41 Whiting in Division 7.b, c, e–k

Type of assessment in 2017

Full analytical assessment (XSA) and short-term forecast tuned with a single combined survey index according to the stock annex. Since WGCSE 2015 national discard data have been available through InterCatch for countries with significant landings for this stock. Biological reference points proposed by WKMSYREF4 (ICES, 2016) are included also.

ICES advice applicable to 2017

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 25 125 tonnes.

Since this stock is only partially under the EU landing obligation, ICES is not in a position to advise on landings corresponding to the advised catch.

http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/whg-7e–k.pdf

ICES advice applicable to 2016

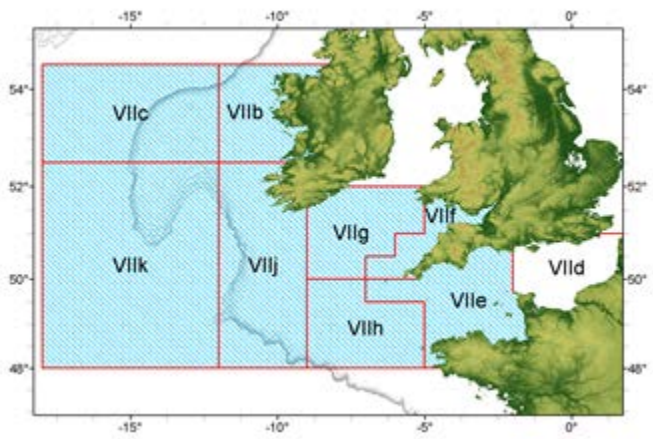
ICES advises based on the MSY approach that catches in 2016 should be no more than 19 076 tonnes. If discards rates do not change from the average of the last three years this implies landings of no more than 15 395 tonnes.

http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/whg-7e–k.pdf

41.1 General

Stock description and management units

The TAC for whiting is set for Divisions 7.b, 7.c, 7.d, 7.e, 7.f, 7.g, 7.h, 7.j and 7.k. The assessment area does not correspond to the TAC area. Since the 2014 Benchmark, Whiting in 7.b,c are now assessed as part of 7.bc, e–k, while whiting in 7.d are included in the WGNSSK assessment of the North Sea stock. Any management measures implemented for this stock should be consistent with the assessment area.



Red Boxes-TAC/Management Areas Blue Shading-Assessment Area.

The 2016 TAC for whiting 7.bc, e–k increased from 17 742 t (2015) to 22 778 t (2016) and increased again to 27 500 t for 2017. ICES official landings for whiting 7.bc, e–k in 2016 are 15 053 t. Thus the current TAC for whiting catches in the 7.bk stock area is not restrictive regarding landings in the 7.bc, e–k assessment area.

TAC in 2016

Species:	Whiting *Merlangius merlangus*	**Zone:**	VIIb, VIIc, VIId, VIIe, VIIf, VIIg, VIIh, VIIj and VIIk (WHG/7X7A-C)
Belgium	222		
France	13 668		
Ireland	6 333		
The Netherlands	111		
United Kingdom	2 444		
Union	22 778		
TAC	22 778	Analytical TAC Article 12(1) of this Regulation applies Article 7(2) of this Regulation applies	

Landings obligation

In 2016 the landings obligation applied to this stock for the first time in accordance with Delegate Regulation (EC, 2015). Vessels where more than 25% of total landings from trawls and seines in the reference years (2013 & 2014) were specified gadoids (cod, haddock, whiting and saithe) were covered by the Landings Obligation. These vessels remain subject to the updated Delegated Regulation (EU) 2016/2375 where the reference fleet is modified to 2014–2015 and total landings consisted of more than 20% cod, haddock, whiting and saithe combined.

This implies that all catches of whiting in the Celtic Sea and Western Channel by those vessels must be landed. However a 7% *de minimus* still applies, meaning that these vessels can discard up to 7% of the whiting they catch up to 2017, reducing to 6% in 2018. It is difficult to assess how this might impact on the fishery, the stock, the scientific data and the advice given for 2018 at this stage.

41.2 The fishery in 2016

ICES officially reported landings for Divisions 7.b, c, e–k and landings as used by the Working Group are given in Table 1.

Catch for 7.b, c, e–k in addition to landings for 7.d (excluding discards) is also presented as a guide figure for comparison to the 7.b–k TAC.

