%**

In the North Sea, around 25% of Norway lobster caught were discarded between 2007 and 2011 (Seafish 2012)(ICES 2013d). In mixed species fisheries throughout this region (including Skagerrak and the Eastern Channel), the total discards (81,000 t) to retained catch (265,000 t) ratio for all main species caught (cod, haddock, plaice, saithe, sole, whiting, and Norway lobster) was 31% in 2012 (ICES 2013z). High discards of haddock and whiting can be an issue in Norway lobster fisheries in some areas. Discards of hake and anglerfish, which may also be caught along with Norway lobster in this region, are relatively low. To account for the likely discards of species in addition to those mentioned above, we have scored this factor as 40-60%.

## **SCOTLAND/NORTHEAST ATLANTIC**

### Bottom Trawls | Scotland

#### **20-40%**

Over the last 5 years, the average discards of Norway lobster in the region have been <20% of the retained catches or landings. In 2012, 14,300 t of Norway Lobster were landed or retained in this region, while around 1,400 t were discarded (~10% of landings) (ICES 2013h2). However, discards of whiting and haddock can be high in Norway lobster fisheries in West Scotland (ICES 2013b)(Heywood 2009). For example, between 1987 and 2012 discard rates (discards/catch) of whiting ranged from 40-80% and discards rates for haddock can also be as high as 80% (Fernandes et al. 2010). In 2012, total whiting catches in all fisheries in West Scotland were 1,041 t, with 728 t (70%) discarded and 312 t (30%) retained (ICES 2013w). In 2012, 919 t of haddock were caught in the Norway lobster fishery in this region, and of this 40% or 376 t were discarded, while 543 t were retained (ICES 2013b). Other species caught in the Norway lobster fisheries in this area include Atlantic cod and megrim. Discards of Atlantic cod for all fisheries in West Scotland were 1,159 t or 70% of the total cod catches (1632 t) in 2012, but the Norway lobster fishery accounts for only a small proportion (5-10%) of cod catches in this region and cod discards in the Norway lobster fishery are reported to be low (ICES 2013h) (Fernandes et al. 2010)(ICES 2013h2). 15% of all megrim were discarded in fisheries in West Scotland and the North Sea in 2012, but the proportion of megrim caught in the Norway lobster fishery is not known (ICES 2013c). In recent years many fisheries in West Scotland have begun to utilize bycatch mitigation measures to reduce interactions with bycatch species and subsequently discards (Heywood 2009). In addition, there is the Scottish Conservation Credits Scheme, which has been put into place to reduce Atlantic cod catches (ICES 2012c). This has likely contributed to reduced discards in recent years. In 2012, catch information for the main species caught in the fishery indicate a discard to retained catch ratio of around ~17% for these species. However, to account for likely additional discards of other species and varying discard rates among years, we have increased the score to 20-40%.

## **FINFISH**

### **Factor 2.1 - Inherent Vulnerability**

#### **KATTEGAT BAY**

##### Traps (Unspecified)

#### **Medium**

Creel fisheries incidentally capture several species of fish including Atlantic cod, short-spined sea scorpion, poor cod and dab (Jansson 2008). Short-spined sea scorpions have been assigned a medium vulnerability score or 37 out of 100 on Fishbase. Sexual maturity for this species is reached at around 15-30 cm and 2

years of age. The maximum length and are around 60 cm and 8 years, respectively. They are demersal egg layers and considered a moderate level predator (Froese and Pauly 2013). Poor cod have been assigned a medium level of vulnerability, 48 out of 100, by Fishbase. Sexual maturity is reach around 2 years of age and 13 cm and poor cod can achieve lengths of 40 cm and live up to 5 years. They are moderate level predators and broadcast spawners (Froese and Pauly 2013). Dab have also been assigned a medium vulnerability score of 38 out of 100 by Fishbase. Maturity is reached between 10 and 20 cm in size and by 3 years of age. The maximum age is 12 years and dab can attain a size of 40 cm. They are also broadcast spawners but have a lower trophic level than the other species (Froese and Pauly 2013). Atlantic cod have a high inherent vulnerability to fishing according to Fishbase (score of 71/100) (Froese and Pauly 2013). Atlantic cod reach sexual maturity between 31 and 60 cm and between 2-9 years of age, with coastal populations reaching sexual maturity at an earlier age (FAO 2004). Atlantic cod are broadcast spawners (FAO 2004). A maximum length of 100 cm and maximum age of 25 years have been reported (Froese and Pauly 2013). They are considered top predators (Froese and Pauly 2013). We have awarded a medium level of vulnerability to account for the variety of life history characteristics of these species.

## Factor 2.2 - Abundance

### KATTEGAT BAY

Traps (Unspecified)

#### High Concern

In Kattegat, the abundance of sexually mature Atlantic cod has been at historically low levels since 2000 and the amount of new, young fish entering the population has been very low in recent years as well. Currently, abundance is below the established limit reference point, and thus the population is considered depleted. Atlantic Cod also remain depleted in Skagerrak (ICES 2013j). There is insufficient information to determine the status of dab in this region, but it does appear that abundances have been increasing over time (ICES 2013a2). Poor cod are listed as a species of Least Concern by the International Union for Conservation of Nature (IUCN) and are thought to be one of the most abundant species in their range (Herdson 2010). Short-spined scorpionfish have not been assessed in this region. We have awarded a high concern score due to the depleted status of Atlantic cod.

## Factor 2.3 - Fishing Mortality

### KATTEGAT BAY

Traps (Unspecified)

#### Moderate Concern

In Kattegat there is insufficient information to determine the current fishing mortality on Atlantic cod, but relative mortality has increased in recent years and the population shows no signs of recovery (ICES 2020a). The fishing mortality on dab is unknown (ICES 2013a2). Short-spined sea scorpions have not been assessed in this region. Although fishing mortality on cod is high in some areas, the trap fisheries for Norway lobsters are only reported to catch low amounts of fish and are likely to have a low impact on cod compared to the trawl fisheries (Jansson 2008)(Macher et al. 2010)(Ziegler 2006). However, due to the low abundance of cod, any fishing impact could be too great; ICES (2020a) recommended no harvest in 2020 but a TAC of 130 tons was set for Kattegat (ICES 2020a). Based on this information, a score of 'moderate concern' was awarded.

## Factor 2.4 - Discard Rate

## KATTEGAT BAY

Traps (Unspecified)

### 60-80%

Although information is lacking, creel (trap) fisheries in Scotland and Kattegat Bay are generally reported to have low levels of both bycatch and discards (Macher et al. 2010)(EC 2011)(ICES 2012c). The survival rate currently used by ICES for discarded Norway lobster from traps is 25%, although some estimates suggest it may be greater than 50% (Wileman et al. 1999)(Bennet and Hough 2009)(ICES 2019c). Discards of nephrops were previously very high in the Kattegat Bay fishery (>50%) (Ziegler 2006)(Jansson 2008). However, discards of nephrops have been greatly reduced to roughly 10% in recent years due to a reduction to the legal landing length for nephrops in 2016 for the Kattegat Bay fishery (ICES 2019g). Discard rates for nephrops in the Scotland trap fishery were not available but overall discard rates were not as high for West Scotland nephrops fisheries and have declined slightly in recent years (ICES 2019c)(ICES 2019d)(ICES 2019e). Bait use (herring) is high in these fisheries (roughly 20% of nephrops harvest) and species aside from nephrops are also discarded, although the amounts were not available. Some studies have suggested up to 3 individual fish are used per trap as bait (Panfil et al. 2007)(Adey et al. 2008). Other studies have indicated that the amount of bait used is higher than the amount of Norway lobster caught (Ziegler 2006). Research conducted in other lobster fisheries also indicate that large amounts of bait are used in lobster traps (Harrish and Willison 2009) (Ryan et al. 2010). We have awarded a score of 0.85 to account for the large amounts of bait needed in lobster trap fisheries as well as reduced discards.

## MEGRIM

### Factor 2.1 - Inherent Vulnerability

#### CELTIC SEA

Bottom Trawls

#### SPAIN/NORTHEAST ATLANTIC

Bottom Trawls | Spain

#### PORTUGAL/NORTHEAST ATLANTIC

Bottom Trawls | Portugal

#### SCOTLAND/NORTHEAST ATLANTIC

Bottom Trawls | Scotland

### Medium

Fishbase assigned a medium inherent vulnerability to fishing score of 54 out of 100 for megrim (Froese and Pauly 2013). Megrim are broadcast spawners reaching sexual maturity around 26 cm and 1-2 years of age. They reach a maximum length of around 60 cm and live 14-15 years. Megrim are top predators (Froese and Pauly 2013)(Seafish 2012a).

### Factor 2.2 - Abundance

#### CELTIC SEA

Bottom Trawls

### Moderate Concern

In the Celtic Sea the abundance of megrim relative to target abundance reference points is unknown. Abundance has been increasing since the mid-2000's. Abundance in 2012-2013 is 13% higher than the previous three year average (ICES 2014r). Since the status of megrim in this region is uncertain and megrim have a medium vulnerability to fishing, we have awarded a moderate concern score.

