Contents

7 Haddock in Division 6.b (Rockall)

7.1 Introduction

In previous years an age-structured assessment model has been used to provide advice as a category 1 stock. This year, methods to update the previously utilised survey index were unavailable and the agreed assessment (and forecast) could not be carried out. Consequently, the assessment this year is based on a new biomass index derived from the Rock-WIBTS-Q3 as an indicator of stock size and a mean catch length indicator as a proxy for fishing pressure (under a category 3 approach). The WG considers this to be a temporary measure until such a time as a benchmark for this stock can be scheduled.

The derivation of the biomass index and the estimation of data/parameters required for the length indicators are described in further detail below.

7.2 General

Advice

ICES advice has been provided on the basis of the MSY approach since 2014. Last year's advice was for catches of no more than 5825 tonnes (for 2022).

Stock description and management units

The haddock stock at Rockall is considered to be an entirely separate stock from that inhabiting the continental shelf of the British Isles. Since 2004, the EU TAC for haddock in 6.b has been included with Divisions 12 and 14. For details of the earlier management units see the Stock Annex.

Management applicable to 2021 and 2022

The TAC is set for the UK, EU and international waters of 6b, and international waters of 12 and 14. For 2021 and 2022, the breakdown by country is given below:

TAC 2021

Species:	Haddock *Melanogrammus aeglefinus*	Zone:	United Kingdom, Union and international waters of 6b; international waters 12 and 14 (HAD/6B1214)
Belgium	16	Analytical TAC	
Germany	19	Article 8(2) of this Regulation applies	
France	799		
Ireland	570		
Union	1 404		
United Kingdom	6 971		
TAC	8 375		

TAC 2022

Species:	Haddock *Melanogrammus aeglefinus*	Zone:	United Kingdom, Union and international waters of 6b; international waters of 12 and 14 (HAD/6B1214)
Belgium	12	Analytical TAC	
Germany	12	Article 8(2) of this Regulation applies	
France	542		
Ireland	385		
Union	951		
United Kingdom	4 874		
TAC	5 825		

The ICES advice, agreed TAC for EU waters, and WG estimates of landings during 2002–2021 are summarised below. All values are in tonnes.

YEAR	Predicted catch corresp. to advice	Predicted landings corresp. to advice#	BASIS	AGREED TAC [a]
2002	< 1300		Reduce F below 0.2	
2003	-		Lowest possible F	
2004	-		Lowest possible F [b]	702
2005	-		Lowest possible F [b]	702
2006	-		Lowest possible F [b]	597
2007	< 7100		Reduce F below F_{PA} [b]	4615
2008	< 10640		Keep F below F_{PA} [b]	6916
2009		< 4300	No long-term gains in increasing F [b]	5879
2010		< 3300	Little gain on the long-term yield by increasing F [b]	4997
2011		<2700	Reduction in F is needed to keep SSB to above B_{PA} in 2012	3748
2012		< 3300	MSY approach	3300
2013	0	0	No directed fisheries, minimize bycatch and discards	990
2014	<1620	<0980	MSY approch	1210
2015	<4310	<2930	MSY approch	2580
2016	< 3932	< 3225	MSY approach	3225
2017	≤ 4690	≤ 4130	MSY approach	4690
2018	≤ 5163		MSY approach	5163
2019	≤10469		MSY approach	10469
2020	≤10472		MSY approach	10472
2021	≤6239		MSY approach	8375
2022	≤5825		MSY approach	5825

[a] Prior to 2014, the TAC was set for Divisions 6.a and 6.b (plus 5.b, 12 and 14) combined with restrictions on quantity that can be taken in 5.b and 6.a. The quantity shown here is the total area TAC minus the maximum amount which is

allowed to be taken from 5.b and 6.a. In 2004, the EU TAC for Division 6 was split and the 6.b TAC for haddock was included with 12 and 14. This value is the TAC for 6.b, 12 and 14.

[b] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries, protecting stocks outside safe biological limits.

The minimum conservation reference size of haddock taken by EU and UK vessels at Rockall is 30 cm. There is no minimum landing size for haddock taken by non-EU/UK vessels within international waters.

In order to protect the pre-recruit stock, the International Waters component of the statistical rectangle 42D5 has been closed for fishing since 2001 and its EU component since 2002 (see the Stock Annex, Section A.3). The protected area (the whole rectangle) is referred to as the Rockall Haddock Box. In 2022, in response to a request for advice from NEAFC on the efficiacy of the closure to protect juvenile haddock, ICES concluded the following:

The Rockall Haddock Box does coincide with areas of high juvenile and adult haddock densities, with high densities also observed outside the box to the northeast. For most years since the closure, haddock densities of age classes 1+ have been higher inside than outside the box. The overall impact of the current closure area on the Rockall haddock stock continues to be difficult to assess

In order to protect cold-water corals, three further areas (North West Rockall, Logachev Mounds and West Rockall Mounds) were closed since January 2007 (see the Stock Annex, Section A.3). A new area to protect cold-water corals (Empress of Britain Banks) was established by the NEAFC in 2007 and 2012.

Since 2009 in NEAFC regulatory area, including international waters of Rockall, a discard ban was established. The fishery for haddock within EU/UK waters is under the landing obligation.

There is no agreed management plan for haddock in this area. Two management strategies (NEAFC and EU MAP) have been assessed to be precautionary. NEAFC requested ICES to evaluate the harvest control rules (HCRs) that use F_{MSY} as a target. ICES concluded that the NEAFC HCRs in the long-term management strategy for Rockall haddock were consistent with the precautionary approach (ICES, 2019a).

The multiannual management plan (MAP) which has been adopted by the EU for this stock (EU, 2019) has not been agreed with UK.

Fishery in 2021

Russian fishery in 2021

No information was provided on the Russian fishery at Rockall in 2021. Total official landings of haddock at Rockall by the Russian Federation amounted to 20 t (Table 7.3.1).

UK fishery in 2021

A small number of larger Scottish demersal trawlers continue to target haddock at Rockall with the fishery largely conducted during the summer months and periods of good weather. Other important target species included anglerfish (*Lophius* spp.), ling, saithe and megrim. Total Scottish haddock landings in 6b have declined by over 40% since 2019. Quota uptake was also relatively low (<50%) in 2021 which may be related to availability of haddock (and quota) on less distant fishing grounds such as in Divisions 6a and 4a. In 2021 there was a significant increase in the proportion of UK landings taken in international waters (almost 30% in 2021 compared to an average of 15% over 2018-2020). (Table 7.3.2).

Irish fishery in 2021

Reported landings by Irish vessels decreased in 2021 compared to 2020 (Table 7.3.1), although as for UK vessels there was an increase in the proportion of landings being taken in the NEAFC area. Irish vessels used single otter trawls with a mesh size ranging from 100 to 120 mm together with a square mesh panel.

7.3 Data

Landings

Nominal landings as reported to ICES are given in Table 7.3.1 and shown in Figure 7.3.1, along with Working Group estimates of total estimated landings. Revisions to official catch statistics for previous years are also shown in Table 7.3.1. Some data previously submitted are now no longer or only partially available due to national data confidentiality clauses (Ireland in 2018 and 2019). As has been the case for over 10 years, the majority of the reported landings come from the UK (almost 90% in 2021) with smaller amounts reported by Ireland and the Russian Federation.

Data for the NEAFC area only (Sub-division 6b.1) are also shown in Table 7.3.1 and in Table 7.3.2 by nation. Up to 2019, these area taken from the official landings statistics. For 2020 and 2021, the estimates are a mixture of official landings and landings from Intercatch as landings for the UK are not available split by sub-division in the preliminary official landings data. In some years, Russian landings are reported as being from 27.6b_NK (i.e. unknown sub-division), however it is assumed that all these landings have been taken in the NEAFC area (i.e. sub-division 27.6.b.1). The proportion of the total landings coming from international waters is almost 30% in 2021, a substantial increase compared to 2019 and 2020.

Anecdotal evidence suggests that misreporting of haddock from Rockall has occurred historically (particularly on fishing trips where vessels fish in both Division 6a and 6b), but a quantitative estimation of the degree of misreporting is not possible.

Landings data submitted to Intercatch are shown in Figure 7.3.2. Russian Federation landings were not submitted by the national data submitter for 2021, however a comparison of historical official landings and ICES estimates suggested the two to be consistent and therefore ICES estimated landings for the Russian Federation were assumed equal to the official reported landings for 2021 (and subsequently imported to Intercatch).

International age composition and mean weight-at-age in the landings were compiled according to the methods described in the Stock Annex. Landings age compositions were allocated to unsampled fleets using a weighted average of all sampled fleets (excluding the Russian fleet which retain all landings on board). The weighting algorithm used is 'Mean weight weighted by numbers-at-age or length'.

The need to use a data limited approach for the assessment and advice this year meant that length frequency data also had to be processed. Landings length compositions were allocated to unsampled fleets in the same manner as age compositions. Data were processed in InterCatch for 2012 onwards.

BMS landings

In 2016, Below Minimum Size (BMS) landings (subject EU landings obligation) were negligable at 0.4 t. In 2017 and 2018 BMS landings were not reflected in the catch statistic. 4 t of BMS landings were reported in 2019, 2 t in 2020 and < 1 t in 2021. The assessment includes BMS landings within

total landings (although these unsampled data are allocated age/length compositions from sampled discards).

Discards

Haddock at Rockall have lower size-at-age than haddock from other areas (Blacker, 1971; Khlivnoy, 2006; Filina, Khlivnoy and Vinnichenko, 2009). Historically, the discard rate was as high between 12 and 75% by weight according to the results of discards trips (see the Stock Annex). The methods used to reconstruct the historical time-series of discards when sampling data were insufficient or unavailable is described in the Stock Annex.

At the 2019 benchmark, the catch-at-age data from 2012 onwards were re-estimated in InterCatch. The two main fleets (UK(Scotland OTB_DEF_>=120 and Irish OTB_DEF_100–119) are t sampled for both landings and discards. Discard rate allocation to other unsampled fleets consisted of:

- Manually matching annual discards to available quarterly landings by country/fleet (where necessary);
- Using a weighted average discard rate for all unsampled fleets (weighted by CATON) with the exception of the Norwegian longline fleet and the Russian fleet for which discards are both assumed to be zero.

Discards age and length compositions are allocated to unsampled fleets in a similar manner to landings age/length compositions. This process has been conducted annually since the 2019 benchmark.

Figure 7.3.3 shows estimated landings and discards for 2021 after raising. Scottish landings data are submitted to InterCatch by sub-division with sampling available only for sub-division 6.b.2 and hence there are raised discards associated with this component of the landings. The final mix of numbers-at-length from sampled and un-sampled landings and sampled and raised (unsampled) discards is given in Figure 7.3.4. The unsampled landings and unsampled raised discards are both associated with the Scottish landings from sub-division 6.b.1.

During the 2019 benchmark meeting, the discards data for 2010 were also revised. The discards were calculated on average discards proportion of total catch but prior to the 2019 benchmark, the discards only for 2010 were calculated on that proportion applied to the landings (not total catch). The benchmark concluded that the previous method applied for 2010 was incorrect, as discards proportion is relative the total catch. Since 2019 in correct assessment, the discards for 2010 were calculated based on the discards numbers in 2009 at-age recalculated using the ratio between total landings in 2009 and 2010 (by numbers).

The WG estimates of total landings and discards by weight are given in Table 7.3.3 and shown in Figure 7.3.5. In recent years, the total discard proportion by weight (Figure 7.3.6) has shown substantial variability but is typically below 20% (21% in 2021). This is substantially lower than the estimated discard proportion at the start of the time series when the Scottish fleet was generally utilising a smaller mesh size.

Due to the distant nature of the fishery and the fact that there are relatively few vessels/trips making landings, sampling levels for both landings and discards for this stock are relatively poor. Sampling levels did not significantly worsen during the COVID-19 pandemic and the WG considers that sampling levels are adequate for the estimation of catch length-based indicators.

Age- and length-compositions and mean weights-at-age

Raised landings numbers-at-age and discard numbers-at-age are given in Tables 7.3.4 and 7.3.5 respectively and total catch numbers-at-age in Table 7.3.6. Although these are not required for the data limited approach utilised this year, they are included here for completeness.

The catch-at-length compositions which are used to derive length based indicators for the data limited approach utilised this year are shown in Figure 7.3.7.

Annual mean weights-at-age in landings, discards and catch are given in Tables 7.3.7, 7.3.8 and 7.3.9 and shown in Figure 7.3.8. Mean weights-at-age in the landings (and catch) were relatively stable historically, but show a significant increase since the mid-2000s, particularly at ages 4 and above, as well as showing increased variability. While the variability may be due to low sampling levels, the reason for the trend is not known, but could potentially be due to cohort dependent growth rates although this has not been fully explored.

Biological

There was no change in natural mortality and maturity compared last year's assessment (see the Stock Annex) although neither are used in the data limited approach employed this year.

Historically, stock weights-at-age were assumed to be equal to the raw catch weights. However, the number of sampled trips for both landings and discards has been low for a number of years and this appears to have led to substantial variability in the mean weight-at-age estimates. For this reason, at the 2019 benchmark, it was agreed that five year rolling average catch mean weights-at-age should be used as stock mean weights-at-age. These are given in Table 7.3.10.