The 7.bc, e–k whiting stock is primarily targeted by otter trawlers and to a lesser extent Scottish seines and beam trawls. An overview of landings by fleet is given in Table 2 and more generally effort trends in fleets catching whiting in the Celtic Sea is provided by STECF (STECF, 2015).

The spatial distributions of landings by Irish and UK fleets in 2014 are given in Figure 1. Irish catches are primarily from within 7.g particularly within 32E2 and 31E3. Landings also emanate, to a lesser extent from 7.j. In previous years French landings have exhibited similar spatial and temporal focus around 31E3. The majority of UK landings are from otter trawlers in 7.e, and focused within rectangles 29E5 and 29E6.

41.3 Data

Landings

National landings and numbers-at-age data were aggregated in InterCatch for the Area 7.bc, e–k following methodology described in the stock annex.

The allocation schemes below were used:

Discard raising scheme

Strata	Unsampled	Sampled
1	GNS_AllCountries	GNS_IRL&UK
2	TBB_BEL&UK	TBB_UK
3	TBB_VIIj_IRL	TBB_VIIg_IRL
4	SSC&SDN_AllAreas_AllCountries	SDN_VIIeg_FRA
5	OTB_MIS_VIIbc_AllCountries	OTB_VIIb_IRL
6	OTB_MIS_VIIjk_AllCountries	OTB _VIIjk_IRL
7	OTB_MIS_VIIeh_FRA	OTB_VIIeg_ FRA
8	OTB_MIS_VIIeh_UKBELNED	OTB _VIIe_UK
9	OTB_MIS_VIIeh_IRLNISCO	OTB _VIIg_IRL
10	GTR_VIIeh_FRA	OTB_VIIgeh_FRA

Sample allocation scheme

Strata	Unsampled	Sampled
1	GNS_DIS _ALL	GNS_DIS_ALL
2	GNS_LAN_ALL	GNS_LAN_ALL
3	SSC&SDN_LAN _ALL	SSC_LAN_ALL
4	TBB_DIS _ALL	TBB_DIS_ALL
5	TBB_LAN _ALL	TBB_LAN_ALL
6	OTB&SSC&Others_DIS_All *	OTB&Others_DIS_All
7	OTB&SSC&Others_LAN_All	OTB&MIS_LAN_All

NB: Everything has been weighted by CATON.

*** SSC included in this group as no SSC specific sampled discards available.**

Age sampling allocation scheme

The length compositions for 2016 from the main gears are presented in Table 3 and Figure 2. The landings and discard length distributions are similar for the all otter trawl fleets (OTB), but TBB tend to have discarded slightly larger fish.

The international catch and landings numbers-at-age are given in Table 4 and Figure 3. It is possible to track the very strong 1999 and 2013 year classes, but the strong 2009 recruitment is only apparent at some older ages. The age distribution has remained similar over time with the exception of periods where strong year classes pass through older ages. Older ages (3+) were proportionally higher in the 2016 catch than in most of the preceding time-series. Age group 0 was included in the assessment data to allow inclusion of 0-group indices in the XSA, although landings at this age are not recorded

in most years. Mean weights-at-age in the catch and stock (Table 5 and Table 6) were derived as per methodology described in the stock annex. The stock weights are shown in Figure 4. There is some variability of stock weights particularly at older ages. Mean weight-at-age appears to have declined during the period of recent high fishing effort and landings between 2005–2008. There is some indication of an increasing trend in weights for ages 6 and 7 since 2008.

Discards

A time-series of discard data for Ireland and France was made available at WKCELT 2014 and is now included in the assessment. Procedures for raising discards to international landings are described above and in the stock annex. However, as more accurate national data become available through InterCatch, these have been included in the assessment as an improvement over simply raising Irish and French OTB discards to the international landings to produce a catch time-series.

A summary of discarding rates at-age for 2016 as available in InterCatch is presented in Table 7. Discarded whiting length distributions from 2016 for the main fleets is presented in Figure 2. The available data suggest that discarding occurs well above the 27 cm minimum conservation reference size (MCRS) with fish occasionally being discarded above 40 cm in some fleets. Annual proportions-at-age of discard numbers in the catch and also catch numbers in the predicted Stock from the XSA assessment are given in Figure 3. Data show a recent upward trend in discarding of all ages in the catch and stock.

Figure 5 presents the proportion of 1–3 year olds in the discards, catch and stock indicating that while there is a lot of 2–3 year olds in the stock and a lot of 1–2 year olds in the catch it is the 2 year olds that seem to suffer from discarding disproportionately higher than the stock.