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**Moderate Concern**

In Spanish and Portuguese waters, megrim abundance has been increasing since 2001 and is above the defined limit and precautionary abundance reference points (ICES 2014q). However, the defined abundance reference points are not considered to be as conservative as more formal reference points, like the biomass needed to produce the maximum sustainable yield (BMSY). We have therefore awarded a moderate concern score.

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**Very Low Concern**

West of Scotland, the abundance of megrim is well above the abundance/biomass needed to produce the maximum sustainable yield (BMSY)(ICES 2013c). We have therefore awarded a very low concern score.

**Factor 2.3 - Fishing Mortality****CELTIC SEA**

Bottom Trawls

**Moderate Concern**

Megrim are caught in mixed-species fisheries along with hake, anglerfish, and Norway lobster in some areas of the Celtic Sea (Casey et al. 2012). Fishing mortality rates of megrim in the Celtic Sea have been decreasing but sustainable fishing targets have not been defined (ICES 2014r). We have therefore awarded a moderate concern score.

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**High Concern**

In these areas, megrim are caught in mixed-species fisheries along with hake, anglerfish, and Norway lobster. Fishing mortality rates on megrim in Spanish and Portuguese waters have been declining, but remain above the fishing mortality at maximum sustainable yield (FMSY) proxy, meaning overfishing is occurring (ICES 2014q). We have therefore awarded a high concern score.

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**Very Low Concern**

Megrim are taken as bycatch in the Norway lobster fishery in some areas in the West Scotland region (Casey

et al. 2012). In West Scotland, fishing mortality rates of megrim have been below the fishing mortality at maximum sustainable yield (FMSY) since the mid-1980s, indicating the population is being fished sustainably (ICES 2013c). We have therefore awarded a very low concern score.

## Factor 2.4 - Discard Rate

### CELTIC SEA

Bottom Trawls

#### 40-60%

Within the Celtic Seas region, discard rates (amount of fish thrown back to sea) vary by area. During 2011 and 2012, discards of Norway lobster in the fisheries in this region have ranged from negligible amounts to 28% of the catch (16,150 t landed/retained in 2011 and 18,400 t in 2012) for the various populations where discards have been quantified (ICES 2012b)(ICES 2013o)(ICES 2013b2)(ICES 2013c2)(ICES 2013d2)(ICES 2013e2)(ICES 2013f2)(ICES 2013g2). In the west Irish Sea, the area that accounts for the largest Norway lobster catches in this region, the discard to retained catch ratio for Norway lobster was 18% in 2012 (ICES 2013g2). Discard rates for other species vary. In the Irish Sea, where bycatch of plaice is high, 70% of all plaice caught or 1152 t were discarded in 2012 (ICES 2013q). Discards of whiting are also known to be high, though they cannot be quantified (ICES 2013r)(ICES 2013u). In the Irish Sea, 68% of all haddock caught were discarded in 2012 (722 t), while in other areas of the Celtic Sea region 36% of all haddock caught were discarded (10,332 t) (ICES 2013s)(ICES 2013t). However, it is unknown how much of these species are discarded specifically in the Norway lobster fisheries. Discards of cod, hake, and megrim appear to be lower (ICES 2014h)(ICES 2014j). Given the range of discard to total catch estimates for species in this region, we have rated the discard/retained catch factor as 40-60%.

### SPAIN/NORTHEAST ATLANTIC

Bottom Trawls | Spain

### PORTUGAL/NORTHEAST ATLANTIC

Bottom Trawls | Portugal

#### < 20%

In 2012, 353 t of Norway lobster were landed/retained in the Spain/Portugal region. Discards of Norway lobster in this region are very low, as low as 0-1% (ICES 2014g)(ICES 2013e). Discards of other species caught in Norway lobster fisheries in this region are a little higher. The discard rate (discards/retained catch) for hake was 13% (2,100 t discarded) for all fisheries in the southern region of its range (ICES 2014k). Discard rates for anglerfish are unknown in this region, although discarding is known to happen (ICES 2014t)(ICES 2014s). The discard rate for megrim in their southern range (where the majority of catch is taken in mixed fisheries for Norway lobster and other species) was 11% (31 t discarded) in 2012 (ICES 2014q). Because discards of species caught in the Norway lobster fisheries in this region appear to be low, we have awarded a score of <20%.

### SCOTLAND/NORTHEAST ATLANTIC

Bottom Trawls | Scotland

#### 20-40%

Over the last 5 years, the average discards of Norway lobster in the region have been <20% of the retained catches or landings. In 2012, 14,300 t of Norway Lobster were landed or retained in this region, while around 1,400 t were discarded (~10% of landings) (ICES 2013h2). However, discards of whiting and haddock can be

high in Norway lobster fisheries in West Scotland (ICES 2013b)(Heywood 2009). For example, between 1987 and 2012 discard rates (discards/catch) of whiting ranged from 40-80% and discards rates for haddock can also be as high as 80% (Fernandes et al. 2010). In 2012, total whiting catches in all fisheries in West Scotland were 1,041 t, with 728 t (70%) discarded and 312 t (30%) retained (ICES 2013w). In 2012, 919 t of haddock were caught in the Norway lobster fishery in this region, and of this 40% or 376 t were discarded, while 543 t were retained (ICES 2013b). Other species caught in the Norway lobster fisheries in this area include Atlantic cod and megrim. Discards of Atlantic cod for all fisheries in West Scotland were 1,159 t or 70% of the total cod catches (1632 t) in 2012, but the Norway lobster fishery accounts for only a small proportion (5-10%) of cod catches in this region and cod discards in the Norway lobster fishery are reported to be low (ICES 2013h) (Fernandes et al. 2010)(ICES 2013h2). 15% of all megrim were discarded in fisheries in West Scotland and the North Sea in 2012, but the proportion of megrim caught in the Norway lobster fishery is not known (ICES 2013c). In recent years many fisheries in West Scotland have begun to utilize bycatch mitigation measures to reduce interactions with bycatch species and subsequently discards (Heywood 2009). In addition, there is the Scottish Conservation Credits Scheme, which has been put into place to reduce Atlantic cod catches (ICES 2012c). This has likely contributed to reduced discards in recent years. In 2012, catch information for the main species caught in the fishery indicate a discard to retained catch ratio of around ~17% for these species. However, to account for likely additional discards of other species and varying discard rates among years, we have increased the score to 20-40%.

## Criterion 3: Management Effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. The Criterion 3 rating is determined as follows:

- Score  $>3.2$ =Green or Low Concern
- Score  $>2.2$  and  $\leq 3.2$ =Yellow or Moderate Concern
- Score  $\leq 2.2$  or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern

Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

### Criterion 3 Summary

Region   Method	Harvest Strategy	Bycatch Strategy	Score
<b>Celtic Sea   Bottom trawls</b>	1.000	3.000	Red (1.732)
<b>France/Bay of Biscay   Bottom trawls</b> France	3.000	3.000	Yellow (3.000)
<b>Kattegat Bay   Bottom trawls</b>	1.000	3.000	Red (1.732)
<b>Kattegat Bay   Traps (unspecified)</b>	1.000	3.000	Red (1.732)
<b>North Sea   Bottom trawls</b>	1.000	3.000	Red (1.732)
<b>Portugal/Northeast Atlantic   Bottom trawls</b> Portugal	1.000	3.000	Red (1.732)
<b>Scotland/Northeast Atlantic   Bottom trawls</b> Scotland	1.000	3.000	Red (1.732)
<b>Scotland/Northeast Atlantic   Traps (unspecified)</b> Scotland	2.000	3.000	Yellow (2.449)
<b>Spain/Northeast Atlantic   Bottom trawls</b> Spain	1.000	3.000	Red (1.732)

In the Northeast Atlantic, the International Council for Exploration of the Sea (ICES), an intergovernmental organization, provides management advice on Norway lobster and other species caught in the fishery to member nations as well as the European Commission (EC). The European Commission has instituted several management measures including a total allowable catch limit and minimum size limits. In addition, some individual countries have adopted additional measures. However, in some regions there are several Norway lobster populations and managers have ignored scientific advice to manage Norway lobster at the population, rather than regional level, to ensure protection of individual Norway lobster populations. In Kattegat Bay and the Bay of Biscay, France, management is occurring at the population assessment level, so these regions scored better. In all regions, managers are working on reducing bycatch through the use of gear selectivity devices and



bycatch management is considered moderately effective.

## Criterion 3 Assessment

### SCORING GUIDELINES

#### Factor 3.1 - Harvest Strategy

*Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.'*

- 5 (Very Low Concern)—Rated as 'highly effective' for all seven subfactors considered
- 4 (Low Concern)—Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective.'
- 3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'
- 2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective.'
- 1 (Very High Concern)—Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective.'
- 0 (Critical)—No management exists when there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of Illegal, unregulated, and unreported fishing occurring.