As a check on the trends in the stock mean weights-at-age derived from catch mean weights-at-age, mean weights-at-age were also derived from survey data and a comparison made (Figure 7.3.9). Survey mean weights-at-age are calculated by i) estimating an annual length-weight relationship (from the samples in the DATRAS 'CA' data), ii) calculating individual weight-at-length using the length-weight parameters, iii) deriving an annual length frequency –at-age by raising the ALK (from the 'CA' data) to the total length distribution (from 'HL' data), iv) calculating mean weight-at-age using the results of ii) and iii). (Pre 2011 an average weight-length relationship over all available years was used as no individual weight data were recorded in this period).

Although there are missing values in the survey data, values appear reasonably consistent with those from the catch and there is some evidence of an increase since the early 2000s (although more recently, survey estimates appear somewhat lower). For the derivation of the total biomass index used as the stock indicator, the stock mean weights-at-age 1-7 are derived from the catch mean weights as per previous assessment WGs (5 year rolling mean) while age 0 stock mean weights-at-age are derived from the survey as these are largely not available from the catch (and in the years they are available, estimates are likely to be impacted by gear selectivity).

Surveys

The Scottish Rock-IBTS-Q3 survey is the only survey available for this stock. The survey is co-ordinated by IBTS and described further in the IBTS reports, the Stock Annex and the 2019 benchmark report (ICES, 2019).

The survey originally began in the 1990s, but in 2011, a number of changes were made: the survey groundgear was changed from GOV-C to GOV-D and the survey changed from a fixed station design to random stratified covering a greater depth range than previously. Studies

conducted in 2006 and 2009, comparing the catchability of the two groundgears (WD 5 in ICES, 2012a) suggested no significant differences in the catch rate of haddock. The assessment WG in 2012 (ICES, 2012b) proposed an approach which was agreed at the 2019 benchmark, whereby only the subset of survey stations occurring within the depth range of the original (pre 2011) survey were included in the post 2011 index calculation. This allowed the survey to be treated as a continuous time series in the assessment (known as the 'standard index'). This year, the WG was unable to recreate the calculation of the 'standard index' and therefore the 2021 index value could not be calculated according to this approach. Therefore, a new index was calculated according to the survey design.

In the new index calculation (2011 onwards), numbers at length per haul are standardised to numbers per hour towing (LFD). An ALK is calculated for each of the four strata and then this ALK is applied to the LFDs from each of the hauls separately to produce age frequencies for each haul. Finally, for each stratum, the age frequencies are summed and the values divided by the number of valid hauls to provide numbers at age per hour. This procedure can be summarised as

$$CPUE_{i,a} = \frac{\sum_{h=1}^{H_i} \sum_{l=l_{\min}}^{l=l_{\max}} N_{i,a,l,h}}{H_i}$$

where $N_{i,a,l,h}$ is the number of fish at age a and length l caught during haul h, H_i is the number of valid hauls in stratum i and $CPUE_{i,a}$ is the catch per unit effort of fish at age a in stratum i.

For each age, the age frequency for each stratum is raised by the stratum area. These raised frequencies are then summed and the result divided by the total area in the assessment region. The final index value for each age is given by

$$I_a = \frac{\sum_{i=1}^{S} CPUE_{i,a} A_i}{\sum_{i=1}^{S} A_i}$$

where A_i = area (m²) of stratum i and S = number of strata. Survey variance estimates are calculated in a similar manner.

The old index (pre-survey change in 2011) is given in Table 7.3.11. The new index (estimate and variance) is given in Table 7.3.12. The previously used continuous 'standard index' is not presented but can be found in last year's WG report (ICES, 2021).

Plots of survey log cpue at age by cohort are shown in Figure 7.3.10 and comparative scatterplots of log index at-age are shown in Figure 7.3.11. The survey shows good internal consistency in tracking of year-class strength through time.

In Figure 7.3.12 compares the new (2011 onwards) index with that used in previous assessment WGs mean standardised over the common time period. The two indices show small differences, mostly confined to age 0 and the older ages, where the new index appears to be higher for the strong year classes.

Commercial Effort, Lpue and Cpue

Commercial effort data have previously been provided for Scottish, Irish and Russian fleets, along with lpue and cpue data respectively. These data have not been updated in recently years

and have not been used for assessment purposes and are therefore not included here (See 2020 WG report for data).

7.4 Derivation of stock indicators

Survey index

The biomass index for use in the data limited approach to advice was derived as the sum of products of the survey numbers-at-age (Table 7.3.12) and stock mean weights-at-age (Table 7.3.10). The index is shown in Figure 7.3.13 (and Table 7.3.13) in comparison and broken down by age class in Figure 7.3.14. The survey biomass index increases from its lowest value at the start of the time series and shows a general decline since 2018. The SSB from the 2021 assessment also shows an increase although this does not begin until after 2014 when the individuals are mature (knife edge maturity at age 3 assumed in the assessment).

Growth parameter estimation

Rockall haddock is a poorly studied stock and there is limited published information on individual growth. Fishbase quote a value of L_∞=43.8 cm and k=0.269 for von Bertalanffy growth parameters for 'Rockall Island' based on Blacker (1971), although the latter publication does not appear to contain these values or the data source from which they are derived, but indicates that this stock is slower growing than others. Fishbase also contains a range of estimates from other haddock stocks around the UK (Figure 7.3.16). There are multiple L_∞ values for North Sea haddock which range from 48 cm to 74 cm and the diversity of values may be associated with cohort dependent growth which is believed to occur in haddock stocks (due to varying cohort size and associated resources).

Given that the Scottish Q3 Rockall haddock survey data contains a substantial amount of length and age sampling, von Bertalanffy growth parameters were estimated using these data. Although it is acknowledged that deriving growth parameters based on length-stratified age samples (the 'CA' data in Datras) results in biased estimates (Perreault et al., 2020) there appears to be no agreed approach as to how best to account for the overall length frequency data in the calculation. The approach taken here was to calculate the length given age (using 'CA' and 'HL' data from Datras) and use a weighted nls regression with each length weighted according to the proportion at length given age. (such that proportions sum to 1 for each age). All survey data from 1999 onwards were included and vB parameters were estimated for each cohort separately for cohorts with more than 6 age classes. Figure 7.3.15 shows the fitted vB curves and length-age data points (although the weighting of each point is not shown). It is clear from this figure that when there are no age zero data points, the k value cannot be estimated correctly (much too small) resulting in an almost linear vB curve with very high L_∞. However, it is also clear that there is significant variability in estimates between cohorts. The WG therefore agreed to take the median L_∞ (55 cm) and k (0.24) values forward for use in the data limited approach. These values are compared to those in Fishbase in Figure 7.3.16. The value is around the middle of the other estimated values while L_∞ appears to be towards the lower end of the range of values (but higher than the previously quoted value for Rockall haddock).

Length-based indicator

Initially annual estimates were made for Lc and $L_{F=M}$ (assuming Linf=55) and are shown in Table 7.3.14. The annual estimate of Lc is calculated as the lower boundary of the length class which has length frequency at half the maximum (i.e the half the frequency at the modal length). The last 5 years (2017-2021) was taken as the period over which to calculate Lc for use in the length-based indicator (and associated reference point) calculation. During this period, catch length frequency data do not appear to be too noisy (Figure 7.3.7) and the stock consists of the full range of lengths (i.e. recruitment has been reasonable over a number of years). Averaged over 2017-2021, Lc=31.6 and the resulting length-based indicator reference point, $L_{F=M}$ = 37.4 cm. The mean length of individuals > Lc (31.6cm) in the catch was then calculated on an annual basis. The resulting mean length estimates (and LBI i.e. values relative to the $L_{F=M}$ reference point) are given in Table 7.3.15. LBI values are greater than one for the whole time series for which they are available which suggests that the stock is being fished below FMSY.

The development of the indicators in relation to their reference points is shown in Figure 7.3.17.

7.5 Derivation of data limited reference points

The only reference points used in the assessment this year are those associated with the data limited approach. MSY Btrigger is defined from the lowest observed survey index (66.764 kg hr^{-1} in 2011). The fishing pressure proxy indicator (length-based indicator) is always given in relative terms and therefore the indicator reference point value is 1. The MSY proxy reference length

Framework	Reference point	Value	Technical basis
MSY approach	MSY $B_{trigger}$	93.5	Biomass index trigger value ($I_{trigger}$), defined as $I_{trigger} = I_{loss} \times 1.4$, where I_{loss} is the lowest observed historical biomass index value from 2011. In kg per hour.
	$F_{MSY\ proxy}$	1	$L_{mean}/L_{F=M}$; Mean catch length divided by MSY proxy reference length ($L_{F=M}$ = 37.4 cm).

7.6 Application of the advice rule

The ICES data limited approach for category 3 stocks was applied. According to the new WKLIFE approach, given that this stock has a von Bertalanffy k value between 0.2 and 0.32, the 'rfbm' rule with m=0.9 is applied. The WG considered that recent catches have not been too different compared to the advice and therefore the starting point for the application of the rule was last year's advice. This rule uses the application of a multiplier based on the recent trend in a stock biomass index (r), the fishing pressure proxy (f), a biomass safeguard (b) and a precautionary multiplier (m). The stock has declined by 38% in recent years, however, it is still well above the Itrigger value and therefore the biomass safeguard is 1. In this case the stability clause is applied to limit the decline in advice to 30%.

Previous catch advice Ay		5825 tonnes
Stock biomass trend		
Index A (2020, 2021)		401 kg hr^{-1}
Index B (2017, 2018, 2019)		646 kg hr^{-1}
r: Index ratio (A/B)		0.62
Fishing pressure proxy		
Mean catch length (Lmean = L2021)		39.0 cm
MSY proxy length (LF = M)		37.4 cm
f: multiplier for relative mean length in catches ($L_{mean}/L_{F=M\ 2020}$)		1.04
Biomass safeguard		
Last index value (I_{2021})		446 kg hr^{-1}
Index trigger value ($I_{trigger} = I_{loss} \times 1.4$)		93.5 kg hr^{-1}
b: multiplier for index relative to trigger min{$I_{2021}/I_{trigger}$, 1}		1
Precautionary multiplier to maintain biomass above Blim with 95% probability		
m: multiplier (generic multiplier based on life history)		0.90
RFB calculation**		3378 tonnes
Stability clause (+20%/−30% compared to Ay, only applied if b≥1)	Applied	0.70
Discard rate		9%
Catch advice for 2023 and 2024 (Ay × stability clause)		4078 tonnes
Projected landings corresponding to advice***		3704 tonnes
% advice change^		-30 %

7.7 Management plans

In 2011 and 2012 in accordance with the conclusions of the 2010–2011, Annual Meeting of the NEAFC, a delegation from the RF and EU considered a management plan. In light of ICES suggestions, the necessary adjustments required to draft a plan were considered. The revised proposal for a harvest control component of a long-term management plan for haddock at Rockall was forwarded to NEAFC for approval at the 2012 Annual Meeting. ICES was requested to evaluate the EU-Russia proposal for the harvest control component of the management plan for Rockall haddock and to evaluate the proposal of protection of juvenile Rockall haddock. The management plan states total catch should not exceed the established TAC and includes measures to record and minimise discards.

ICES evaluated a new HCR proposal for Rockall haddock between RF and EU nations in August 2013 (ICES, 2013) and found that a maximum F of 0.2 was required in the HCR to ensure consistency with the precautionary approach, under the low recruitment conditions observed since 2004.

The NEAFC regulatory area (RA) established a ban on discards. Measures to reduce discards for the stock distribution area were required. The remainder of the management plan for this species is considered to be suitable and has been agreed by the Contracting Parties (NEAFC, 2015).

In 2017, NEAFC requested ICES to evaluate the harvest control component and to consider whether the plan is consistent with the precautionary approach required to provide sustainable harvesting of the stock.

In 2019, ICES evaluated the harvest control rules (HCRs) proposed for Rockall haddock and advised that they are considered precautionary in the short, medium, and long term under the assumption of intermediate levels of productivity.

The HCRs with TAC constraint rule (a) in the request are precautionary in the long term under all scenarios, except those with very low recruitment. If recruitment is low (as observed between 2007 and 2012) over a long time frame, without sporadic recruitment peaks, none of the HCRs

are precautionary in the long term. TAC constraint rule (a) generally leads to lower probability of SSB < B_{lim} than the constraint rule (b), both in the short and long term.

7.8 Recommendation for next benchmark

The WG was unable to recreate the survey index used in previous assessments due to the lack of availability of code/spreadsheet. Therefore the agreed (at 2019 benchmark) category 1 assessment could not be conducted and advice had to be provided on the basis of a category 3 stock. Given that the previous category 1 assessment was not rejected and that survey and catch data are considered adequate for an analytical assessment, the WG agreed that this stock should be benchmarked as soon as possible with the following issues.