Biological

Mean stock and catch weights-at-age data were calculated following the methodology described in the stock annex. Natural mortality is based on Lorenzen's model and thus a power function of catch weights-at-age. Maturity is knife-edge at-age 2.

The proportions of F and M before spawning were both set to zero to reflect the SSB calculation date of January 1st.

Surveys

The combined Q4 IBTS survey index for the Irish (IGFS) and French (EVHOE) time-series for ages 0–5 is given in Table 8. Further details for combining the survey series is given in the stock annex. The internal consistency of the survey tuning fleet was examined using pairwise scatterplots of log numbers-at-age (Figure 6), bearing in mind that the correlations may be impacted by changes in fishing mortality. Other than 0-grp fish, the index is reasonably consistent for older ages (Ages 1–5).

Cohort and year effects were examined with mean log standardized plots of indices by cohort and year (Figure 7). The index is quite noisy and shows a number of year affects for some ages.

Commercial lpue

Commercial lpue, from 2000 to 2013, were evaluated at WKCELT 2014 and have been omitted from the assessment due to catchability trends.

41.4 Historical stock development

An XSA assessment was carried out for this stock applying the same settings as last year, using a truncated time-series 1999–2015 of combined landings and discards data. The settings previously used were applied again this year and are detailed within the stock annex.

Data screening & Final update assessment

The general methodology is outlined in Section 2. Exploratory analysis was carried out using FLR under R version 3.1.1. The packages FLCore 2.5, and FLXSA 2.5 and FLEDA 2.5 were used.

Catch date range:	Years	1999–2015
	Ages	0–7+
Fbar Age Range:		2–5
Assessment Method:		XSA
Survey Tuning-series:		
IGFS-EVHOE	Yrs	2003–2015
	Ages	0–5
Time taper:		No
Q plateau age:		5
F shrinkage S.E:		1.0
	Num yrs	5
	Num ages	3
Fleet S.E:		0.5

The full XSA diagnostics are given in Table 9. Overall the estimates are reasonably consistent for ages 1+ given that whiting are prone to year effects in survey catches.

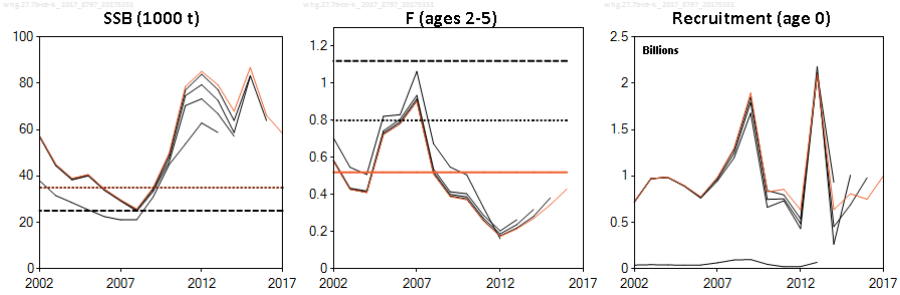
The log-catchability residuals from the XSA fit are plotted for the tuning-series in Figure 8. The residual patterns for the survey index does not show significant trends. Some year effects however are apparent 2005 and 2011.

The retrospective pattern is shown in Figure 9. A retrospective bias in F and SSB appears to be developing in this assessment with F being revised down and SSB being revised up. This year the WG scaled F to F_{2016} to address this retrospective trend.

Estimates of fishing mortality and stock numbers from the final XSA are given in Table 10 and Table 11. These are summarized in Figure 10. The assessment this year reveals a further increase in fishing mortality and recruitment in 2013 remains the second highest in the time-series (Figure 11).

Comparison with previous assessments

The current assessment is consistent with last year as shown in the historical stock summary retrospective below.



State of the stock

Trends in landings, F(2–5), SSB, and recruitment are presented in Table 12. For the current time-series SSB displays a peak biomass in 2012 following the strong recruitment of the 2009 year class and again in 2015 following the 2013 recruitment.

Fishing mortality (F_{bar}) has declined since 2007, but is now increasing possibly in response to recent increased SSB and F_{bar} increasing to achieve F_{MSY}. SSB is well within precautionary limits for this stock while F_{bar} is approaching F_{MSY}.

There has been two above average recruitments (2008 and 2009) entering the fishery in recent years prior to the 2013 cohort, estimated to be the second highest in the time-series. Notwithstanding a downward revision of the 2013 year-class F and catch-at-age suggest significant numbers of two year olds in the 2015 fishery.