#### Factor 3.1 Summary

FACTOR 3.1 - MANAGEMENT OF FISHING IMPACTS ON RETAINED SPECIES							
Region   Method	Strategy	Recovery	Research	Advice	Enforce	Track	Inclusion
<b>Celtic Sea   Bottom trawls</b>	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Highly Effective	Moderately Effective	Highly Effective
<b>France/Bay of Biscay   Bottom trawls</b> France	Moderately Effective	N/A	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
<b>Kattegat Bay   Bottom trawls</b>	Moderately Effective	Ineffective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
<b>Kattegat Bay   Traps (unspecified)</b>	Moderately Effective	Ineffective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
<b>North Sea   Bottom trawls</b>	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Highly Effective	Moderately Effective	Highly Effective
<b>Portugal/Northeast Atlantic   Bottom trawls</b> Portugal	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Highly Effective

<b>Scotland/Northeast Atlantic   Bottom trawls</b> Scotland	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Highly Effective	Moderately Effective	Highly Effective
<b>Scotland/Northeast Atlantic   Traps (unspecified)</b> Scotland	Moderately Effective	N/A	Moderately Effective	Ineffective	Highly Effective	Moderately Effective	Highly Effective
<b>Spain/Northeast Atlantic   Bottom trawls</b> Spain	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Highly Effective

### Subfactor 3.1.1 – Management Strategy and Implementation

*Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? To achieve a highly effective rating, there must be appropriate management goals, and evidence that the measures in place have been successful at maintaining/rebuilding species.*

#### **CELTIC SEA**

Bottom Trawls

#### **FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

#### **KATTEGAT BAY**

Bottom Trawls

#### **KATTEGAT BAY**

Traps (Unspecified)

#### **NORTH SEA**

Bottom Trawls

#### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

#### **SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

#### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

### **Moderately Effective**

The International Council for the Exploration of the Sea (ICES) conducts population assessments for Norway Lobster and provides management advice to the European countries. In most regions, there are several different populations of Norway Lobster called 'functional units' and ICES has advised that management should occur at the functional unit level, rather than the regional level. However, currently Norway Lobster continue to

be managed regionally. Target abundance conservation goals have not been established for most populations, but fishing mortality targets have been defined in many areas (Casey et al. 2012). The European Union has determined a total allowable catch limit (TAC) of 66,524 t for Norway Lobster that is divided up between individual countries and regions within the NE Atlantic (EU 2013). Additional management measures are in place regionally and because Norway Lobster is caught in mixed species fisheries, regulations for other species affect Norway lobsters fisheries as well.

Skagerrak and Kattegat: Unlike in most other areas, there is only one Norway lobster population in this region, so management is occurring at the population level. The management of cod in this region greatly affects Norway lobster fisheries. For example, there are effort restrictions and gear restrictions that the Norway lobster fishery must adhere to in order to ensure the protection of cod. There is also a minimum landing size for Norway lobster in the region; however because of the high minimum landing size, this often leads to high discards of Norway lobster (ICES 2013a). Management measures are in place for other main species as well. For example, there are annual catch limits in place for sole, European plaice, and whiting (ICES 2013k)(ICES 2014l)(ICES 2013x), a recovery plan is in place for European hake, which includes a catch limit (ICES 2014j) and a management plan is in place for haddock that includes a catch limit (ICES 2013y). In addition, the European Union has set a total allowable catch limits for dab and witch flounder (ICES 2013n2).(ICES 2013m2)

North Sea: In the North Sea there is a cod management plan that affects the Norway lobster fishery through effort restrictions, there is a minimum landing size for lobster and gear restrictions (ICES 2014c). However, the current management system may not be sufficient to protect the many individual Norway lobster populations in this region. Management measures are in place for other main species. There is a recovery plan in place for European hake, which includes an annual catch limit (ICES 2014j), management plans in place for haddock and whiting, which include catch limits (ICES 2013p)(ICES 2014p), and a catch limit is in place for monkfish (ICES 2013f).

West Scotland: In areas west of Scotland there is a bycatch limit for Norway Lobster of 3 t for British vessels over 10 m in length targeting whitefish (SG 1998). There is also a minimum landing size limit for lobster, as well as gear restrictions. There are several Norway lobster populations in this region, and the current management system may not be sufficient to protect these individual populations (ICES 2013h2). There are annual catch limits in place for European whiting and megrim (ICES 2013w)(ICES 2013c) and a long term management plan in place for cod, which also includes an annual catch limit (ICES 2013h). In addition, there is a management plan currently proposed for haddock in this region, along with a catch limit (ICES 2013b). Norway lobster stocks in this region have been relatively healthy, suggesting that management has been appropriate; however, several other invertebrate species harvested in the creel/trap fishery are considered overfished and few management actions are currently directed toward reducing over-exploitation (Nimmo et al. 2019)(Mesquita et al. 2017).

Celtic Seas Region: There is a minimum landing size for Norway lobster in this region (ICES 2012b). In the Celtic Sea region, there is also a long-term cod recovery plan, which has led to reduced fishing effort in the Norway lobster fisheries (ICES 2012b). However, the current management system may not be sufficient to protect the many individual Norway lobster populations in this region. Annual catch limits are also in place for many other species caught in the Norway Lobster fisheries, including European plaice, whiting, megrim, monkfish and haddock, and a recovery plan is in place for European hake, which includes an annual catch limit (ICES 2014j)(ICES 2013q)(ICES 2013u)(ICES 2013v)(ICES 2014o)(ICES 2014r).

Bay of Biscay, French Waters: There is a minimum landing size for lobster in this region; however, because the minimum size was increased in 2006 and mesh size of the trawls was not increased, this has resulted in high discards of undersized Norway lobster in recent years. There are also gear restrictions in place for the Norway lobster fishery and fishing effort has been reduced as a result of several decommissioning

schemes (ICES 2014b). Norway lobster in this region are assessed as a single population, so management is occurring at the population assessment level. The other main species caught in this fishery is European hake. A recovery plan is in place for European hake, which includes an annual catch limit (ICES 2014j).

Spain and Portugal: In these regions there are gear restrictions, time/area closures, and a minimum landing size for Norway lobster (EU 2005}. However, the management measures for Norway lobster in this region may not be sufficient to protect the many individual Norway lobster populations. There is a joint recovery plan in place for Norway lobster and European hake, which includes catch limits, but the goals of the management plan may no longer be appropriate (EC 2005)(ICES 2014k). Catch limits are also in place for megrim and monkfish (ICES 2014s)(ICES 2014q).

We have awarded a moderately effective score because while there are management measures in place for all main species in these fisheries, the effectiveness of these measures has been mixed. As well, management of Norway lobster is still occurring at a regional level instead of on a smaller scale and some populations are at low abundances or experiencing high fishing.

### **Subfactor 3.1.2 – Recovery of Species of Concern**

*Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success? To achieve a rating of Highly Effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.*

#### **CELTIC SEA**

Bottom Trawls

#### **KATTEGAT BAY**

Bottom Trawls

#### **KATTEGAT BAY**

Traps (Unspecified)

#### **NORTH SEA**

Bottom Trawls

#### **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

#### **Ineffective**

The Atlantic cod stock in the Celtic Sea, English Channel, Skagerrak, and the North Sea region as well as the West of Scotland stock (caught in both trawl and trap fisheries) have been considered "overfished" for many years and fishing mortality has increased in recent years (ICES 2020b)(ICES 2020c). In Kattegat, Atlantic cod status is unknown but stock abundance has declined to the lowest level in the 20+ year time-series and relative mortality has increased in recent years (ICES 2020a). Catch limits and a long-term management plan that includes fishing effort controls are in place for the cod populations, but the management strategy has not been effective in recovering these stocks. Whiting (caught in the trawl fisheries) are no longer considered overfished in the North Sea/Eastern English Channel, but overfishing is still occurring (ICES 2020f); whereas the status of whiting is unknown in Skagerrak/Kattegat and West of Scotland (ICES 2020g)(ICES 2020h). Other species retained in these fisheries have generally improved to no longer be overfished or overfishing (or never were), although stock status for some species in these regions remain unknown.

While reference points and management plans exist for most main species, Atlantic cod stocks targeted by these fisheries are depleted with fishing mortality generally increasing. Cod stocks do not show signs of

recovering (abundance has declined) in recent years. Because the recovery plan implementation has proved inadequate for Atlantic cod, this factor is deemed "ineffective."

#### **FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**N/A**

Based on the most recent stock assessment, northern hake stock is not depleted. No other species in this fishery are considered stock of concern.

#### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Ineffective**

For the fisheries off the Spain and Portugal coasts, a recovery plan for Norway lobster and hake was instituted in 2005 (EC 2005). Although fishing levels on Norway lobster have been reduced, based on the most recent assessments, the population is still at low levels and declining in many areas. Current management measures are considered insufficient to prevent depletion of Norway lobster (ICES 2014g)(ICES 2013e). Abundance of hake has increased and it is unclear if the species remains depleted or not, but fishing levels on hake remain too high (ICES 2014k). Due to new information on hake population dynamics, the goals of the hake recovery plan are no longer considered appropriate. We have rated this factor ineffective because of the lack of sufficient measures in place to recover Norway lobster.

#### **SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**N/A**

Although several benthic invertebrate species are caught in this fishery in relatively large numbers, and at least three species are considered overfished as of the most recent stock assessments, stock status is considered unknown for all these species (Mesquita et al. 2017). No finfish were caught in large enough numbers to be considered main species (Nimmo et al. 2019). Therefore, no species are considered depleted and this factor was scored as 'NA.'

### **Subfactor 3.1.3 – Scientific Research and Monitoring**

*Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species? To achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.*

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderately Effective**

The International Council for the Exploration of the Sea (ICES) conducts assessments for Norway Lobster for each population or functional unit, using available information on catches, fishing effort, size data, and abundance data from scientific surveys. Catch and effort information is collected through logbooks (Casey et al. 2012)(ICES 2012c). In cases where there is not sufficient information to assess the populations, ICES assesses the functional unit using a 'data-limited' approach. In 'data-limited' cases they will provide a qualitative assessment of abundance and fishing levels, and use this to provide management advice (Casey et al. 2012). Other species caught in the fishery are also regularly assessed by ICES. However, because appropriate abundance targets/reference points have not been determined for all populations, we have only awarded a moderately effective score.

**Subfactor 3.1.4 – Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.*

**CELTIC SEA**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Ineffective**

The International Council for the Exploration of the Sea (ICES) provides scientific advice to the European Union on how to manage Norway Lobster fisheries. ICES has advised that Norway lobster should be managed as individual populations, known as 'functional units', and provides advice on total allowable catch limits for each 'functional unit', when possible. However, in the North Sea, Celtic Sea, West Scotland, Portugal and Spain, managers are still establishing total allowable catch limits at the regional level, rather than the 'functional unit' level (Casey et al. 2012)(ICES 2014c)(ICES 2014d)(ICES 2014g)(ICES 2013h2)(ICES 2013o). As a result, current management may not sufficiently protect individual Norway lobster populations in these regions, and over-exploitation of some functional units is occurring. Because managers are not following scientific advice in these regions, this factor is rated ineffective.

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**Moderately Effective**

The International Council for the Exploration of the Sea (ICES) provides scientific advice to the European Union on how to manage Norway Lobster fisheries. ICES has advised that Norway lobster should be managed as individual populations, known as 'functional units', and provides advice on total allowable catch limits for each 'functional unit', when possible. In Kattegat Bay and Bay of Biscay, France, Norway lobster are assessed as a single population and management is occurring at the population assessment level (ICES 2014a)(ICES 2014b). Managers appear to generally following following recommended guidelines for setting catch limits for Norway lobster and other retained species, but sometimes they may be set slightly higher than recommended. We have therefore awarded a moderately effective score.

**Subfactor 3.1.5 – Enforcement of Management Regulations**

*Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.*

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Highly Effective**

The European Union has a control system in place to ensure compliance with adopted management measures. These include measures such as vessel monitoring systems, marking of fishing gear and requiring individual countries to monitor fishing effort (through measures such as vessel inspections and surveillance aircraft) among other measures. In addition, if an allotted catch limit/quota is exceeded by a member country there are measures in place to subtract overages in subsequent years (EU 2009). Catches have generally remained below agreed upon catch limits, with the exception of the fisheries off Spain/Portugal. We have therefore awarded a highly effective score for all areas besides Spain/Portugal.

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderately Effective**

Enforcement of the recovery plan for Norway lobster and European hake in the Spain/Portugal fisheries is conducted through specific monitoring of the region, inspection and surveillance through logbooks, weighing of landed catches and notification prior to landing Norway Lobster (EU 2005). Despite the monitoring and enforcement measures in place catches of hake have been well above established total allowable catch limits in recent years (ICES 2014k). So we have only awarded a moderately effective score.

**Subfactor 3.1.6 – Management Track Record**

*Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels? A Highly Effective rating is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.*



**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Moderately Effective**

Although many management measures are in place for Norway lobster, that abundance of Norway Lobster remains uncertain in many areas. As well, fishing levels on Norway lobster are too high in some locations. It has been recommended that Norway lobster be managed at the functional unit/individual population level rather than the regional level to ensure their sustainability, but managers continue to manage this species at the regional level (Casey et al. 2012). Management effectiveness for other species caught in Norway lobsters has been mixed. We have therefore awarded a moderately effective score.

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Ineffective**

In this region management measures have not been sufficient to maintain populations of Norway Lobster and or allow them to recover (Casey et al. 2012). In addition, fishing mortality rates of hake, which are also caught in the Norway lobster fisheries, remain too high. The total allowable catch limits in place for hake have been ineffective because they have been greatly exceeded in recent years (ICES 2014k). We have therefore awarded an ineffective score for this region.

**Subfactor 3.1.7 – Stakeholder Inclusion**

*Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent and includes stakeholder input.*

**CELTIC SEA**

Bottom TrawlsY

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | FranceY

**KATTEGAT BAY**

Bottom TrawlsY

**KATTEGAT BAY**

Traps (Unspecified)Y

**NORTH SEA**

Bottom TrawlsY

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | PortugalY

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | ScotlandY

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | ScotlandY

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | SpainY

**Highly Effective**

Stakeholders are represented in the management process within the European Union (EU). For example, the EU's Advisory Committee on Fisheries and Aquaculture, was created to represent stakeholders in the EU's common fisheries policy (CPF) (EU 2013). In 2002 the Common Fisheries Policy was altered and Regional Advisory Councils (RACs) were developed to aid in the involvement of stakeholders. The 2009 reform of the Common Fisheries Policy resulted in stakeholders being able to fully participate in the management process (EU 2009b). We have therefore awarded a highly effective score.

**Factor 3.2 - Bycatch Strategy****SCORING GUIDELINES**

*Four subfactors are evaluated: Management Strategy and Implementation, Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.' Unless reason exists to rate Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations differently, these rating are the same as in 3.1.*

- 5 (Very Low Concern)—Rated as 'highly effective' for all four subfactors considered
- 4 (Low Concern)—Management Strategy rated 'highly effective' and all other subfactors rated at least 'moderately effective.'
- 3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'
- 2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy but some other factors rated 'ineffective.'
- 1 (Very High Concern)—Management exists, but Management Strategy rated 'ineffective.'
- 0 (Critical)—No bycatch management even when overfished, depleted, endangered or threatened species are known to be regular components of bycatch and are substantially impacted by the fishery

FACTOR 3.2 - BYCATCH STRATEGY						
Region   Method	All Kept	Critical	Strategy	Research	Advice	Enforce
<b>Celtic Sea   Bottom trawls</b>	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>France/Bay of Biscay   Bottom trawls</b> France	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>Kattegat Bay   Bottom trawls</b>	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>Kattegat Bay   Traps (unspecified)</b>	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>North Sea   Bottom trawls</b>	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>Portugal/Northeast Atlantic   Bottom trawls</b> Portugal	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective
<b>Scotland/Northeast Atlantic   Bottom trawls</b> Scotland	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>Scotland/Northeast Atlantic   Traps (unspecified)</b> Scotland	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
<b>Spain/Northeast Atlantic   Bottom trawls</b> Spain	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective

### Subfactor 3.2.2 – Management Strategy and Implementation

*Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures? To achieve a Highly Effective rating, the primary bycatch species must be known and there must be clear goals and measures in place to minimize the impacts on bycatch species (e.g., catch limits, use of proven mitigation measures, etc.).*

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderately Effective**

The majority of management measures in place to protect other species caught along with Norway lobster have been addressed in the harvest strategy section of this report, as many are targeted along with Norway lobster and retained. However, bycatch and discards may include unwanted fish species, or undersized targeted species. Measures in place which may help reduce bycatch and discards include mesh size restrictions and bycatch reduction devices, like sorting grids (which are designed to allow bycatch to escape capture). The success of bycatch reduction devices, such as sorting grids has varied but appears to have been successful with regards to cod in several areas, like Kattegat/Skagerrak, West Scotland, Irish Sea, and parts of the North Sea (Madsen and Valentinsson 2010)(Madsen et al. 2012). Trawl's in Kattegat and Skagerrak have been required to use selective device since 2013 (Cappell et al. 2014). All Irish and UK vessels have been required to use species-selective gears since 2012, with preliminary data indicating a reduction in bycatch of 30-60% in some regions (ICES 2013g2)(ICES 2014c). Mesh size restrictions in the Norway lobster fishery have not been as successful at reducing bycatch as in other trawl fisheries in the region, likely because smaller mesh sizes are required to catch the target species (Graham and Ferro 2004)(Fernandes et al. 2010). We have awarded a moderately effective score to account for the use of bycatch reduction measures, while acknowledging that they do not reduce bycatch completely.