Type	Problem/Aim	Work Required	Data Required
Tuning series	Calculation of previously used index (derived from Scottish Q3 survey) cannot be reproduced due to non availability of code/spreadsheet. Need to agree a new index for use in the assessment. Due to survey design change in 2011 may require a break in the index or potentially modelled index to account for this.	Develop a modelled index including relevant explanatory variables. Explore internal consistency. Comparison with previously used index & stratified mean estimates (from MSS work up). Consider sensitivity of assessment results/quality of assessment for alternative indices.	Scottish Q3 survey data (available in Datras)
Biological parameters	Stock mean weights are currently assumed rolling average of catch mean weights which have shown significant increases (particularly older ages) and variability in recent years. which contributes to the increase in stock size. Not clear if this is a low sampling issue or a real change (cohort effect?).	Explore catch sampling data for mean sizes (consistency across samples/fleets etc). Use survey data to derive mean weights at age for comparison. Other options?	Catch mean weights at age data. Survey data (in Datras).
Biological parameters	Maturity - currently assumption of knife-edge at age 3. Limited data suggest some maturity at age 2. Consider whether current assumption remains appropriate.	Review available data/literature. Comparison to other stocks.	Maturity data - very limited due to timing of current survey (no Q1 survey).
Biological parameters	Natural mortality. Currently fixed over all ages. Last benchmark suggested exploring potential for age-dependent M based on life-history/mean weights.	Explore alternative approaches for deriving natural mortality values.	Life history parameters.
Assessment method	Previous cat1 assessment used FLXSA. Poor catch sampling leads to substantial uncertainty in the catch at age data used in the assessment - a more appropriate	Development of a SAM assessment.	Assessment input data.

Type	Problem/Aim	Work Required	Data Required
	assessment method which can account for this uncertainty is required (e.g. SAM).		
Biological reference points	If a new analytical assessment is agreed, biological ref pts will need to be re-estimated.	Re-estimation of biological ref pts.	Assessment model outputs.
Discards	Very poor sampling of the fishery. Some historical discard data (UK & EU fleets) have been estimated using a combination of survey data & selectivity/discard ogives derived from years with samples. Unlikely to be able to revisit or make re-visions due to unavailability of raw data. Not clear if all recent data have been uploaded to Intercatch. (Currently 2012 onwards processed in Intercatch).	Check WKROCK data call (2019), contents of Intercatch & with national data submitters. If additional data likely to be available, then data call, otherwise, no data call.	

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7.9 Management considerations

The fishery for haddock at Rockall is partly in international waters and can therefore be exploited by non UK and EU vessels. The agreed TAC applies only to UK and EU vessels.

Previously, advice for this stock was given following ICES MSY approach based on a Category 1 stock assessment; the applied method gives advice following ICES MSY approach for data limited stocks using the empirical rfb rule (Fischer et al., 2021).

The basis for the advice (rfb rule) has a biennial advice interval and so advice is provided for 2 years (ICES 2022).

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Table 7.3.1. Nominal landings (tonnes) of haddock in Division 6.b, as officially reported to ICES.

Year	Faroe Islands	France	Iceland	Ireland	Norway	Portugal	Russian Federation	Spain	UK (E,W, & NI)	UK (Scot.)	UK (total)	Total	Unallocated	Landings from NEAFC area**	ICES landings#
1996	-	-	-	747	24	-	-	1	293	5753		6818	254	n/a	7072
1997	-	-	+	895	24	-	-	22	165	4114		5220	-53	n/a	5167
1998	-	-	-	704	40	4	-	21	561	3768		5098	-112	n/a	4956
1999	-	-	167	1021	61	-	458	25	288	3970		5990	-634	n/a	5356
2000	-	5	-	824	152	-	2154	47	36	2470		5688	-243	n/a	5445^
2001	-	2	-	357	70	-	630	51	-	1205		2315	-295	n/a	2020^
2002	-	-	-	206	49	-	1630	7	+	1145		3037	81	n/a	3118^
2003	-	-	-	169	60	-	4237	19	56	1607		6148	-180	n/a	5968^
2004	-	-	-	19	32	-	5844	-	-	411		6306	128	n/a	6434
2005	-	-	-	105	33	-	4708	-	-	332		5178	61	n/a	5239
2006	2	+	-	41	123	-	2154	5	1	439		2765	-9	n/a	2756
2007	2	-	-	338	84	-	1282	+	8	1635		3349	-2	n/a	3347
2008	16	-	-	721	36	-	1669	1	-	1779		4222	0	n/a	4222
2009	10	1	-	352	71	-	55	+	-	2951		3440	-199	n/a	3241
2010	42	-	-	169	65	-	198	+	-	2931		3405	-1	n/a	3404
2011	2	+	-	123	40	-	-	-	-	1732		1897	-37	n/a	1860
2012	53	-	-	31	48	-	1	-	-	577		710	-24	33	686
2013	-	-	-	105	121	-	4	-	-	596		826	63	147	889
2014	24	2	-	94	55	-	388	-	-	1152		1713	132	423	1845
2015	1	-	-	190	66	-	136	-			2052	2445	65	241	2510
2016	+	-	-	362	63	-	-	-			2160	2585^^	-81	565	2504^^
2017	+	-	-	500	26	-	153	-			3907	4586	-156	715	4430
2018	-	-	-	431##	16	-	-	-			3418	3865##	-15	782##	3850
2019	-	8	-	4##	13	-	245	1			6536	6807##^^	975	809	7782^^
2020*	-	-	-	679	14	-	133	+			4575	5401^^	109	745	5510^^
2021*	+	+	-	510		-	20	-			3558	4088^^	7	1183	4095^^

*** Preliminary official landings.**

****Official landings except 2020 & 2021 which include ICES estimates.**

^ Includes the total Russian catch.

^^ Including below minimum size (BMS) landings.

+ <0.5 tonnes.

 # Updated in 2022.

##Incomplete: part of the data being unavailable under data confidentiality clauses.

n/a = Not available.

Table 7.3.2. Haddock 27.6b. Landings from the NEAFC area (Subdivision 27.6b.1). (Mixture of official landings and ICES estimates – see Section 7.3 for explanation).

Year	Faroe Islands	France	Ireland	Norway	Russian Federation	Spain	UK (total)	Total
2012		0	2.2	4.96	1	0	24.6	32.8
2013		0	4.5	31.4	4	0	107.2	147.1
2014		0	5.85	28.9	388	0	0	422.7
2015		0	6.4	38.6	136	0	59.9	240.9
2016		0	5.2	47.9	-	0	511.8	564.9
2017		0	19.9	7.3	153	0	535.1	715.3
2018		0	**	9.9	-	0	772.6	782.5**
2019		1.4	3.8	7.3	245	0.51	550.4	808.5
2020*			15.3	11.6	133		584.6	744.6
2021*	0.2	0.012	140.9		20	0	1021.6	1182.7

***Preliminary**

****Incomplete: part of the data being unavailable under data confidentiality clauses.**

Table 7.3.3. Haddock in 6.b. ICES estimates of landings and discards. (* Indicates including BMS)

Year	Landings	Discards
1991	5656	13231
1992	5321	11874
1993	4781	9854
1994	5732	11028
1995	5588	9170
1996	7072	9356
1997	5167	5893
1998	4986	10863
1999	5356	11065
2000	5445	6611
2001	2020	1536
2002	3118	4154
2003	5968	5520
2004	6434	883
2005	5239	505
2006	2756	386
2007	3347	2242
2008	4222	2104
2009	3241	1556
2010	3404	907
2011	1860	152
2012	686	26
2013	889	1065
2014	1845	332
2015	2510	554
2016	2504	401
2017	4430	379
2018	3850	788
2019	7782*	303
2020	5510*	130
2021	4095*	1117

Table 7.3.4. Haddock in 6.b. International landings numbers (*10^3) at-age.

	Age						
Year	1	2	3	4	5	6	7
1991	87	6807	3011	1344	558	32	464
1992	86	3642	5623	964	580	364	160
1993	28	1919	4740	1157	489	144	290
1994	30	1160	5299	3665	1039	66	141
1995	1	146	5205	4791	1319	279	43
1996	2	5149	1861	4149	2347	473	85
1997	0	319	2102	2155	3658	1540	192
1998	4	392	1815	1340	1898	2284	1301
1999	245	2600	2994	1972	1228	1600	2291
2000	33	3446	5081	3006	1296	1176	1963
2001	402	994	1116	555	991	462	549
2002	657	2983	3998	2111	809	217	392
2003	920	8103	11010	1848	1189	879	593
2004	197	1765	9502	9119	1364	286	472
2005	887	2835	6866	7913	725	98	182
2006	2344	768	1290	2356	2269	428	150
2007	31	1220	2709	1074	1550	1634	719
2008	17	749	6191	1164	479	761	848
2009	5	11	244	5243	460	261	486
2010	0	71	196	352	4078	274	294
2011	2	23	71	177	181	2405	222
2012	0	0	134	51	0	35	410
2013	162	14	2	46	6	46	553
2014	226	1553	418	52	138	47	679
2015	9	820	3214	104	7	61	112
2016	127	612	2137	842	3	2	11
2017	7	1336	1783	2179	1207	58	59
2018	0	3418	502	2233	598	222	13
2019	10	1514	10556	59	484	90	60
2020	21	1936	1190	3392	364	518	180
2021	132	544	2863	556	1788	53	337

Table 7.3.5. Haddock in 6.b. International discards numbers (*10³) at-age.

YEAR	AGE						
	1	2	3	4	5	6	7
1991	21099	27040	12178	3998	1146	313	58
1992	15998	21069	12961	4397	1181	312	46
1993	11151	17456	10755	3781	1128	317	69
1994	8140	19464	12570	4545	1409	410	91
1995*	2748	9685	16379	4965	1145	508	36
1996	12094	13662	9051	5463	952	278	7
1997*	9957	10216	3286	1944	1344	218	15
1998*	14220	19415	8357	3423	1842	483	91
1999*	17037	19348	9209	3526	2191	1084	485
2000*	8189	9136	5616	1912	755	322	103
2001*	7268	1019	583	266	50	15	21
2002	12706	8136	539	334	89	43	51
2003	5655	15503	3558	217	97	48	8
2004	735	2346	781	93	22	10	2
2005	174	888	554	210	28	11	11
2006	536	707	336	58	22	8	1
2007	1458	8609	921	440	678	193	0
2008	458	1458	5246	128	28	203	82
2009	218	696	993	2803	35	2	18
2010*	152	463	868	1736	19	2	2
2011*	2	36	4	6	0	174	27
2012*	5	6	10	7	3	0	18
2013*	4733	84	99	40	33	38	12
2014*	179	1454	0	0	0	0	0
2015*	71	2153	173	0	0	0	0
2016*	245	439	503	146	0	0	0
2017*	1187	334	20	12	0	0	0
2018*	88	2955	3	40	0	0	0
2019*	275	471	308	8	76	0	0
2020*	237	263	0.00	0.2	0	0	0
2021*	2797	1556	339	72	74	0	0

*** Data calculated using estimates from discard observer trips.**

Table 7.3.6. Haddock in 6.b. International catch (landings and discards) numbers (*10^3) at-age.

	Age						
Year	1	2	3	4	5	6	7
1991	21 186	33 847	15 189	5 341	1 704	346	522
1992	16 084	24 711	18 584	5 361	1 761	676	206
1993	11 178	19 375	15 494	4 938	1 617	461	359
1994	8 170	20 623	17 868	8 209	2 449	476	232
1995	2 749	9 831	21 584	9 756	2 464	787	79
1996	12 096	18 811	10 911	9 612	3 299	751	92
1997	9 957	10 535	5 388	4 098	5 002	1 758	206
1998	14 224	19 807	10 173	4 763	3 740	2 767	1 391
1999	17 282	21 949	12 203	5 499	3 419	2 684	2 776
2000	8 222	12 581	10 698	4 917	2 050	1 498	2 066
2001	7 669	2 013	1 699	821	1 041	477	570
2002	13 363	11 119	4 537	2 445	898	260	444
2003	6 576	23 606	14 568	2 065	1 286	927	602
2004	932	4 112	10 282	9 212	1 386	296	474
2005	1 061	3 723	7 420	8 124	753	109	193
2006	2 880	1 475	1 626	2 414	2 291	436	151
2007	1 489	9 829	3 630	1 514	2 227	1 827	720
2008	476	2 207	11 437	1 291	507	964	930
2009	223	707	1 237	8 046	495	263	504
2010	152	534	1 064	2 087	4 096	276	296
2011	4	59	75	183	181	2 579	249
2012	5	6	144	58	3	35	428
2013	4 896	98	101	86	39	84	565
2014	406	3 008	418	52	138	47	679
2015	80	2 973	3 387	104	7	61	112
2016	374	1 051	2 639	988	3	2	11
2017	1 194	1 670	1 802	2 191	1 207	58	59
2018	88	6373	504	2273	598	222	13
2019	288	1995	10866	67	560	90	60
2020	264	2202	1190	3392	364	518	180
2021	2931	2101	3202	628	1862	53	337

Table 7.3.7. Haddock in 6.b. International landings mean weights-at-age (kg).