41.5 Short-term projections

The short-term projection settings were as described in the stock annex with the following exceptions. The GM period was 1999–2015 (full time-series minus the last year).

Table 13 gives the management option table. Fishing at F_{MSY} = 0.52 in 2018 implies catches of 19 548 t and landings of 13 841 t.

The input values for the catch forecast (using FLR 2.5) are given in Table 14. The F-at-age values used were calculated as the mean of the XSA values from 2013–2015, scaled to the most recent year. Historically F has been used unscaled, but as mentioned in the Annex it was suggested in the benchmark that other options might be considered depending on consistent patterns in the retrospective analysis. Catch and stock weights-at-age were also the mean of the period 2013–2015. Stock numbers-at-age in 2015 for ages 0 and older were obtained from the XSA. SSB values are calculated for 1 January.

The estimated contributions of recent recruited year classes to the landings and SSB predictions are given in Figure 12. The assumptions of $GM_{1999\text{-}2015}$ recruitment for 2016 and 2017 are predicted to contribute c.2% to the landings in 2017 and <1% to SSB in 2017–2018. Yield is still heavily reliant on the XSA estimate 2013 year class which is estimated at 57%.

41.6 MSY evaluations and Biological reference points

ICES carried out an evaluation of MSY and PA reference points for this stock at WKMSYREF4 (ICES, 2016a). The results are summarised below:

Reference points

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	35 000 t	B_{pa}	ICES, 2016b
	F_{MSY}	0.524	Segmented regression with B_{lim} as the breakpoint Range = 0.32–0.67	ICES, 2016b
Precautionary approach	B_{lim}	25 000 t	B_{loss}, the lowest observed spawning–stock biomass.	2016a
	B_{pa}	35 000 t	B_{lim} X 1.4	ICES, 2016a
	F_{lim}	1.120	Based on segmented regression simulation of recruitment with B_{lim} as the breakpoint	2016a
	F_{pa}	0.800	F_{lim}/1.4	2016a
Management plan	SSB_{MGT}	Undefined		
	F_{MGT}	Undefined		

41.7 Management plans

No management plan has been agreed or proposed.

41.8 Uncertainties and bias in assessment and forecast

Sampling

Sampling levels of the landed catch for recent years are considered to be sufficient to support current assessment approaches. There has been SOP differences in some recent years particularly that have led to a disparity between the reported catch in tons (landings and discards) going into the assessment and the comparable ∑(CNAA x MWAA) coming out of the assessment. While the overall SOP checks are invariably <1%, any difference in the catches going into the assessment vs those coming out will cause concern. Rather than correct the national data provided therefore a SOP correction is now done within FLR once the initial data QC is complete to ensure corrections are minor and not masking a potential error/bias.

Ageing

Cohort tracking in the landings-at-age matrix appears fairly consistent up to age 6. Tracking deteriorates at older ages.

Discards

Discarding is a major feature of most fisheries catching whiting in the Celtic Sea. Sampling coverage of discarding has improved over time particularly since 2004. Attempts to reconstruct a time-series for the main Irish and French fleets failed to extend further back than 1999. No discard data were available for France prior to 2004 and had to be constructed as proportion-at-age for the recent years where data were available. Sampling levels for either country also did not allow for quarterly age-based reconstruction of the discards so a length-based ogive from Ireland had to be used to reconstruct the

data for both countries. Discard estimates for the UK were not available at the benchmark, but are available now through InterCatch and have been included in the assessment.

Selectivity

Square-mesh panels were introduced in the second half of 2012 to reduce catches and discards of smaller whiting and haddock. The current assessment does not show an obvious reduction in F-at-age since the introduction of this TCM (see Figure 5 and Figure 10).

Surveys

The surveys for whiting are prone to year effects. However, cohort tracking for the 1+ fish is quite consistent for the combined tuning index.

Misreporting

The level of misreporting of this stock is not known and underreporting has previously been considered unlikely to have been a significant source of unaccounted mortality of whiting in the assessment because the TAC has been in excess of recent landings.

41.9 Recommendation for next benchmark

Overall, WGCSE recommend that cod, haddock and whiting in the Celtic Sea should be benchmarked together in 2018. The focus of the benchmark should be on streamlining data compilation procedures for fishery-dependent and survey data. This would give improved transparency for diagnostics surrounding commercial tuning fleets and surveys. The benchmark should also relook at the assessment methods and diagnostics given the potential for changes in selectivity in the commercial fishery. The benchmark should also investigate mixed fisheries and multi-species interactions as well as environmental drivers that may be impacting on growth and recruitment of all three species.