**KATTEGAT BAY**

Traps (Unspecified)

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Moderately Effective**

Bycatch in the creel or trap fisheries for Norway lobster can include crustaceans and some fish species such as cod (Bennet and Hough 2006)(Jansson 2008). Management measures are in place for cod, but primarily pertain to the trawl fisheries. There no specific bycatch mitigation measures in place for the creel fisheries West of Scotland or in Swedish waters in Kattegat/Skagerrak (ICES 2012c)(ICES 2013a). However, bycatch is low and most non-target catch can be released unharmed. We have therefore awarded a moderately effective score.

**Subfactor 3.2.3 – Scientific Research and Monitoring**

*Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to*

*measure fishery's impact on bycatch species? To achieve a Highly Effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are being met*

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderately Effective**

Information on catches of various bycatch species is collected by individual countries and used by the International Council for Exploration of the Sea (ICES) (EC 2013a)(EU 2009). Bycatch data is collected through onboard scientific observer programs and onboard camera systems are being investigated in some areas. The observer program in Scotland has been in place for over twenty years, averaging 63 trips a year in the North Sea and 28 trips a year west of Scotland (Fernandes et al. 2010). Observer coverage rates are often not reported, but current observer coverage is less than 10% for some countries, such as Ireland and France, so we have awarded a moderately effective score (ISFB 2008)(Cornou et al. 2013).

**Subfactor 3.2.4 – Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.*

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderately Effective**

In all regions, managers are working to reduce bycatch levels, but scientists have noted that further gear selectivity measures are still needed in some areas (ICES 2014a)(ICES 2014d). Managers generally seem to follow management guidelines but not always, so we have awarded a moderately effective score (see harvest strategy section for details).

**Subfactor 3.2.5 – Enforcement of Management Regulations**

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations? To achieve a Highly Effective rating, there must be consistent enforcement of regulations and verification of compliance.*

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**KATTEGAT BAY**

Traps (Unspecified)

**NORTH SEA**

Bottom Trawls

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**Highly Effective**

We have awarded a highly effective score (see harvest strategy section for details).

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderately Effective**

We have awarded a moderately effective score (see harvest strategy section for details).

## Criterion 4: Impacts on the habitat and ecosystem

*This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.*

*The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management score. The Criterion 2 rating is determined as follows:*

- Score >3.2=Green or Low Concern
- Score >2.2 and ≤3.2=Yellow or Moderate Concern
- Score ≤2.2=Red or High Concern

*Rating cannot be Critical for Criterion 4.*

### Criterion 4 Summary

Region   Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
<b>Celtic Sea   Bottom trawls</b>	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)
<b>France/Bay of Biscay   Bottom trawls</b> France	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)
<b>Kattegat Bay   Traps (unspecified)</b>	3.00: Low Concern	0.00: No Effective Mitigation	3.00: Moderate Concern	Yellow (3.000)
<b>Kattegat Bay   Bottom trawls</b>	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)
<b>North Sea   Bottom trawls</b>	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)
<b>Portugal/Northeast Atlantic   Bottom trawls</b> Portugal	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)
<b>Scotland/Northeast Atlantic   Traps (unspecified)</b> Scotland	3.00: Low Concern	0.00: No Effective Mitigation	3.00: Moderate Concern	Yellow (3.000)
<b>Scotland/Northeast Atlantic   Bottom trawls</b> Scotland	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)
<b>Spain/Northeast Atlantic   Bottom trawls</b> Spain	2.00: Moderate Concern	0.25: Minimal Mitigation	3.00: Moderate Concern	Yellow (2.598)



Creel or trap fisheries have a low impact on bottom habitats, while the trawl fishery, which catches the majority of Norway Lobster, causes moderate damage to bottom habitats. Overall ecosystem impacts by these fisheries are a moderate concern.

## **Criterion 4 Assessment**

### **SCORING GUIDELINES**

#### **Factor 4.1 - Impact of Fishing Gear on the Habitat/Substrate**

- *5 (None) - Fishing gear does not contact the bottom*
- *4 (Very Low) - Vertical line gear*
- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*
- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*  
*Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

#### **Factor 4.2 - Mitigation of Gear Impacts**

- *+1 (Strong Mitigation)—Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.*
- *+0.5 (Moderate Mitigation)—20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation)—A few measures are in place (e.g., vulnerable habitats protected but other habitats not protected); there are some limits on fishing effort/intensity, but not actively being reduced*
- *0 (No Mitigation)—No effective measures are in place to limit gear impacts on habitats*

#### **Factor 4.3 - Ecosystem-Based Fisheries Management**

- *5 (Very Low Concern)—Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators)*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*
- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts*
- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

## Factor 4.1 - Impact of Fishing Gear on the Habitat/Substrate

### **CELTIC SEA**

Bottom Trawls

### **FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

### **KATTEGAT BAY**

Bottom Trawls

### **NORTH SEA**

Bottom Trawls

### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

### **SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

### **Moderate Concern**

Bottom trawling, can have significant negative impacts on bottom habitats, damaging both the physical substrate and bottom dwelling organisms (Valdemarsen et al. 2007)( Kaiser and Spencer 1996)( Moran and Stephenson 2000)(Morgan and Chuenpagdee 2003). Trawling for Norway Lobster can permanently disturb the seabed. For example, research has estimated areas as large as 3000 m<sup>2</sup> of Kattegat Bay being disturbed by trawls targeting Norway Lobster. Specifically during 2003, it was estimated that 29% of Kattegat Bay was impacted by trawling. Within these impacted areas, muddy bottoms were affected the most, followed by areas made up of a combination of sediment and sandy bottoms. Muddy bottoms do tend to recovery quicker than other bottom habitats; however this recovery rate is negated if trawling occurs more frequently than twice a year (Ziegler 2006). In the North Sea, trawling leaves "severe" marks on the ocean floor, however there is evidence that burrowing animals have some resilience to trawling (ICES 2013a). Overall, bottom trawling that occurs over mud and sand, which includes trawling for Norway Lobster, is considered a moderate concern.

### **KATTEGAT BAY**

Traps (Unspecified)

### **SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

### **Low Concern**

Norway lobster fisheries typically occur over muddy and soft bottom habitats. Creel or trap fishing typically occurs in areas where trawlers cannot fish due to habitat limitations, such as steep drop offs (ICES 2013a). Although there is the potential for ghost fishing from lost traps and short term damage to fragile benthic species (Eno et al. 2001)(Morgan and Chuenpagdee 2003), trap fishing generally has a low impact on bottom habitats (Ziegler 2006)(Eno et al. 2001).

## Factor 4.2 - Mitigation of Gear Impacts

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Minimal Mitigation**

There are several areas closed to bottom trawling in the NE Atlantic to protect the bottom habitat. For example, off the Spanish and Portuguese coasts, bottom trawls are prohibited from June through August and from May through August in specific areas (EU 2005). In Scotland, there is a closed area to mobile fishing gear, areas closed to mixed gear, and areas with a 6 month closure to mobile gear and year round closures for trawlers over 12 m (Bennet and Hough 2006). Effort restrictions are in place in areas such as the North Sea (ICES 2013a). However, because these closures and protections do not protect a substantial proportion of Norway lobster habitat, we have only awarded a minimal mitigation score.

**KATTEGAT BAY**

Traps (Unspecified)

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**No Effective Mitigation**

There are no closures in place for the Norway lobster trap fisheries.

**Factor 4.3 - Ecosystem-Based Fisheries Management**

**CELTIC SEA**

Bottom Trawls

**FRANCE/ BAY OF BISCAY**

Bottom Trawls | France

**KATTEGAT BAY**

Traps (Unspecified)

**KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

**SCOTLAND/ NORTHEAST ATLANTIC**

Traps (Unspecified) | Scotland

**SCOTLAND/ NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

**SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

**Moderate Concern**

The Norway lobster fisheries do not capture species of "exceptional ecological importance". There are few management measures in place that address the ecosystem impacts, although the International Council for the Exploration of the Sea (ICES) does provide mixed species advice (combined advice for the entire set of species caught in the same fishery) in areas such as the North Sea (ICES 2013t). The advice considers what the fishing level should be to ensure protection of all species in the fishery. In addition, the European Union's (EU) Integrated Maritime Policy includes goals to use an ecosystem based approach to managing fisheries and the EU's Common Fisheries Policy was recently reformed to include, among other things, ways to address ecosystem concerns and ensure negative impacts to marine ecosystems (caused by fishing) are minimized (EU Regulation 1380/2013 of the European Parliament and the Council, OJ L 354, 28/12/2013)(EC 2013b)(EC 2013c). We have therefore awarded a moderate concern score.