YEAR	AGE						
	1	2	3	4	5	6	7
1991	0.302	0.402	0.444	0.592	0.724	0.963	0.704
1992	0.136	0.366	0.455	0.658	0.612	0.759	0.954
1993	0.305	0.402	0.503	0.701	0.830	0.820	0.972
1994	0.314	0.356	0.452	0.558	0.638	1.224	0.890
1995	0.377	0.311	0.414	0.479	0.640	0.699	1.236
1996	0.327	0.436	0.501	0.487	0.627	0.709	0.783
1997	0.300	0.315	0.401	0.444	0.564	0.661	0.973
1998	0.256	0.344	0.494	0.517	0.542	0.591	0.678
1999	0.085	0.177	0.326	0.417	0.495	0.595	0.662
2000	0.111	0.206	0.242	0.328	0.413	0.483	0.720
2001	0.094	0.281	0.344	0.497	0.427	0.522	0.690
2002	0.107	0.196	0.227	0.323	0.521	0.627	0.804
2003	0.100	0.164	0.246	0.350	0.387	0.423	0.606
2004	0.142	0.172	0.241	0.293	0.446	0.617	0.754
2005	0.103	0.184	0.230	0.310	0.461	0.614	1.095
2006	0.084	0.167	0.223	0.327	0.440	0.598	0.789
2007	0.096	0.238	0.275	0.322	0.449	0.521	0.578
2008	0.125	0.197	0.302	0.444	0.583	0.752	0.984
2009	0.300	0.346	0.420	0.416	0.692	0.512	1.031
2010	0.052	0.420	0.517	0.457	0.591	0.980	1.473
2011	0.214	0.329	0.613	0.454	0.694	0.594	0.780
2012	0.189	0.368	0.632	0.850	0.898	1.412	1.238
2013	0.510	0.554	0.713	0.972	1.361	0.948	1.267
2014	0.186	0.351	0.268	0.545	1.000	1.036	1.370
2015	0.107	0.327	0.615	0.354	1.178	0.948	1.439
2016	0.409	0.574	0.664	0.767	1.576	1.808	2.650
2017	0.173	0.460	0.587	0.692	0.944	0.780	1.270
2018	-1	0.332	0.564	0.705	0.935	1.235	1.928
2019	0.190	0.489	0.589	0.825	1.116	1.440	1.683
2020	0.298	0.531	0.576	0.807	0.749	1.029	1.363
2021	0.284	0.394	0.512	0.837	0.818	1.138	1.150

Table 7.3.8. Haddock in 6.b. International discards mean weights-at-age (kg).

YEAR	AGE						
	1	2	3	4	5	6	7
1991	0.142	0.199	0.253	0.306	0.345	0.358	0.499
1992	0.133	0.217	0.258	0.298	0.330	0.342	0.499
1993	0.137	0.220	0.260	0.307	0.346	0.359	0.504
1994	0.153	0.226	0.263	0.308	0.345	0.356	0.508
1995	0.118	0.220	0.276	0.325	0.341	0.329	0.438
1996	0.136	0.218	0.276	0.326	0.370	0.348	0.515
1997	0.136	0.238	0.272	0.312	0.372	0.442	0.512
1998	0.141	0.248	0.267	0.291	0.327	0.336	0.451
1999	0.139	0.212	0.255	0.288	0.313	0.318	0.417
2000	0.189	0.267	0.289	0.311	0.330	0.334	0.484
2001	0.135	0.247	0.294	0.344	0.412	0.440	0.513
2002	0.137	0.254	0.308	0.335	0.398	0.338	0.382
2003	0.161	0.223	0.287	0.342	0.337	0.440	0.487
2004	0.148	0.218	0.282	0.343	0.324	0.371	0.449
2005	0.171	0.240	0.298	0.357	0.387	0.473	0.511
2006	0.132	0.233	0.334	0.420	0.495	0.435	0.423
2007	0.115	0.179	0.233	0.227	0.243	0.280	0.420
2008	0.202	0.264	0.279	0.370	0.351	0.358	0.446
2009	0.247	0.287	0.319	0.343	0.360	0.662	0.507
2010	0.141	0.220	0.292	0.301	0.322	0.534	0.250
2011	0.178	0.248	0.300	0.302	0.795	0.727	0.481
2012	0.263	0.295	0.488	0.319	0.339	0.733	0.797
2013	0.201	0.337	0.228	0.397	0.247	0.679	0.980
2014	0.082	0.218	-	-	-	-	-
2015	0.104	0.227	0.334	-	-	-	-
2016	0.240	0.276	0.325	0.393	-	-	-
2017	-	0.308	0.482	0.520	0.726	-	-
2018	0.088	0.258	0.361	0.422	0.479	0.536	-
2019	0.180	0.259	0.297	0.374	0.486	-	-
2020	0.2422	0.274	-	0.512	-	-	-
2021	0.182	0.284	0.336	0.344	0.394	-	-

Table 7.3.9. Haddock in 6.b. International catch (landings and discards) mean weights-at-age (kg).

YEAR	AGE						
	1	2	3	4	5	6	7
1991	0.142	0.240	0.291	0.378	0.469	0.414	0.681
1992	0.133	0.239	0.318	0.362	0.423	0.567	0.852
1993	0.137	0.238	0.335	0.400	0.493	0.503	0.882
1994	0.153	0.233	0.319	0.420	0.469	0.477	0.740
1995	0.118	0.222	0.309	0.401	0.501	0.460	0.870
1996	0.136	0.278	0.314	0.396	0.553	0.575	0.762
1997	0.136	0.240	0.322	0.381	0.512	0.634	0.940
1998	0.141	0.250	0.308	0.354	0.436	0.546	0.663
1999	0.138	0.208	0.272	0.334	0.379	0.483	0.619
2000	0.189	0.250	0.267	0.321	0.382	0.451	0.709
2001	0.133	0.264	0.326	0.447	0.427	0.520	0.683
2002	0.135	0.239	0.237	0.325	0.509	0.579	0.755
2003	0.153	0.203	0.256	0.349	0.384	0.424	0.604
2004	0.147	0.198	0.244	0.294	0.444	0.609	0.753
2005	0.114	0.197	0.235	0.311	0.459	0.600	1.062
2006	0.093	0.198	0.245	0.329	0.441	0.595	0.787
2007	0.114	0.186	0.265	0.294	0.386	0.496	0.578
2008	0.199	0.241	0.291	0.437	0.571	0.669	0.937
2009	0.248	0.288	0.339	0.391	0.668	0.513	1.012
2010	0.141	0.247	0.333	0.327	0.590	0.977	1.464
2011	0.198	0.280	0.596	0.449	0.695	0.603	0.748
2012	0.263	0.295	0.622	0.784	0.372	1.411	1.219
2013	0.211	0.368	0.236	0.704	0.423	0.827	1.261
2014	0.140	0.286	0.268	0.545	1.000	1.036	1.370
2015	0.104	0.254	0.601	0.354	1.178	0.948	1.439
2016	0.298	0.449	0.600	0.711	1.556	1.808	2.650
2017	0.219	0.430	0.586	0.691	0.944	0.780	1.270
2018	0.088	0.298	0.563	0.700	0.935	1.233	1.928
2019	0.180	0.434	0.581	0.771	1.030	1.440	1.683
2020	0.245	0.500	0.576	0.807	0.749	1.029	1.363
2021	0.186	0.312	0.493	0.781	0.801	1.138	1.150

Table 7.3.10. Haddock 6.b. Stock mean weights-at-age (kg). (* Indicates values from survey data)

YEAR	AGE							
	0*	1	2	3	4	5	6	7
1991	NA	0.142	0.240	0.291	0.378	0.469	0.414	0.681
1992	NA	0.133	0.239	0.318	0.362	0.423	0.567	0.852
1993	NA	0.137	0.238	0.335	0.400	0.493	0.503	0.882
1994	NA	0.153	0.233	0.319	0.420	0.469	0.477	0.740
1995	NA	0.137	0.234	0.314	0.392	0.471	0.484	0.805
1996	NA	0.136	0.242	0.319	0.396	0.488	0.516	0.821
1997	NA	0.136	0.242	0.320	0.399	0.506	0.530	0.839
1998	NA	0.137	0.245	0.314	0.390	0.494	0.538	0.795
1999	0.017	0.134	0.240	0.305	0.373	0.476	0.540	0.771
2000	NA	0.148	0.245	0.297	0.357	0.452	0.538	0.739
2001	0.022	0.148	0.242	0.299	0.368	0.427	0.527	0.723
2002	0.028	0.147	0.242	0.282	0.356	0.426	0.516	0.686
2003	0.029	0.150	0.233	0.272	0.355	0.416	0.491	0.674
2004	NA	0.151	0.231	0.266	0.347	0.429	0.517	0.701
2005	0.028	0.136	0.220	0.260	0.345	0.444	0.546	0.771
2006	0.027	0.128	0.207	0.243	0.322	0.447	0.561	0.792
2007	0.030	0.124	0.197	0.249	0.315	0.423	0.545	0.757
2008	0.013	0.134	0.204	0.256	0.333	0.460	0.594	0.823
2009	0.008	0.154	0.222	0.275	0.352	0.505	0.574	0.875
2010	NA	0.159	0.232	0.295	0.355	0.531	0.650	0.956
2011	0.008	0.180	0.248	0.365	0.380	0.582	0.651	0.948
2012	0.018	0.210	0.270	0.436	0.477	0.579	0.834	1.076
2013	0.024	0.212	0.295	0.425	0.531	0.550	0.866	1.141
2014	0.020	0.191	0.295	0.411	0.562	0.616	0.971	1.212
2015	0.023	0.183	0.297	0.465	0.567	0.734	0.965	1.207
2016	0.018	0.203	0.330	0.465	0.619	0.906	1.206	1.588
2017	0.012	0.195	0.357	0.458	0.601	1.020	1.080	1.598
2018	0.021	0.170	0.343	0.524	0.600	1.123	1.161	1.731
2019	0.012	0.178	0.373	0.586	0.645	1.129	1.242	1.794
2020	0.015	0.206	0.422	0.581	0.736	1.043	1.258	1.779
2021	0.025	0.184	0.395	0.560	0.750	0.892	1.124	1.479

Table 7.3.11. Haddock in 6.b. Scottish Q3 Rockall haddock survey 1991-2009 (old index).

	0	1	2	3	4	5	6	7	8
1991	14458	16398	4431	683	315	228	37	64	3
1992	20336	44912	14631	3150	647	127	200	4	32
1993	15220	37959	15689	3716	1104	183	38	73	21
1994	23474	13287	11399	4314	969	203	30	12	4
1995	16923	16971	6648	5993	1935	483	200	16	-1
1996	33578	19420	5903	1940	1317	325	69	6	1
1997	28897	10693	2384	538	292	281	71	9	1
1998	-1	-1	-1	-1	-1	-1	-1	-1	-1
1999	10178	9969	2410	708	279	172	90	64	32
2000	-1	-1	-1	-1	-1	-1	-1	-1	-1
2001	31813	7455	521	284	154	39	14	12	14
2002	11704	20925	2464	173	105	65	20	10	15
2003	2526	10114	10927	1656	138	97	100	26	6
2004	-1	-1	-1	-1	-1	-1	-1	-1	-1
2005	24452	4082	920	1506	2107	231	33	13	7
2006	3570	18715	2562	256	1402	1694	349	16	6
2007	558	2671	6019	570	254	516	367	28	2
2008	85	560	966	3813	182	41	282	249	49
2009	132	139	323	488	1651	40	9	54	17

Table 7.3.12. Haddock in 6.b. Scottish Q3 Rockall haddock survey 2011 onwards (number per 10 hours).

Mean

	0	1	2	3	4	5	6	7+
2011	5.34	15.86	137.60	17.92	67.95	101.45	816.59	8.03
2012	14778.60	2.15	8.47	55.82	9.59	59.30	32.03	424.06
2013	3247.62	12258.74	7.94	22.05	36.56	22.59	27.98	347.17
2014	1925.84	6146.09	5274.52	3.84	0.00	8.82	0.00	109.53
2015	1211.67	2237.97	5390.05	4194.88	0.00	0.00	8.60	51.27
2016	33441.08	1154.50	1403.12	2444.32	1702.92	13.55	0.76	25.63
2017	18583.48	23852.74	615.22	966.59	1595.60	691.67	0.71	10.78
2018	6118.72	2878.79	10395.64	249.22	532.29	856.83	325.10	3.94
2019	2933.15	4003.82	2934.86	5806.47	107.41	131.20	317.02	178.34
2020	25149.28	1456.96	2114.08	774.48	1700.02	39.63	52.60	94.52
2021	29363.38	9445.42	679.64	864.30	414.42	892.77	45.34	55.80

Variance

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7+**
2011	2.90	27.76	1697.44	19.08	340.97	526.65	25921.61	2.69
2012	108959685.11	0.68	5.41	273.30	6.75	277.59	44.99	6162.86
2013	625196.73	3346529.04	25.18	152.47	844.77	86.09	360.46	16760.42
2014	195960.84	403331.21	620653.05	5.04	0.00	7.89	0.00	462.41
2015	65123.93	61454.67	171518.52	314384.40	0.00	0.00	12.67	99.08
2016	549457752.18	21367.73	29421.70	130113.84	88936.29	6.86	0.25	34.44
2017	184354785.46	4911190.53	6874.48	14332.22	41415.90	6184.16	0.02	3.33
2018	1204812.27	116784.67	1341249.83	5489.44	14867.12	62230.53	14816.24	1.29
2019	803305.84	260170.82	192851.61	2520643.85	804.91	820.30	6292.20	1548.22
2020	136236520.83	33883.47	50157.51	16396.79	131875.36	172.91	304.24	554.79
2021	77305629.48	1045147.35	5115.86	10912.53	2708.44	12225.15	63.14	24.66

Table 7.3.13. Haddock in Division 27.6.b. Survey biomass index (estimate and variance) including ages 0+ in kg per 10 hours.