For whiting, specifically:

- Further develop and evaluate statistical Catch at Age models such as SAM first conducted during WKCELT.
- Simplification of the complexity of métiers and the raising process in InterCatch. This is error prone and places a significant onus on the stock co-ordinator as the last stage in the data raising process in the narrow window before the assessment.
- Mapping of survey indices by age show significant recruitment data available outside the current combined index area which could potentially be utilised to improve the 0-grp estimates.

41.10 Management considerations

Catches and SSB in 7.b, c, e–k whiting fluctuate considerably depending on year-class strength. The 2008 and 2009 year classes were above average with 2013 being second highest in the time-series. These will be contributing to catches and SSB in the short term but the upturn in catches and SSB is likely to be short lived as recent recruitment is episodic and F appears to be increasing.

Discarding of this stock for different fleets is substantial and highly variable depending on gear and year-class strength. High levels of discarding for a species like whiting reduce the longer term yields one might expect from the stock so efforts to improve selection and reduce discards in the mixed fishery should be encouraged. ICES notes the introduction of square mesh panels in all trawl fisheries operating in ICES Divisions 7.fg. It is important that these measures are fully implemented and their effectiveness in reducing discards and the impact on commercial catches is monitored and evaluated. Further gear modifications to increase the likelihood of small whiting passing through the gear, such as introduction of larger minimum mesh sizes, separator panels, or grids may be needed.

Whiting are caught in directed gadoid trips and as part of mixed fisheries throughout the Celtic Sea, as well as bycatch within *Nephrops* fisheries. Discard rates are high as a consequence of the low market value of the species, particularly at smaller sizes. High-grading above the MLS to some extent is also prevalent in most fisheries.

From the 1 February to the 31 March fishing activity has been prohibited within ICES rectangles: 30E4, 31E4, 32E3 (excluding within six nautical miles from the baseline) annually since 2005 to protect the cod stock.

There have been major changes in fleet dynamics over the period of the assessment. Effort in the French gadoid fleet has been declining since 1999, but the effort has fluctuated in recent years due to the way the effort series is derived. Irish otter-trawl effort in 7.b–k has been declined slightly over the time-series.

41.11 References

EC. 2015. Commission Delegated Regulation (EU) 2015/2438 of 12 October 2015 establishing a discard plan for certain demersal fisheries in north-western waters.

EC. 2016. Commission Delegated Regulation (EU) 2016/2375 of 12 October 2016 establishing a discard plan for certain demersal fisheries in north-western waters.

ICES. 2016a. Report of the Workshop to consider F_{MSY} ranges for stocks in ICES categories 1 and 2 in Western Waters (WKMSYREF4), 13–16 October 2015, Brest, France. ICES CM 2015/ACOM:58. 187 pp.

ICES. 2016b. EU request to ICES to provide F_{MSY} ranges for selected stocks in ICES Subareas 5 to 10. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 5, Section 5.2.3.1.

41.12 Tables

Table 1. Whiting in Divisions 7.bc,e–k. Nominal Landings (t) as reported to ICES, and total landings as used by the Working Group.

	Official ICES Landings							Used by WG			7.bc,e–k Catch +	
Year	BEL	FRA	IRL	UK_EW	Others	Total	Unallocated	WG Total	Dicards	Catch	7.d Landings	TAC
1998	479	11748	5549	1755	179	19710	-	-	-	-		
1999b	448	16418	6013	1354	27	7842	-12336	20178	5420	25598	31401	
2000	194	9184	5358	1255	39	16030	385	15645	4400	20045	26117	
2001	171	7317	5365	948	31	13832	640	13192	9877	23070	29684	
2002	149	7546	5718	847	35	14295	655	13640	7336	20977	26338	
2003	129	5989	4516	763	21	11418	321	11097	3559	14656	21661	
2004	180	4870	4350	587	132	10119	-70	10189	6481	16670	21953	
2005	218	5886	5774	482	136	12496	285	12211	6700	18911	23812	
2006	128	4711	4570	413	129	9951	291	9660	12031	21691	25440	
2007	127	3575	4864	575	87	9227	140	9087	8456	17543	20934	19900
2008	122	3072	2406	618	36	6254	394	5860	2880	8740	11933	19900
2009	87	2815	2798	828	25	6554	41	6513	4101	10614	17183	16950
2010	101	3464	4331	792	93	8778	190	8588	3008	11596	17729	14407
2011	100	4311	4752	739	174	10076	592	9484	1954	11438	16902	16658
2012	170	3709	5842	763	142	10626	438	10188	2449	12630	16234	19053
2013	226	4007	6887	906	92	12118	187	11931	2512	14796	18700	24500
2014	222	4927	6873	1057	38	13117	158	12847	3977	16742	19954	19162
2015	152	5640	6437	819	97	13145	-29	13174	6101	19275	19954	17742
2016[a]	186	6294	7644	890	39	15053	-126	15179	7278	22457	26187	22778