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## **Appendix A: Extra By Catch Species**

### **COMMON DAB**

#### **Factor 2.1 - Inherent Vulnerability**

##### **KATTEGAT BAY**

Bottom Trawls

##### **Medium**

Dab have a moderate vulnerability to fishing according to Fishbase (score of 43 out of 100) (Froese and Pauly 2014). Dab reach sexual maturity between 13-25 cm in length and 2-3 years of age. Dab attain a maximum length and age of 40 cm and 12 years, respectively. Within the food chain, they are moderate level predators (Froese and Pauly 2014).

#### **Factor 2.2 - Abundance**

##### **KATTEGAT BAY**

Bottom Trawls

##### **Moderate Concern**

This species is considered data limited, so there are no abundance targets/reference points. The abundance of dab in the North Sea, including Skagerrak and Kattegat has been stable or increasing since the mid 1990's. The survey abundance indicator (number of fish caught/hour) in Skagerrak and Kattegat was 16% higher from 2010-2012 than during the previous five years (2005-2009) and was 7% higher in the North Sea (ICES 2013m2). We have awarded a moderate concern score since the status of dab is uncertain and the species has a medium vulnerability to fishing.

#### **Factor 2.3 - Fishing Mortality**

##### **KATTEGAT BAY**

Bottom Trawls

##### **Moderate Concern**

Fishing mortality rates for dab in the North Sea including Skagerrak and Kattegat are unknown and there are no defined fishing targets. However, it should be noted that fishing effort in this region has declined 50% since 2002 (ICES 2013m2). Dab are caught in beam trawl and otter trawl fisheries for bottom species. Discards of dab are high, but are unquantified. We have awarded a moderate concern score due to the lack of information on fishing mortality rates.

#### **Factor 2.4 - Discard Rate**

##### **KATTEGAT BAY**

Bottom Trawls

##### **40-60%**

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded,

while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j) (ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## **EUROPEAN DOVER SOLE**

### **Factor 2.1 - Inherent Vulnerability**

#### **KATTEGAT BAY**

Bottom Trawls

##### **Low**

Fishbase has assigned a low vulnerability score of 35 out of 100 to common sole (Froese and Pauly 2013). Sexual maturity is first reached by around 30 cm and 2-4 years of age. Sole reach a maximum size of 70 cm and live up to 26 years of age. They are broadcast spawners and can produce a large number of eggs per spawning event. Within the food chain, they are an intermediate level species (Froese and Pauly 2013).

### **Factor 2.2 - Abundance**

#### **KATTEGAT BAY**

Bottom Trawls

##### **High Concern**

In Kattegat Bay/Skagerrak, there is no defined limit/overfished abundance reference point for sole, but abundance has been declining since 2006 and is currently at the lowest level since the mid 1980's. As well, recruitment (=amount of new fish entering the population) is also at a historical low (ICES 2013k). Based on this low abundance, we have awarded a high concern score.

### **Factor 2.3 - Fishing Mortality**

#### **KATTEGAT BAY**

Bottom Trawls

##### **Moderate Concern**

In this region, sole are taken in a mixed fishery with Norway lobster, plaice, and cod (Casey et al. 2012)(ICES 2013k). Fishing mortality rates in this region have fluctuated over the years and are currently around the established precautionary fishing mortality reference point (ICES 2013k). However, the fishing mortality reference point used in this case is considered less conservative than the fishing mortality at maximum sustainable yield (FMSY). Because it is uncertain if the defined fishing mortality reference point represents true sustainable fishing levels, we have awarded a moderate concern score.

### **Factor 2.4 - Discard Rate**

#### **KATTEGAT BAY**

Bottom Trawls

## 40-60%

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j) (ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## EUROPEAN PLAICE

### Factor 2.1 - Inherent Vulnerability

#### CELTIC SEA

Bottom Trawls

#### KATTEGAT BAY

Bottom Trawls

#### High

Fishbase assigned a high inherent vulnerability to fishing score of 69 out of 100 for European plaice (Froese and Pauly 2013). Sexual maturity is reached between 24 and 42 cm in size and between 2-7 years of age.

European plaice can reach a maximum size and age of 100 cm and 50 years respectively. They are broadcast spawners and an intermediate to top level species in the food chain (Froese and Pauly 2013).

### Factor 2.2 - Abundance

#### CELTIC SEA

Bottom Trawls

#### High Concern

Abundance targets/reference points have not been determined for plaice in this region. In the Irish Sea, abundance of plaice has increased since the mid 1990's to a stable level (ICES 2013q), and in the Celtic Sea, abundance has increased over the period 2004 to 2012 (ICES 2013r). In southwest Ireland abundance of plaice has been increasing in recent years but is low relative to historical levels (ICES 2013o2). In west Ireland, there is very limited information on abundance levels (Casey et al. 2012). We have awarded a high concern score due to the limited information and high vulnerability rating.

#### KATTEGAT BAY

Bottom Trawls

#### Moderate Concern

In Kattegat Bay, the plaice population has increased in recent years. Abundance in 2012-2013, is 129% higher than the previous three year average (ICES 2014m). However no abundance targets/reference points have been defined. The status of European plaice in Skagerrak is also unknown with regard to abundance

targets/reference points. There are considered to be two population components in this area: a western component and an eastern component. Most plaice catches now come from the western component. In the western area, plaice abundance has been fluctuating. Plaice in the area are mixed with the North Sea population, and a combined assessment of North and Skagerrak plaice shows an increase in abundance since the mid-2000's. In the eastern area, abundance is increasing from a historic low (ICES 2014l). Because abundance of plaice is generally increasing, but abundance in relation to target conservation goals is uncertain, we have awarded a moderate concern score.

## Factor 2.3 - Fishing Mortality

### CELTIC SEA

Bottom Trawls

#### Moderate Concern

Bycatch of plaice in Norway Lobster fisheries can be high in some area of the Celtic Seas region (Casey et al. 2012). In the Irish Sea, recent fishing mortality rates appear to be low and below possible fishing targets (ICES 2013q). While in southwest Ireland, fishing levels may be above possible reference points/targets (ICES 2013o2). In the Celtic Sea and West Ireland, information to determine fishing levels is generally insufficient (ICES 2013r)(Casey et al. 2012). Due to the limited information and varying fishing trends among areas, we have awarded a moderate concern score.

### KATTEGAT BAY

Bottom Trawls

#### Moderate Concern

In this area, plaice are often caught in mixed species fisheries with Norway lobster, sole, and cod. In Kattegat Bay fishing mortality on plaice is considered low and likely below the provisional fishing mortality at maximum sustainable yield (FMSY) proxy (ICES 2014m). There is insufficient information in Skagerrak to determine the fishing mortality on plaice, although fishing effort has been substantially reduced (ICES 2014l). Due to the limited information we have awarded a moderate concern score.

## Factor 2.4 - Discard Rate

### CELTIC SEA

Bottom Trawls

#### 40-60%

Within the Celtic Seas region, discard rates (amount of fish thrown back to sea) vary by area. During 2011 and 2012, discards of Norway lobster in the fisheries in this region have ranged from negligible amounts to 28% of the catch (16,150 t landed/retained in 2011 and 18,400 t in 2012) for the various populations where discards have been quantified (ICES 2012b)(ICES 2013o)(ICES 2013b2)(ICES 2013c2)(ICES 2013d2)(ICES 2013e2)(ICES 2013f2)(ICES 2013g2). In the west Irish Sea, the area that accounts for the largest Norway lobster catches in this region, the discard to retained catch ratio for Norway lobster was 18% in 2012 (ICES 2013g2). Discard rates for other species vary. In the Irish Sea, where bycatch of plaice is high, 70% of all plaice caught or 1152 t were discarded in 2012 (ICES 2013q). Discards of whiting are also known to be high, though they cannot be quantified (ICES 2013r)(ICES 2013u). In the Irish Sea, 68% of all haddock caught were discarded in 2012 (722 t), while in other areas of the Celtic Sea region 36% of all haddock caught were discarded (10,332 t) (ICES 2013s)(ICES 2013t). However, it is unknown how much of these species are discarded specifically in the Norway lobster fisheries. Discards of cod, hake, and megrim appear to be lower (ICES 2014h)(ICES 2014j). Given the range of discard to total catch estimates for species in this region, we

have rated the discard/retained catch factor as 40-60%.

## **KATTEGAT BAY**

Bottom Trawls

### **40-60%**

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j) (ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## HADDOCK

### **Factor 2.1 - Inherent Vulnerability**

#### **CELTIC SEA**

Bottom Trawls

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

#### **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

### **Medium**

Fishbase assigned a medium inherent vulnerability to fishing score of 47 out of 100 for haddock (Froese and Pauly 2013). Haddock are broadcast spawners, reaching sexual maturity around 35 cm and 2-10 years of age. They reach a maximum size of 112 cm and live around 20 years of age. Haddock are top predators (Froese and Pauly 2013).