Year	idx	var
2011	667.64	11323.48
2012	822.24	44562.36
2013	3139.49	173139.86
2014	2908.21	69487.92
2015	4059.65	85357.36
2016	3545.33	245237.44
2017	7219.27	238626.71
2018	5982.50	267038.84
2019	6176.63	916841.05
2020	3558.91	122493.71
2021	4464.18	99515.50

Table 7.3.14. Haddock in Division 27.6.b. Annual estimates of modal length, Lc, LF=M and Lmax.

Year	Lmode	Lc	LFeqM	Lmax
2012	48	34	39.25	74
2013	26	24	31.75	74
2014	27	26	33.25	82
2015	29	26	33.25	73
2016	38	31	37	72
2017	37	34	39.25	76
2018	31	28	34.75	91
2019	37	33	38.5	77
2020	38	33	38.5	82
2021	33	30	36.25	82

Table 7.3.15. Haddock in Division 27.6.b. Summary of the stock indicators used in the assessment and advice.

Year	low	value	high	Lbar	LBI	landings	discards	bms	catch
1991	NA	NA	NA	NA	NA	5656	13231	0	18868
1992	NA	NA	NA	NA	NA	5321	11874	0	17199
1993	NA	NA	NA	NA	NA	4781	9854	0	14655
1994	NA	NA	NA	NA	NA	5732	11028	0	16751
1995	NA	NA	NA	NA	NA	5588	9170	0	14754
1996	NA	NA	NA	NA	NA	7072	9356	0	16433
1997	NA	NA	NA	NA	NA	5167	5893	0	11049
1998	NA	NA	NA	NA	NA	4986	10863	0	15841
1999	NA	NA	NA	NA	NA	5356	11065	0	16417
2000	NA	NA	NA	NA	NA	5445	6611	0	12058
2001	NA	NA	NA	NA	NA	2020	1536	0	3554
2002	NA	NA	NA	NA	NA	3118	4154	0	7274
2003	NA	NA	NA	NA	NA	5968	5520	0	11498
2004	NA	NA	NA	NA	NA	6434	883	0	7321
2005	NA	NA	NA	NA	NA	5239	505	0	5740
2006	NA	NA	NA	NA	NA	2756	386	0	3141
2007	NA	NA	NA	NA	NA	3347	2242	0	5587
2008	NA	NA	NA	NA	NA	4222	2104	0	6325
2009	NA	NA	NA	NA	NA	3241	1556	0	4799
2010	NA	NA	NA	NA	NA	3404	907	0	4311
2011	46	67	88	NA	NA	1860	152	0	2012
2012	41	82	124	45.7	1.22	686	26	0	712
2013	232	314	396	42.9	1.15	889	1065	0	1952
2014	239	291	342	44.8	1.2	1845	332	0	2175
2015	349	406	463	39.5	1.05	2510	554	0	3063
2016	257	355	452	39.1	1.04	2504	401	0	2906
2017	626	722	818	40.6	1.09	4430	379	0	4810
2018	497	598	700	38.7	1.03	3850	788	0	4640
2019	430	618	805	41.4	1.1	7778	303	4	8090
2020	287	356	424	41.2	1.1	5508	130	2	5640
2021	385	446	508	39.0	1.04	4094	1117	1	5212

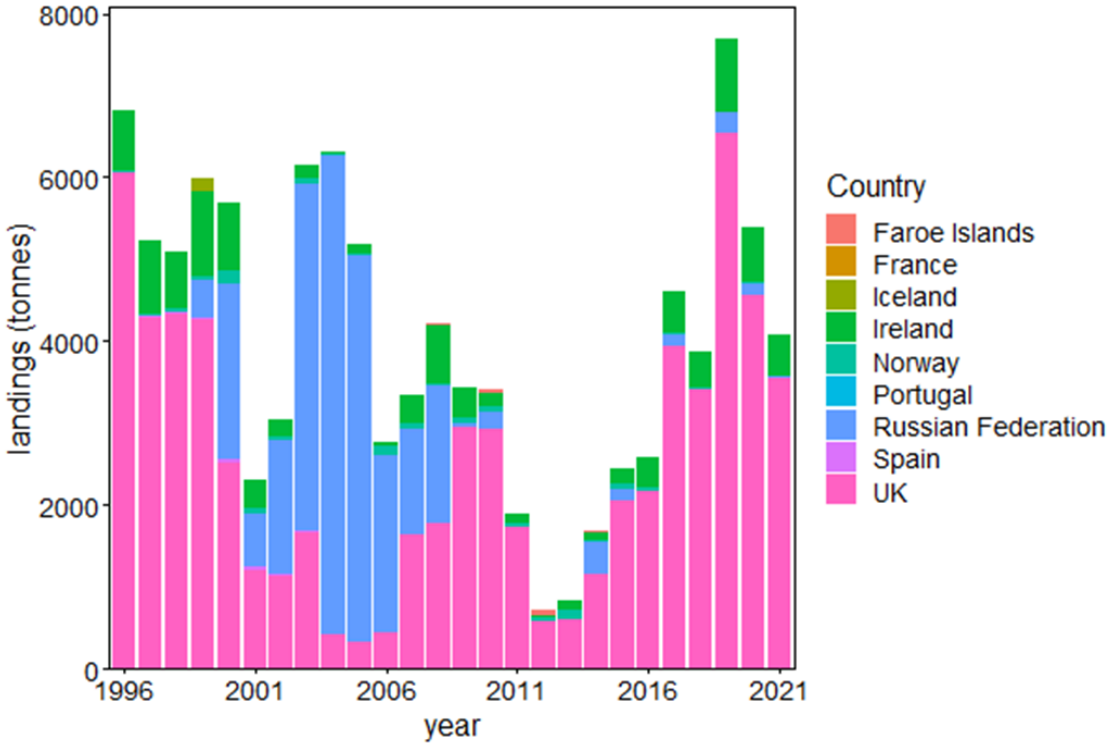

Figure 7.3.1. Haddock in Division 6.b. Official landings by country.

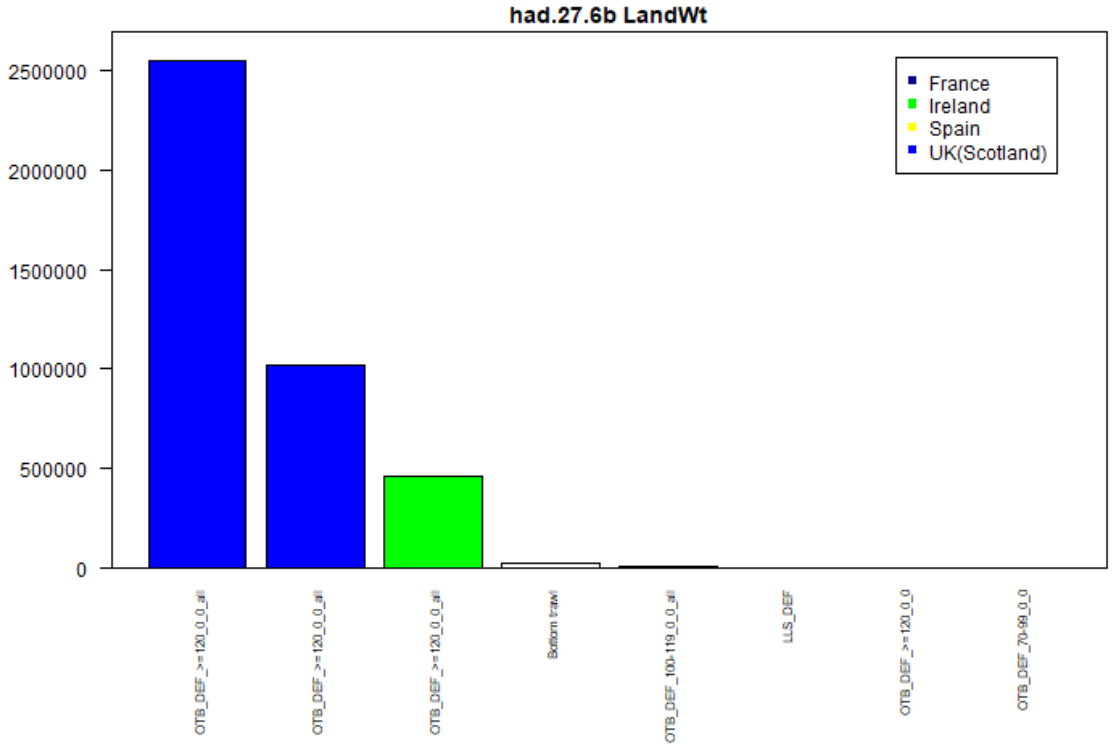

Figure 7.3.2. Haddock in Division 6.b. ICES estimated landings as submitted to Intercatch for 2021.

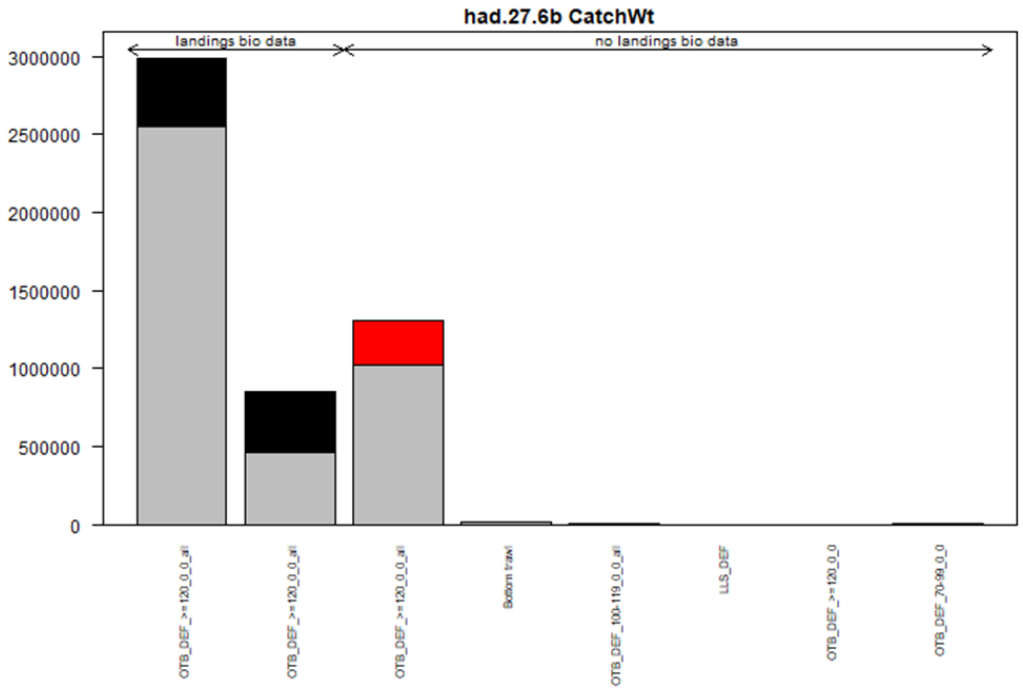

Figure 7.3.3. Haddock in Division 6.b. ICES estimated landings and discards after raising in Intercatch (grey=imported landings; black=imported discards; red=raised discards).