[a]**Provisional data.**

[b]**French Official landings not available, not updated.**

Table 2. Whiting in Divisions 7.bc–ek. Landings (t) by fleet.

Fleet	BEL	FRA	IRL	UK	Others	Total	%
OTB	25	5202	4132	359	3	9720	74%
SSC	7	97	2042	0	156	2300	17%
TBB	123	0	24	66	0	212	2%
Other	0	449	272	176	44	941	7%
	155	5748	6469	601	202	13174	100%

Table 3. Whiting in Divisions 7.b,c,e–k. Length distributions for Landings (LAN) and Discards (DIS) for 2016 by country and main fleet (Numbers in '000s). Nos raised to the Catch.

CatchCat	Lngt	GNS_IRL	OTB_FRA	OTB_IRL	OTB_UK	OTT_FRA	TBB_BEL	TBB_IRL	TBB_UK
DIS	6	0	0	0	0	0	0	0	0
DIS	7	0	0	1	1	0	0	0	0
DIS	8	0	0	1	1	0	0	0	0
DIS	9	0	0	1	1	0	0	0	0
DIS	10	0	0	1	0	1	0	0	0
DIS	11	0	0	1	0	1	3	0	0
DIS	12	0	0	0	0	0	9	0	1
DIS	13	0	0	1	2	4	38	0	0
DIS	14	0	0	6	4	0	91	0	0
DIS	15	0	11	9	3	2	92	0	0
DIS	16	0	4	31	3	6	106	0	0
DIS	17	0	42	31	0	4	71	0	3
DIS	18	0	14	21	2	4	55	0	0
DIS	19	0	16	21	3	2	68	0	5
DIS	20	0	69	21	3	2	62	0	11
DIS	21	0	147	29	14	2	102	0	13
DIS	22	0	162	27	13	22	130	0	7
DIS	23	0	190	85	75	20	183	0	25
DIS	24	0	161	136	207	13	215	0	27
DIS	25	0	110	119	166	15	207	0	24
DIS	26	0	188	228	228	61	289	1	63
DIS	27	0	254	248	214	53	277	1	59
DIS	28	0	259	270	172	59	339	2	96
DIS	29	0	240	238	183	46	280	2	94
DIS	30	0	256	125	114	67	241	2	135
DIS	31	0	181	102	82	100	282	2	172
DIS	32	0	132	86	72	91	229	2	143
DIS	33	0	103	60	55	39	153	2	109
DIS	34	0	55	36	29	20	140	2	76
DIS	35	0	44	26	30	6	77	1	47
DIS	36	0	27	17	16	12	88	1	44
DIS	37	0	22	9	7	12	41	1	16
DIS	38	0	2	9	5	22	56	1	23
DIS	39	0	3	5	1	20	19	1	5
DIS	40	0	5	2	2	1	4	0	4
DIS	41	0	0	2	1	15	1	0	2
DIS	42	0	5	1	0	0	6	0	3
DIS	43	0	1	0	0	0	0	0	0
DIS	44	0	8	1	0	0	0	0	0
DIS	45	0	2	0	0	0	0	0	0
DIS	46	0	0	0	1	0	1	0	0