### **Factor 2.2 - Abundance**

#### **CELTIC SEA**

Bottom Trawls

### **Moderate Concern**

In the Celtic Sea and West Ireland areas, abundance of haddock is currently above the established limit abundance reference point Btrigger (=lowest estimated abundance over a given period) (Casey et al. 2012) (ICES 2014o). It is uncertain if this is an appropriate limit/overfished reference point, and more formal reference points like the biomass needed to produce the maximum sustainable yield (BMSY) have not been determined. Abundance of haddock peaked in 2011, but since then recruitment (=new fish entering the population) has been below average and the population is rapidly declining toward the Btrigger reference

point (ICES 2014o). In the Irish Sea (also part of the Celtic Sea region), the population status relative to abundance targets/reference points is unknown, but abundance in 2013-2014 was 22% higher than the average abundance over the previous 3 years (ICES 2014n). We have awarded a moderate concern score since the status of haddock in this region is somewhat uncertain, abundance is declining in the Celtic Sea and West Ireland areas, and the species has a medium vulnerability to fishing.

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

#### **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

#### **Moderate Concern**

The abundance of haddock for the North Sea, Skagerrak, and West Scotland population has been above both the limit and precautionary reference points since 2001 (ICES 2014p). However, these reference points are not considered to be as conservative as more formal abundance reference points, like the biomass at maximum sustainable yield (BMSY). As well, recruitment (=new fishing entering the population) has been poor since 2009 and the population is decreasing in recent years (ICES 2014p). We have therefore awarded a moderate concern score.

### **Factor 2.3 - Fishing Mortality**

#### **CELTIC SEA**

Bottom Trawls

#### **High Concern**

Haddock are caught along with Norway lobster in several areas within the Celtic Sea region (Casey et al. 2012). Fishing mortality rates on the Celtic Sea and Western Ireland haddock population have been above sustainable levels since the 1990's (ICES 2014o). In the Irish Sea, fishing mortality rates on haddock are unknown (Casey et al. 2012)(ICES 2014n). We have awarded a high concern score due to fishing mortality rates being high in the Celtic Sea/Western Ireland.

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

#### **SCOTLAND/NORTHEAST ATLANTIC**

Bottom Trawls | Scotland

#### **Very Low Concern**

Haddock are caught in targeted fisheries and mixed-species fisheries with Norway lobster, cod and whiting in these areas. Fishing mortality rates on this haddock population have been below the fishing mortality at maximum sustainable yield (FMSY) since 2008 (ICES 2014p). We have therefore awarded a score of very low concern.

### **Factor 2.4 - Discard Rate**

## **CELTIC SEA**

### Bottom Trawls

#### **40-60%**

Within the Celtic Seas region, discard rates (amount of fish thrown back to sea) vary by area. During 2011 and 2012, discards of Norway lobster in the fisheries in this region have ranged from negligible amounts to 28% of the catch (16,150 t landed/retained in 2011 and 18,400 t in 2012) for the various populations where discards have been quantified (ICES 2012b)(ICES 2013o)(ICES 2013b2)(ICES 2013c2)(ICES 2013d2)(ICES 2013e2)(ICES 2013f2)(ICES 2013g2). In the west Irish Sea, the area that accounts for the largest Norway lobster catches in this region, the discard to retained catch ratio for Norway lobster was 18% in 2012 (ICES 2013g2). Discard rates for other species vary. In the Irish Sea, where bycatch of plaice is high, 70% of all plaice caught or 1152 t were discarded in 2012 (ICES 2013q). Discards of whiting are also known to be high, though they cannot be quantified (ICES 2013r)(ICES 2013u). In the Irish Sea, 68% of all haddock caught were discarded in 2012 (722 t), while in other areas of the Celtic Sea region 36% of all haddock caught were discarded (10,332 t) (ICES 2013s)(ICES 2013t). However, it is unknown how much of these species are discarded specifically in the Norway lobster fisheries. Discards of cod, hake, and megrim appear to be lower (ICES 2014h)(ICES 2014j). Given the range of discard to total catch estimates for species in this region, we have rated the discard/retained catch factor as 40-60%.

## **KATTEGAT BAY**

### Bottom Trawls

#### **40-60%**

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j)(ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

## **NORTH SEA**

### Bottom Trawls

#### **40-60%**

In the North Sea, around 25% of Norway lobster caught were discarded between 2007 and 2011 (Seafish 2012)(ICES 2013d). In mixed species fisheries throughout this region (including Skagerrak and the Eastern Channel), the total discards (81,000 t) to retained catch (265,000 t) ratio for all main species caught (cod, haddock, plaice, saithe, sole, whiting, and Norway lobster) was 31% in 2012 (ICES 2013z). High discards of haddock and whiting can be an issue in Norway lobster fisheries in some areas. Discards of hake and anglerfish, which may also be caught along with Norway lobster in this region, are relatively low. To account for the likely discards of species in addition to those mentioned above, we have scored this factor as 40-60%.

## SCOTLAND/NORTHEAST ATLANTIC

Bottom Trawls | Scotland

### 20-40%

Over the last 5 years, the average discards of Norway lobster in the region have been <20% of the retained catches or landings. In 2012, 14,300 t of Norway Lobster were landed or retained in this region, while around 1,400 t were discarded (~10% of landings) (ICES 2013h2). However, discards of whiting and haddock can be high in Norway lobster fisheries in West Scotland (ICES 2013b)(Heywood 2009). For example, between 1987 and 2012 discard rates (discards/catch) of whiting ranged from 40-80% and discards rates for haddock can also be as high as 80% (Fernandes et al. 2010). In 2012, total whiting catches in all fisheries in West Scotland were 1,041 t, with 728 t (70%) discarded and 312 t (30%) retained (ICES 2013w). In 2012, 919 t of haddock were caught in the Norway lobster fishery in this region, and of this 40% or 376 t were discarded, while 543 t were retained (ICES 2013b). Other species caught in the Norway lobster fisheries in this area include Atlantic cod and megrim. Discards of Atlantic cod for all fisheries in West Scotland were 1,159 t or 70% of the total cod catches (1632 t) in 2012, but the Norway lobster fishery accounts for only a small proportion (5-10%) of cod catches in this region and cod discards in the Norway lobster fishery are reported to be low (ICES 2013h) (Fernandes et al. 2010)(ICES 2013h2). 15% of all megrim were discarded in fisheries in West Scotland and the North Sea in 2012, but the proportion of megrim caught in the Norway lobster fishery is not known (ICES 2013c). In recent years many fisheries in West Scotland have begun to utilize bycatch mitigation measures to reduce interactions with bycatch species and subsequently discards (Heywood 2009). In addition, there is the Scottish Conservation Credits Scheme, which has been put into place to reduce Atlantic cod catches (ICES 2012c). This has likely contributed to reduced discards in recent years. In 2012, catch information for the main species caught in the fishery indicate a discard to retained catch ratio of around ~17% for these species. However, to account for likely additional discards of other species and varying discard rates among years, we have increased the score to 20-40%.

## MONKFISH (UNSPECIFIED)

### Factor 2.1 - Inherent Vulnerability

#### NORTH SEA

Bottom Trawls

#### PORTUGAL/NORTHEAST ATLANTIC

Bottom Trawls | Portugal

#### SPAIN/NORTHEAST ATLANTIC

Bottom Trawls | Spain

### High

Fishbase assigned a high inherent vulnerability to fishing score of 72 out of 100 for monkfish (Froese and Pauly 2013). Monkfish are broadcast spawners reaching sexual maturity between 6-14 years of age and between 35-60 cm. They reach a maximum length and age of 200 cm and 24 years respectively. Monkfish are top predators (Froese and Pauly 2013).

### Factor 2.2 - Abundance

#### NORTH SEA

Bottom Trawls

### High Concern



Monkfish or anglerfish (white and black-bellied) in the North Sea are part of a larger population that includes Kattegat and West Scotland. The average abundance for this population from 2011-2012 is 22% lower than the average from 2008-2010 (ICES 2013f). There are no defined abundance targets/reference points for this population (ICES 2013f). Because of the unknown population status of monkfish in this region and their high vulnerability to fishing, we have awarded a high concern score.

#### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

#### **Moderate Concern**

In Spain and Portuguese waters, abundance of black-bellied monkfish or anglerfish is currently below the target level, the biomass need to produce the maximum sustainable yield (BMSY), but above the limit reference point (50% of BMSY), and therefore not considered depleted (ICES 2014s). Abundance has been increasing and is approaching the BMSY target. Abundance of white monkfish/anglerfish has been increasing since the mid-1990's, but abundance relative to sustainable abundance reference points is unknown (ICES 2014t). Since the abundance of black-bellied monkfish is at an adequate level, and the abundance of white-bellied monkfish has been increasing but there is some uncertainty about this species' status, we have awarded a moderate concern score.