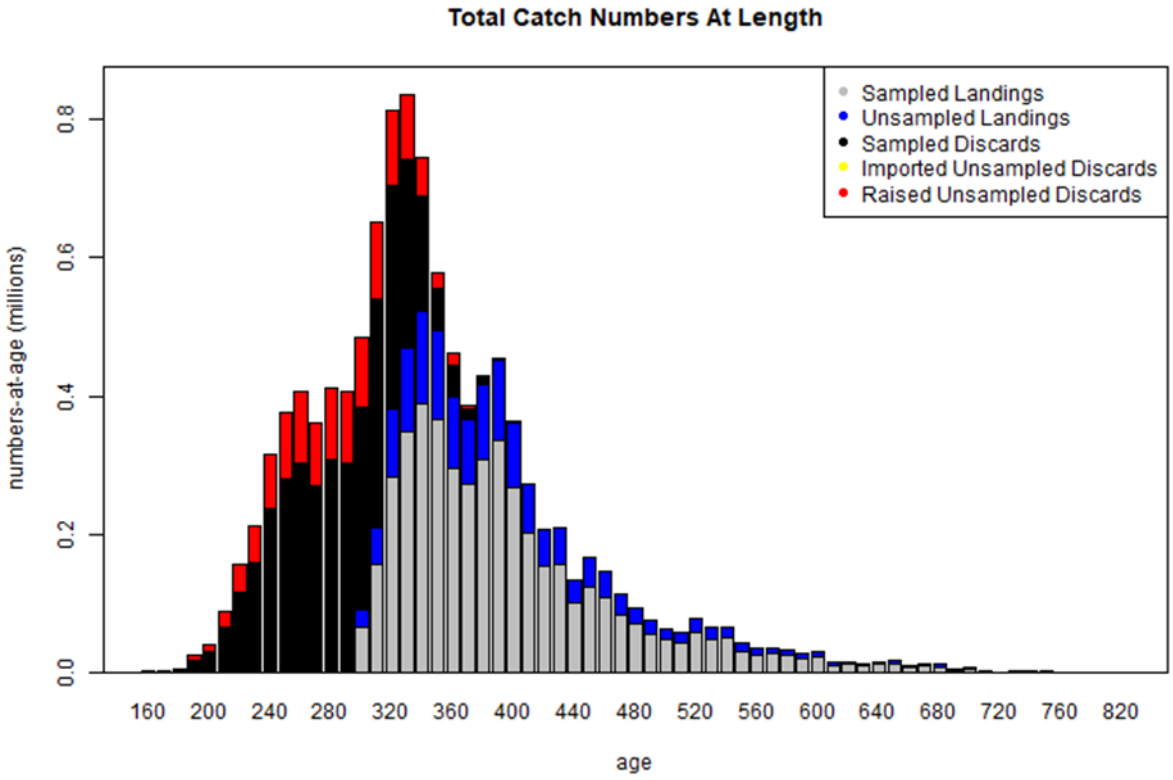

Figure 7.3.4. Haddock in Division 6.b. Catch numbers-at-length by sampled and un-sampled landings and sampled and raised (unsampled) discards for 2021, after allocations within InterCatch.

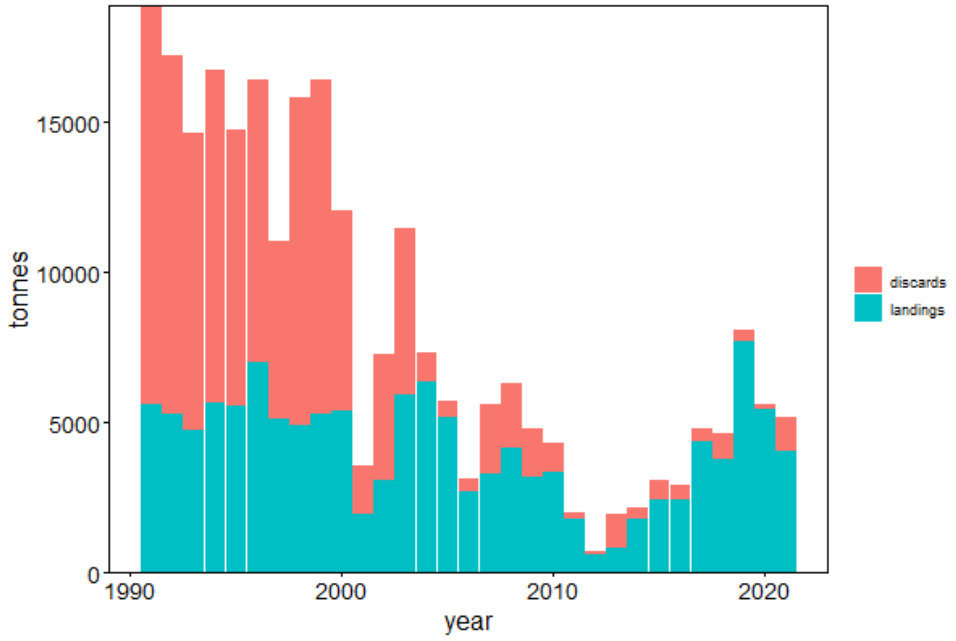

Figure 7.3.5. Haddock in Division 6.b. ICES estimates of total landings and discards.

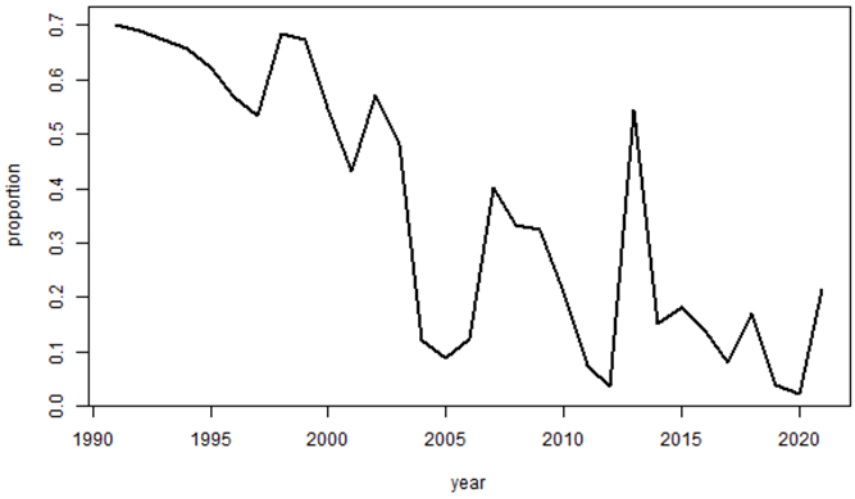

Figure 7.3.6. Haddock in Division 6.b. Discard proportion by weight.

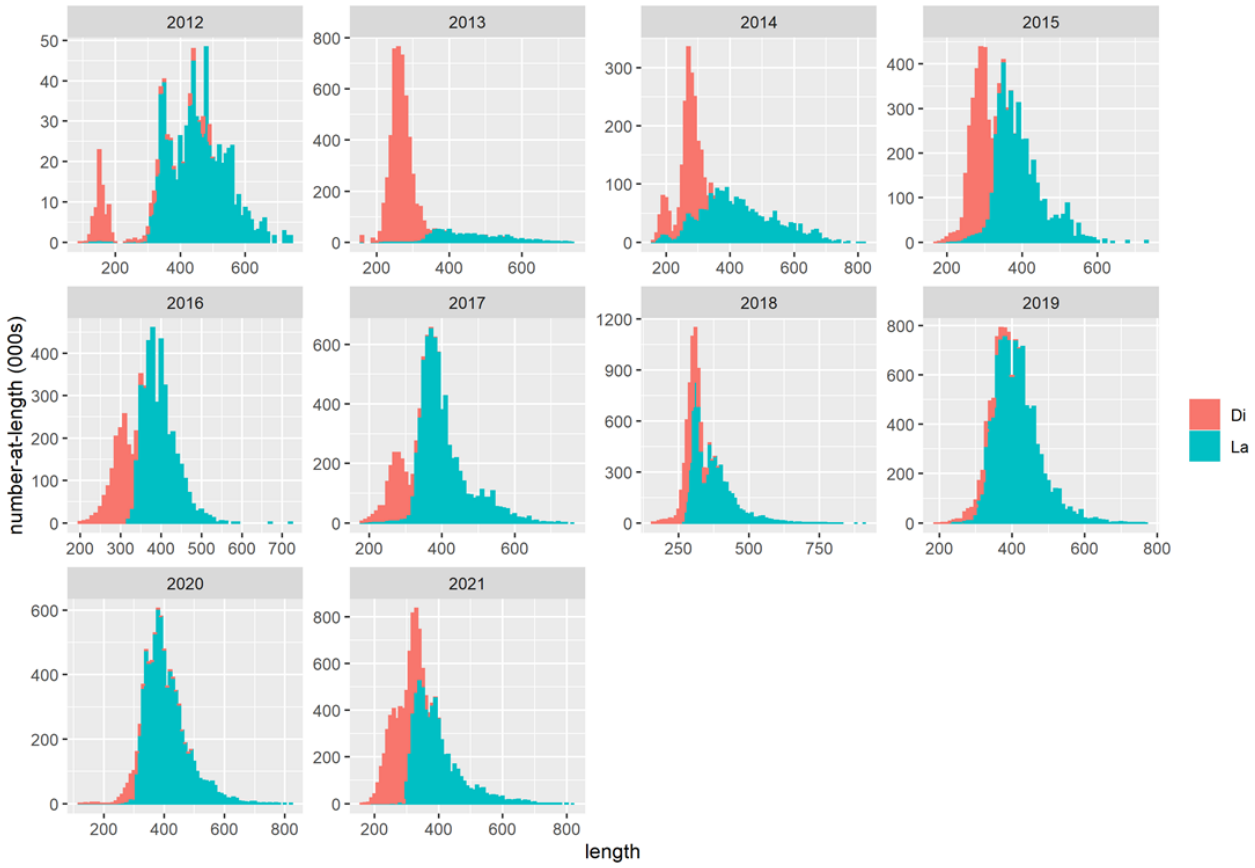

Figure 7.3.7. Haddock in Division 6.b. Catch-at-length in numbers by year. Red: discards, blue: landings.

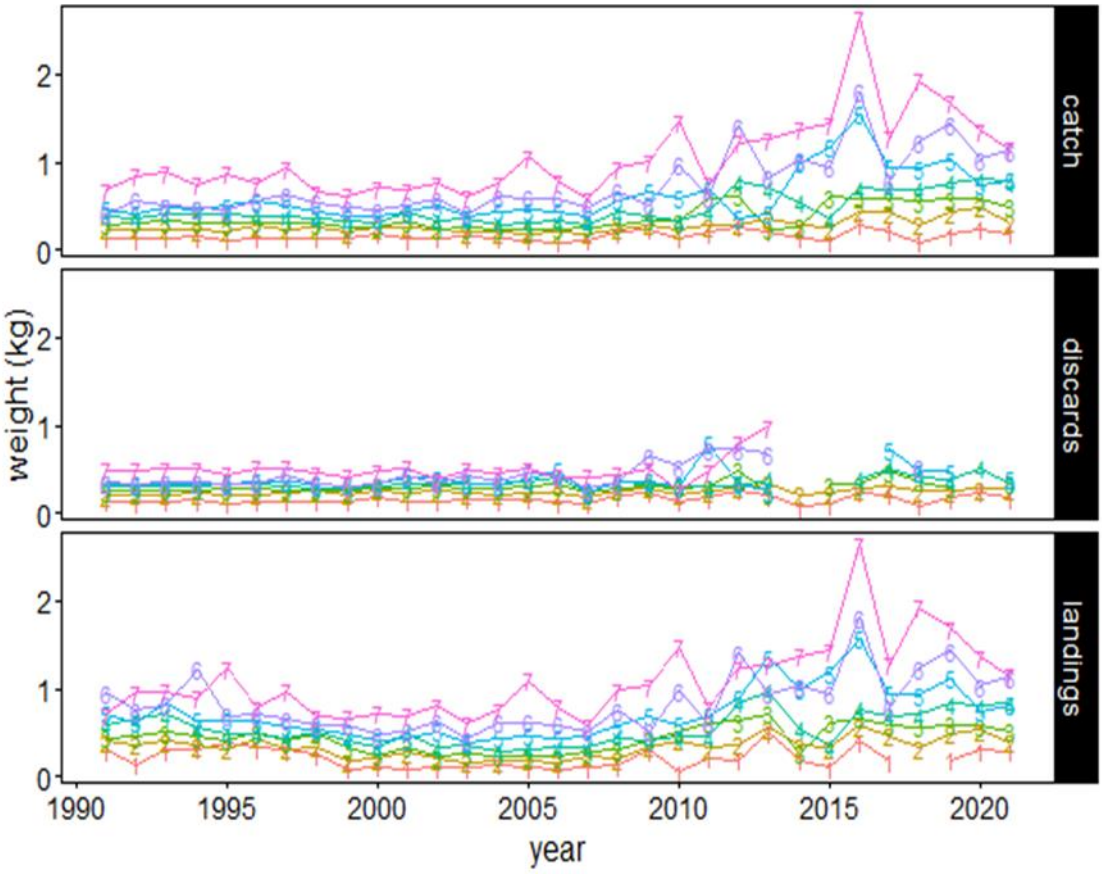

Figure 7.3.8. Haddock in Division 6.b. Mean weight-at-age in catch, discards and landings.