CatchCat	Lngt	GNS_IRL	OTB_FRA	OTB_IRL	OTB_UK	OTT_FRA	TBB_BEL	TBB_IRL	TBB_UK
DIS	47	0	0	0	5	0	0	0	0
DIS	48	0	1	0	0	0	0	0	0
DIS	49	0	0	0	1	0	0	0	0
DIS	50	0	0	0	0	0	0	0	0
DIS	51	0	0	0	0	0	0	0	0
DIS	52	0	0	0	0	0	0	0	0
DIS	53	0	0	0	0	0	0	0	0
DIS	54	0	0	0	0	0	0	0	0
DIS	55	0	0	0	0	0	0	0	2
DIS	56	0	0	0	0	0	0	0	0
DIS	57	0	0	0	0	0	0	0	0
DIS	58	0	0	0	0	0	0	0	0
DIS	59	0	0	0	0	0	0	0	0
DIS	60	0	0	0	0	0	0	0	0
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DIS	63	0	0	0	0	0	0	0	0
DIS	64	0	0	0	0	0	0	0	0
DIS	65	0	0	0	0	0	0	0	0
DIS	66	0	0	0	0	0	0	0	0
DIS	69	0	0	0	0	0	0	0	0
LAN	6	0	0	0	0	0	0	0	0
LAN	7	0	0	0	0	0	0	0	0
LAN	8	0	0	0	0	0	0	0	0
LAN	9	0	0	0	0	0	0	0	0
LAN	10	0	0	0	0	0	0	0	0
LAN	11	0	0	0	0	0	0	0	0
LAN	12	0	0	0	0	0	0	0	0
LAN	13	0	0	0	0	0	0	0	0
LAN	14	0	0	0	0	0	0	0	0
LAN	15	0	0	0	0	0	0	0	0
LAN	16	0	0	0	0	0	0	0	0
LAN	17	0	0	0	0	0	0	0	0
LAN	18	0	0	34	0	0	0	0	0
LAN	19	0	0	0	0	0	0	0	0
LAN	20	0	0	0	0	0	0	0	0
LAN	21	0	0	0	0	0	0	0	0
LAN	22	0	0	0	0	0	0	0	0
LAN	23	0	0	0	0	0	0	0	0
LAN	24	0	16	0	0	0	0	0	0
LAN	25	0	12	0	0	0	0	0	0
LAN	26	0	13	0	1	0	0	0	0
LAN	27	0	95	0	9	0	0	0	1
LAN	28	0	33	16	24	1	2	0	0

CatchCat	Lngt	GNS_IRL	OTB_FRA	OTB_IRL	OTB_UK	OTT_FRA	TBB_BEL	TBB_IRL	TBB_UK
LAN	29	0	301	47	48	0	2	0	3
LAN	30	0	240	119	80	1	6	0	4
LAN	31	0	550	154	138	1	9	0	8
LAN	32	0	392	211	145	2	14	0	10
LAN	33	0	479	293	147	8	17	0	12
LAN	34	0	614	345	129	6	17	0	10
LAN	35	23	526	370	127	6	20	0	10
LAN	36	85	484	350	118	6	19	0	6
LAN	37	0	415	291	86	11	23	0	10
LAN	38	19	407	251	78	9	25	0	11
LAN	39	19	402	128	62	9	18	0	10
LAN	40	0	521	114	58	4	20	0	15
LAN	41	0	479	116	52	7	15	0	15
LAN	42	0	445	115	39	7	10	0	3
LAN	43	0	332	127	42	6	11	0	11
LAN	44	0	248	116	36	8	8	0	9
LAN	45	0	174	183	27	7	6	0	4
LAN	46	0	192	144	19	9	2	0	7
LAN	47	0	96	170	19	4	3	0	6
LAN	48	0	91	102	19	4	2	0	5
LAN	49	0	81	99	16	4	1	0	3
LAN	50	0	120	66	10	7	0	0	2
LAN	51	0	72	62	7	6	0	0	2
LAN	52	0	48	40	9	5	0	0	2
LAN	53	0	35	28	6	3	1	0	0
LAN	54	0	27	29	7	1	0	0	0
LAN	55	0	13	2	2	1	0	0	2
LAN	56	0	7	10	5	1	0	0	0
LAN	57	0	11	10	2	1	0	0	0
LAN	58	0	7	5	2	0	0	0	0
LAN	59	0	1	3	0	0	0	0	0
LAN	60	0	1	2	1	0	0	0	0
LAN	61	0	0	2	1	0	0	0	0
LAN	62	0	1	0	1	0	0	0	0
LAN	63	0	0	0	0	0	0	0	0
LAN	64	0	1	0	0	0	0	0	0
LAN	65	0	0	0	0	0	0	0	0
LAN	66	0	0	0	0	0	0	0	0
LAN	69	0	1	0	0	0	0	0	0

Table 4. Whiting in Divisions 7.bc,e–k. The strong 1999 year class is distinct in both the catch and landings data, with some evidence of the strong 2009 year class appearing at older ages. Catch numbers-at-age ('000).