### **Factor 2.3 - Fishing Mortality**

#### **NORTH SEA**

Bottom Trawls

#### **Moderate Concern**

Monkfish or anglerfish (white and black-bellied) are caught as bycatch in Norway lobster trawl fisheries and mixed roundfish trawl fisheries in the North Sea (Casey et al. 2012). There is insufficient information to determine the fishing mortality rate on monkfish in this region (ICES 2013f)(ICES 2013i). We have therefore awarded a moderate concern score.

#### **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

#### **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

#### **Low Concern**

Monkfish or anglerfish are caught in mixed species fisheries along with Norway lobster, megrim, and hake off the Spain and Portuguese coasts (Casey et al. 2012). Fishing mortality rates for white anglerfish have been below sustainable levels, i.e. the fishing mortality at maximum sustainable yield (FMSY) since 2011 (ICES 2014t). Fishing mortality rates for black-bellied anglerfish are also below FMSY (ICES 2014s). However, because fishing levels are just below sustainable levels and discards are known to occur but not included in the assessment, we have awarded a low concern score instead of very low concern (ICES 2014s).

### **Factor 2.4 - Discard Rate**

## **NORTH SEA**

Bottom Trawls

### **40-60%**

In the North Sea, around 25% of Norway lobster caught were discarded between 2007 and 2011 (Seafish 2012)(ICES 2013d). In mixed species fisheries throughout this region (including Skagerrak and the Eastern Channel), the total discards (81,000 t) to retained catch (265,000 t) ratio for all main species caught (cod, haddock, plaice, saithe, sole, whiting, and Norway lobster) was 31% in 2012 (ICES 2013z). High discards of haddock and whiting can be an issue in Norway lobster fisheries in some areas. Discards of hake and anglerfish, which may also be caught along with Norway lobster in this region, are relatively low. To account for the likely discards of species in addition to those mentioned above, we have scored this factor as 40-60%.

## **PORTUGAL/ NORTHEAST ATLANTIC**

Bottom Trawls | Portugal

## **SPAIN/ NORTHEAST ATLANTIC**

Bottom Trawls | Spain

### **< 20%**

In 2012, 353 t of Norway lobster were landed/retained in the Spain/Portugal region. Discards of Norway lobster in this region are very low, as low as 0-1% (ICES 2014g)(ICES 2013e). Discards of other species caught in Norway lobster fisheries in this region are a little higher. The discard rate (discards/retained catch) for hake was 13% (2,100 t discarded) for all fisheries in the southern region of its range (ICES 2014k). Discard rates for anglerfish are unknown in this region, although discarding is known to happen (ICES 2014t) (ICES 2014s). The discard rate for megrim in their southern range (where the majority of catch is taken in mixed fisheries for Norway lobster and other species) was 11% (31 t discarded) in 2012 (ICES 2014q). Because discards of species caught in the Norway lobster fisheries in this region appear to be low, we have awarded a score of <20%.

## WITCH FLOUNDER

### **Factor 2.1 - Inherent Vulnerability**

#### **KATTEGAT BAY**

Bottom Trawls

#### **NORTH SEA**

Bottom Trawls

### **High**

Witch flounder have been assigned a high to vulnerability score of 68 out of 100 by Fishbase (Froese and Pauly 2014). Sexual maturity is reached between 25 and 35 cm and between 4-7 years of age. Witch flounder reach a maximum length of 60 cm and live up to 25 years of age. They are moderate level predators (Froese and Pauly 2014).

### **Factor 2.2 - Abundance**

**KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**High Concern**

There are no defined abundance targets/reference points for witch flounder. The abundance of the North Sea/Skagerrak/Kattegat population has declined from peak levels in 2000, but has been increasing in recent years (ICES 2013n2). Because the status of witch flounder is unknown and the species has a high vulnerability to fishing, we have awarded a high concern score.

**Factor 2.3 - Fishing Mortality****KATTEGAT BAY**

Bottom Trawls

**NORTH SEA**

Bottom Trawls

**Moderate Concern**

Witch flounder is an important bycatch in some Norway lobster fisheries. Fishing effort by the fleets that catch witch flounder has decreased, but exploratory analysis of fishing mortality rates on witch flounder suggest fishing levels could be above sustainable levels (ICES 2013n2). Because fishing mortality on witch flounder is uncertain, we have awarded a moderate concern score.

**Factor 2.4 - Discard Rate****KATTEGAT BAY**

Bottom Trawls

**40-60%**

In the past, discards of Norway lobster were high in the trawl fisheries in Kattegat and Skagerrak due to a high minimum landing size and low trawl mesh size. More Norway lobster are typically discarded than retained. For instance, in 2012, 52% of all Norway lobster caught (all fisheries) in this region were discarded, while 48% were retained (ICES 2013a). However, discards have been greatly reduced in recent years (approximately 10% of landings), due to a reduction to the legal landing length for nephrops in 2016; however, discards of other species remain (Cappell et al. 2018)(ICES 2019g). There are high discards of whiting in this area, with 88% of all whiting caught discarded back to sea (ICES 2013x). There are also high discards of cod in some areas, and although not quantified, discards of dab are considered high (ICES 2013j) (ICES 2013a2). For other species, discards relative to retained catches appear lower. Because discards of Norway lobster are now low, but discards of some of the other species caught in the fishery are high, we consider the discard to retained ratio to be 40-60%.

**NORTH SEA**

Bottom Trawls

**40-60%**

In the North Sea, around 25% of Norway lobster caught were discarded between 2007 and 2011 (Seafish 2012)(ICES 2013d). In mixed species fisheries throughout this region (including Skagerrak and the Eastern

Channel), the total discards (81,000 t) to retained catch (265,000 t) ratio for all main species caught (cod, haddock, plaice, saithe, sole, whiting, and Norway lobster) was 31% in 2012 (ICES 2013z). High discards of haddock and whiting can be an issue in Norway lobster fisheries in some areas. Discards of hake and anglerfish, which may also be caught along with Norway lobster in this region, are relatively low. To account for the likely discards of species in addition to those mentioned above, we have scored this factor as 40-60%.

## **Appendix B: Updates to Norway Lobster Report**

Updates to the August 21, 2014 Norway Lobster report were made on August 5, 2020:

Overall recommendations for Norway lobster caught by bottom trawl and trap in Kattegat Bay fisheries downgraded to "Avoid." These changes are due to new information on stock status and lack of recovery for Atlantic cod, a species retained in these fisheries.

Updates to the report included:

- C1: Upgraded from 'Moderate' to 'Low' concern (C1.2 and 1.3) for Scotland bottom trawl and trap fisheries due to an updated stock assessment showing abundance and fishing mortality of Norway lobster was at sustainable levels in this area. Upgraded from 'High' to 'Moderate' concern (C1.3) for Celtic Sea bottom trawl fishery due to an updated stock assessment showing fishing mortality of Norway lobster was at sustainable levels for eight of ten stocks in this area, two of which were fluctuating around  $F_{MSY}$  (with overfishing occurring for one stock and one stock unknown).
- C2: Upgraded from 'Moderate' to 'Low' concern (C2.2) and 'High' to 'Moderate' (C1.3) for France Bay of Biscay bottom trawl fishery due to a new stock assessment indicating the northern stock of European hake was not overfished and fishing mortality has been fluctuating around  $F_{MSY}$  in recent years. Upgraded from 'High' to 'Moderate' concern (C2.3) for Spain and Portugal bottom trawl fisheries due to a new stock assessment indicating fishing mortality is unknown for the southern stock of European hake, but relative fishing pressure has been fairly consistent in recent years. Downgraded from 'Moderate' to 'High' concern (C2.3) for Scotland trap fishery due to new stock assessments indicating fishing mortality was above sustainable levels for at least three species in the 'benthic inverts' category. Removed 'finfish' category from C2 main species for Scotland trap fishery due to new information indicating catch of finfish species was negligible in this fishery. Downgraded from 'Low' to 'Moderate' concern (C2.3) for Kattegat Bay trap fishery due to low but continued harvest of depleted Atlantic cod stocks. Upgraded from 0.75 to 0.85 (C2.4) for Scotland and Kattegat Bay trap fisheries due to fewer discards of Norway lobster, but continued high bait use. Upgraded from 0.75 to 0.9 (C2.4) for Kattegat Bay trawl fishery due to fewer discards of Norway lobster.
- C3: Upgraded from 'moderate concern' to 'NA' (C3.1.2) for France Bay of Biscay fishery due to a new stock assessment indicating the northern hake stock is not depleted and a lack of any species of concern caught by the fishery. Upgraded from 'Moderate Concern' to 'NA' (C3.1.2) for Scotland trap fishery due to removal of 'finfish' category from main species, and lack of any species of concern caught in the fishery. Downgraded from "Moderately Effective" to "Ineffective" (C3.1.2) in the following fisheries: Scotland bottom trawl, Kattegat Bay bottom trawl, Kattegat Bay trap, Celtic Sea bottom trawl, and North Sea bottom trawl. This was due to the long-term depleted status and generally declining abundance and increasing fishing mortality for Atlantic cod in these fishery areas.