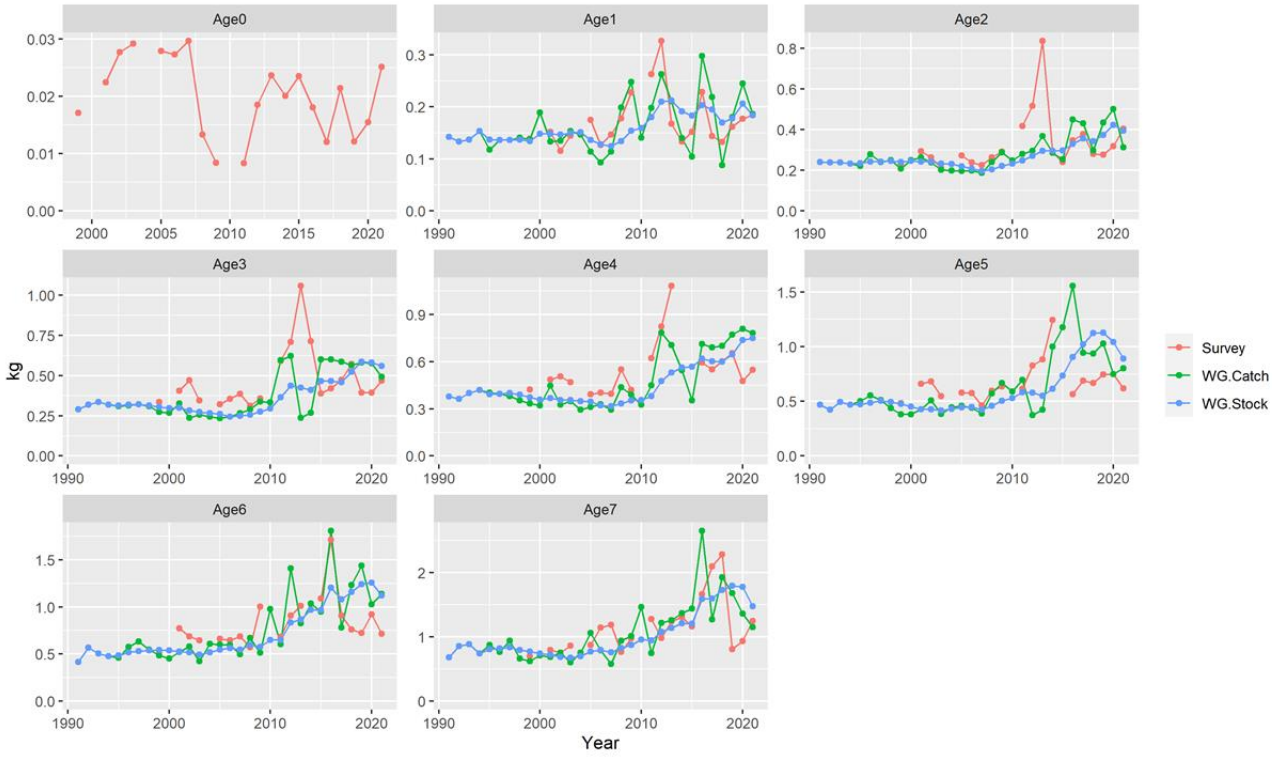

Figure 7.3.9. Haddock in Division 6.b. Mean weight-at-age in catch, stock and survey.

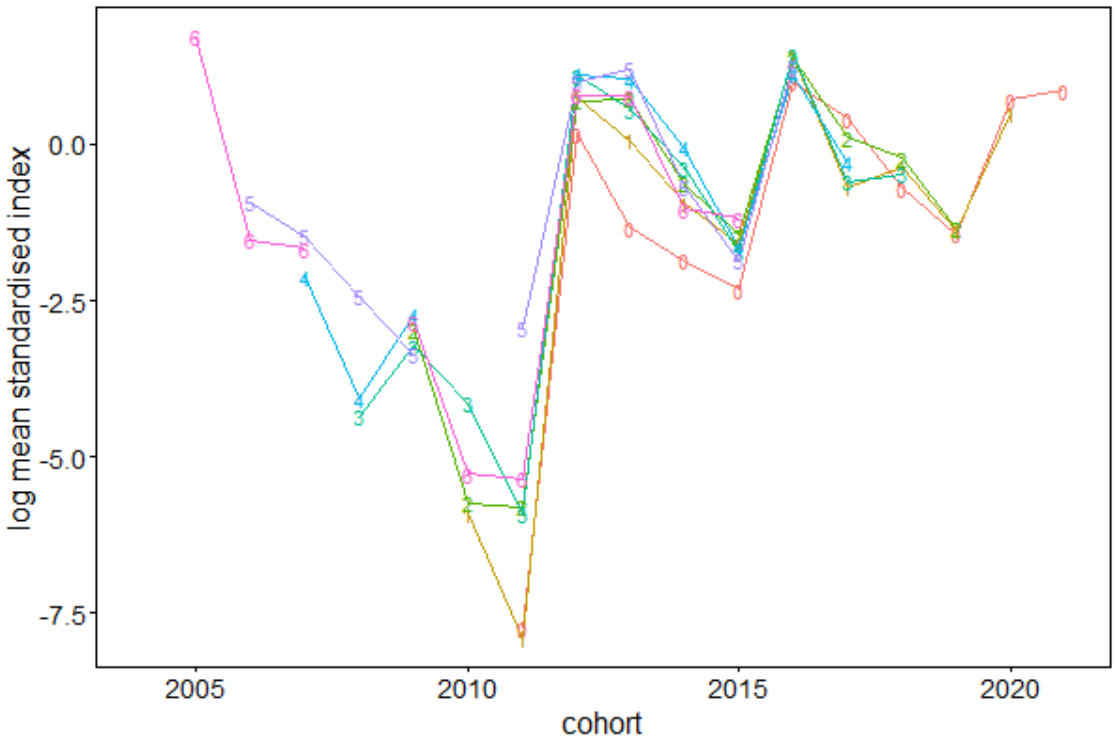

Figure 7.3.10. Haddock in Division 27.6.b. Log mean standardised index values by cohort from ScoRoc-Q3 survey (2011 onwards).

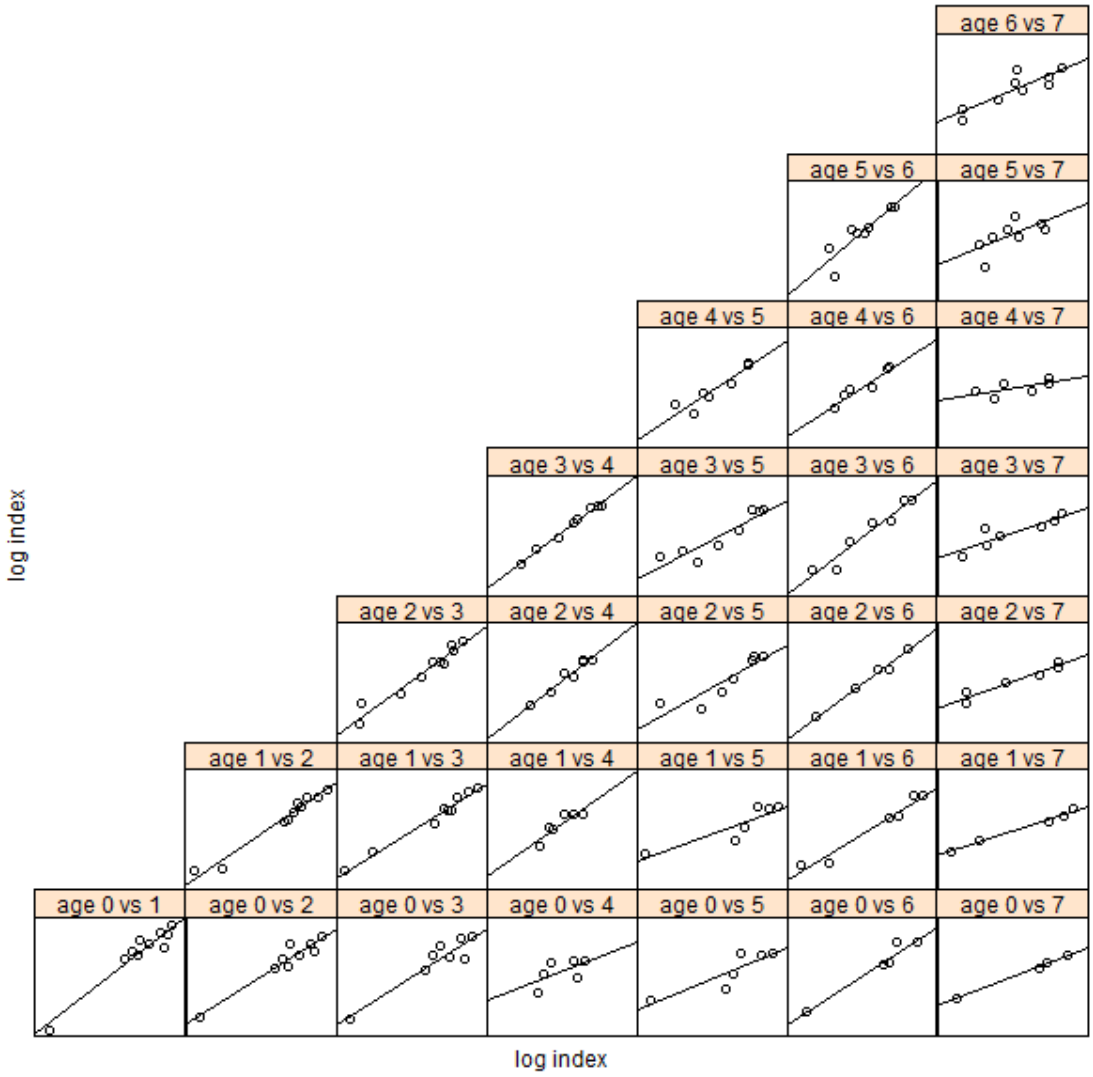

Figure 7.3.11. Haddock in Division 27.6.b.. Within-survey correlations for the ScoRoc-Q3 survey, comparing index values at different ages for the same cohorts (2011 onwards).

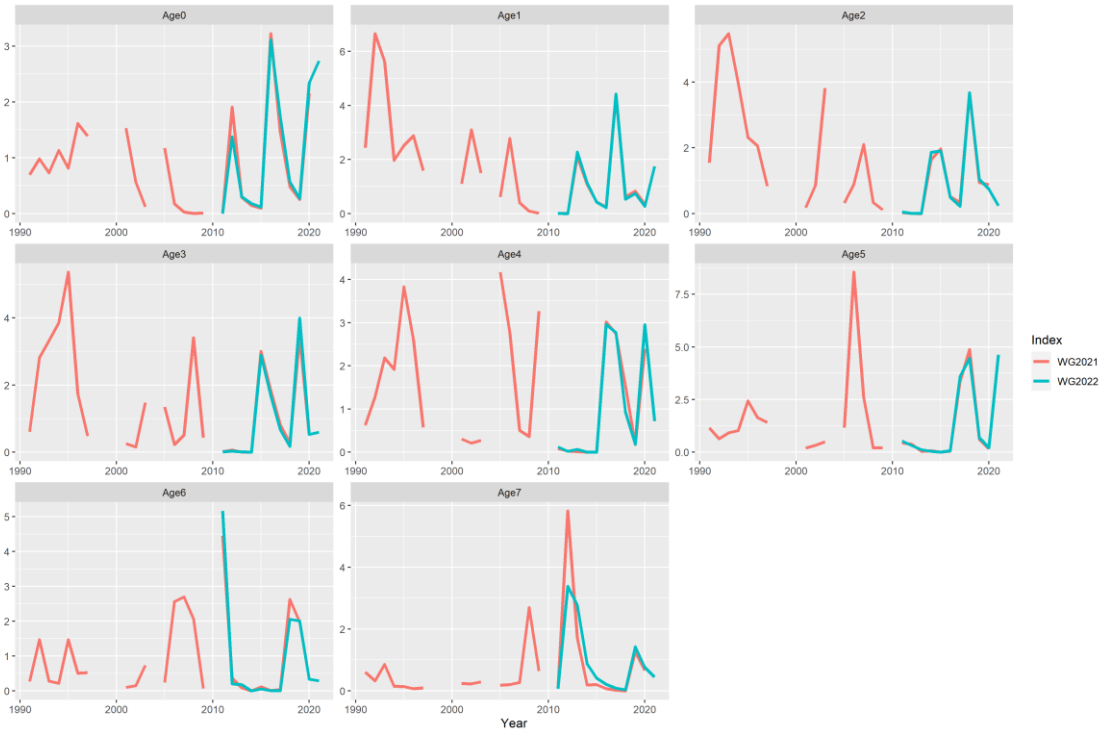

Figure 7.3.12. Haddock in Divisino 27.6.b. Comparison of survey index at age between the new index (2011 onwards) and the 'standard index' from the 2021 WG.

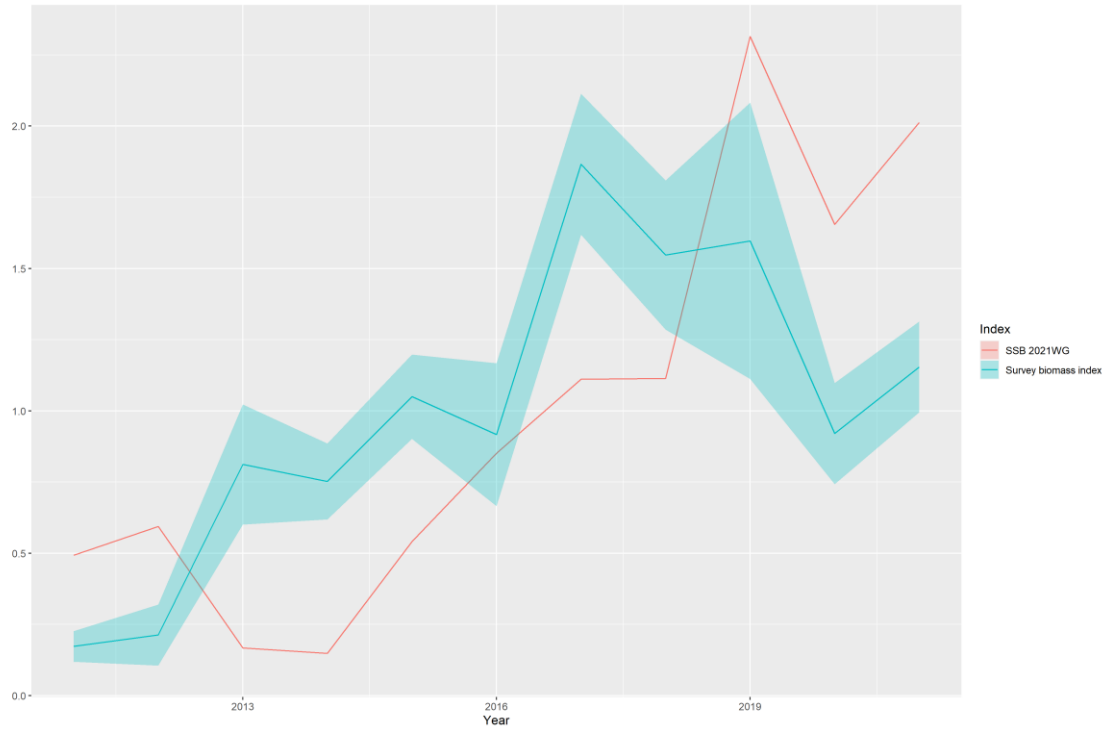

Figure 7.3.13. Haddock in Division 27.6.b. Comparison of biomass index with SSB from 2021 WG assessment (including the intermediate year value). Series are mean standardised.

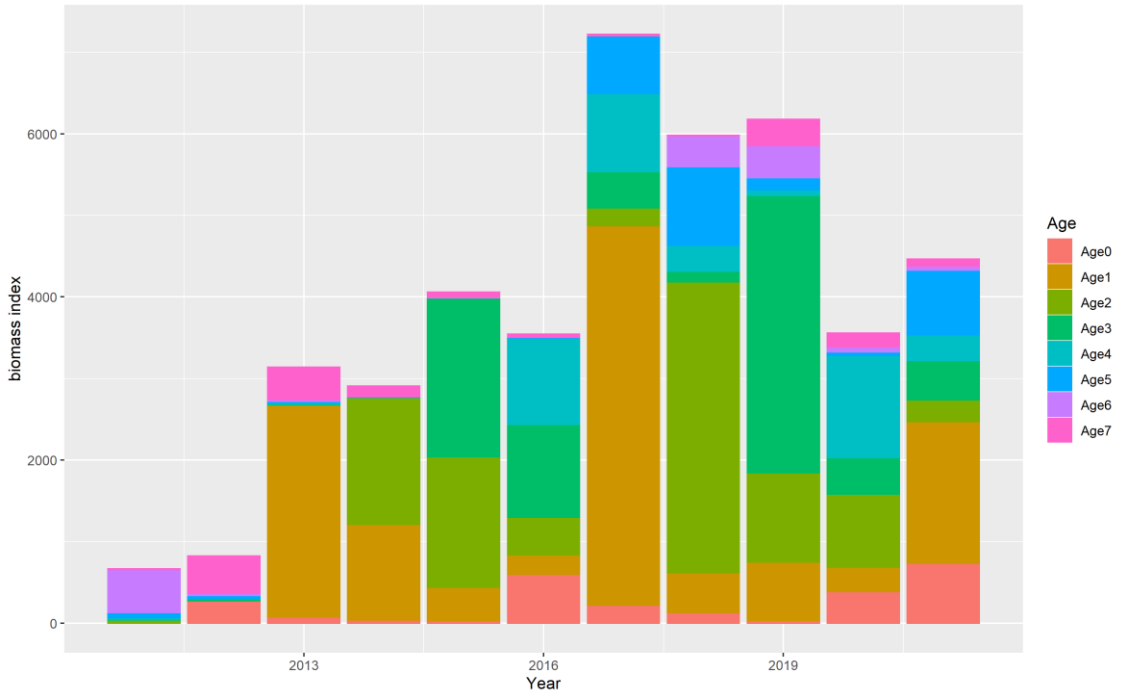

Figure 7.3.14. Haddock in Divison 27.6.b. Survey biomass (kg 10 hr^{-1}) over time by age.

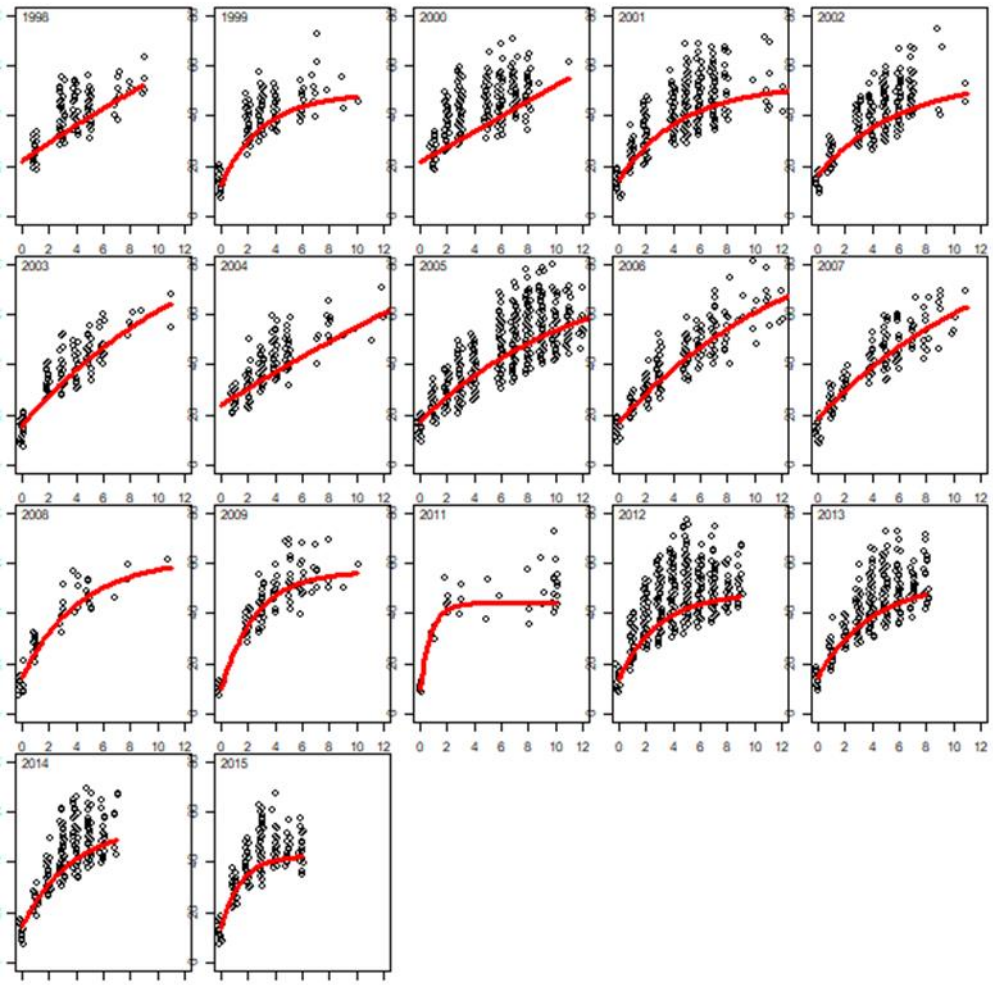

Figure 7.3.15. Haddock in Division 27.6.b. von Bertalanffy curves fitted to survey data by cohort. Note that circles represent individual length-age combinations and the weighting of each value is not shown.

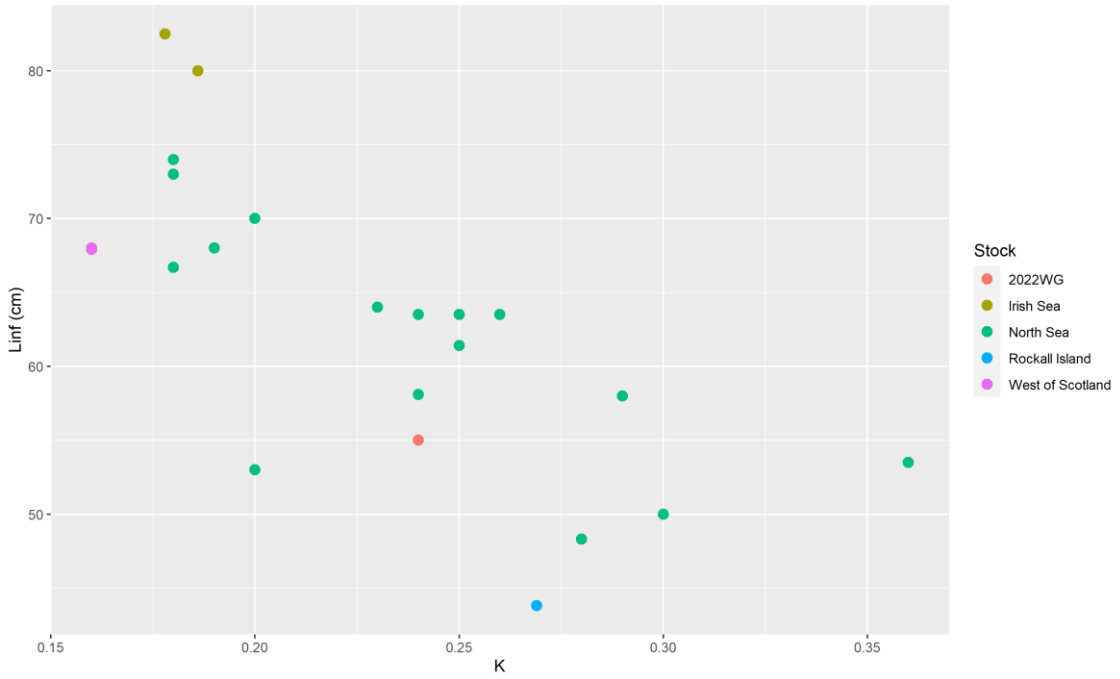

Figure 7.3.16. Comparison of growth parameters estimated at WG 2022 with those in Fishbase (other stocks around UK).

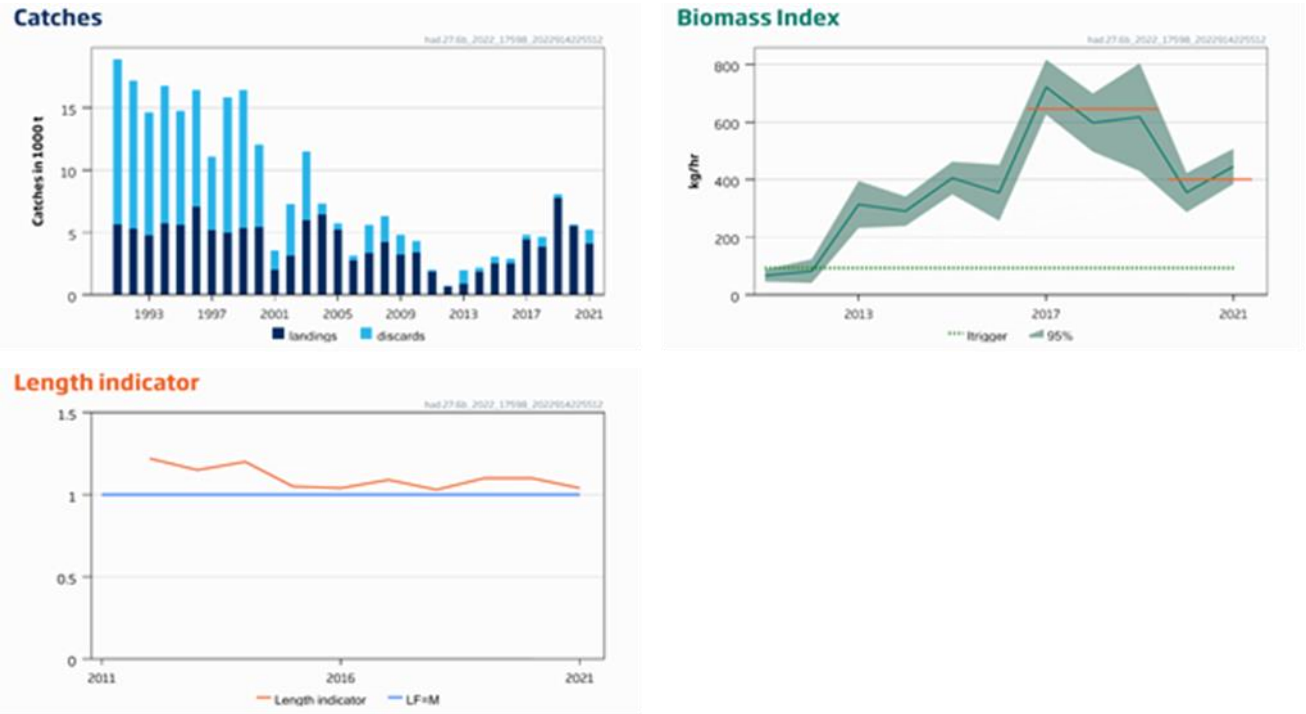

Figure 7.3.17. Haddock in Division 27.6.b. Summary of the stock assessment.