CATCH							
1999	2016						
0	7						
5370.0	20744.1	25957.7	14662.4	8744.8	8987.8	6670.2	1498.7
8176.3	26561.7	26303.7	12529.9	6122.5	2605.9	2100.9	2424.3
8795.0	26105.8	51390.6	13715.2	5317.1	2049.0	763.1	627.3
4568.6	13387.4	34319.6	24356.6	5968.2	1057.6	291.6	111.0
3687.0	12213.5	11836.5	10634.3	12778.4	1640.7	227.8	58.1
2473.8	27330.2	15052.2	6542.4	7241.9	6212.0	573.2	81.2
1421.1	10663.5	32482.0	12581.9	5079.9	4819.8	3717.7	155.1
5114.1	29760.2	44102.5	10995.4	4217.2	1750.4	1181.6	579.4
1017.0	14791.8	36137.0	12258.9	5296.7	1407.4	345.4	325.7
1650.1	8270.8	13274.5	6373.7	3290.8	858.5	214.8	68.4
538.1	8045.5	20840.4	7931.2	2653.7	770.3	192.4	201.5
348.0	4004.6	12591.3	10429.8	4761.1	1201.0	260.9	101.4
737.0	4691.4	8226.7	8280.5	5464.3	1738.5	355.4	84.5
156.0	5399.4	6661.7	10006.3	5577.9	1725.5	505.5	116.1
739.0	1076.3	6880.1	7160.1	10810.1	4379.2	938.2	216.5
158.7	13119.4	5727.8	7237.2	6301.1	7941.1	2032.8	352.8
262.3	4167.2	25419.9	8601.1	7555.1	2619.8	4343.9	805.3
1223.7	9891.3	11827.4	29870.3	5397.2	3145.3	1160.7	1933.0

LANDINGS							
1999	2016						
0	7						
0.0	3939.1	10139.7	12589.4	8597.8	8987.8	6670.2	1498.7
4.3	3176.7	9988.7	10773.9	6030.5	2605.9	2100.9	2424.3
0.0	297.8	11793.6	11628.2	5251.1	2049.0	763.1	627.3
6.6	926.4	6034.6	20341.6	5877.2	1057.6	291.6	111.0
0.0	306.5	3246.5	8574.3	12482.4	1640.7	227.8	58.1
39.8	1310.2	4358.2	5703.4	7213.9	6212.0	573.2	81.2
1.1	725.5	5991.0	8258.9	4968.9	4819.8	3717.7	155.1
0.1	868.2	6238.5	8187.4	3880.2	1750.4	1181.6	579.4
0.0	781.8	5142.0	8760.9	5248.7	1407.4	345.4	325.7
3.1	661.8	3555.5	5235.7	3272.8	858.5	214.8	68.4
0.1	462.5	4562.4	6267.2	2640.7	770.3	192.4	201.5
0.0	399.6	3571.3	7713.8	4293.1	1201.0	260.9	101.4
0.0	297.4	3214.7	6618.5	5316.3	1738.5	355.4	84.5
0.0	91.4	1191.7	7728.3	5276.9	1725.5	505.5	116.1
0.0	241.6	1713.2	3635.9	9299.9	3915.7	897.1	208.2
0.0	1664.3	1722.4	4551.1	4918.3	6829.7	1680.8	311.9
0.0	257.3	5835.8	3865.9	5308.7	2489.2	2887.0	802.9
3.3	592.7	2296.4	14067.9	4504.8	2833.3	996.3	1735.4

Table 5. Whiting in Divisions 7.bc,e–k. Catch weights-at-age (kg).

	Age							
	0	1	2	3	4	5	6	7+
1999	0.027	0.133	0.222	0.341	0.427	0.440	0.496	0.623
2000	0.031	0.069	0.220	0.396	0.505	0.563	0.580	0.587
2001	0.032	0.112	0.185	0.378	0.529	0.633	0.760	0.777
2002	0.027	0.097	0.197	0.351	0.532	0.707	0.825	1.013
2003	0.029	0.094	0.211	0.360	0.452	0.629	0.831	1.087
2004	0.040	0.155	0.227	0.361	0.432	0.491	0.537	0.785
2005	0.020	0.105	0.195	0.361	0.501	0.504	0.487	0.674
2006	0.033	0.124	0.210	0.385	0.538	0.588	0.544	0.675
2007	0.042	0.121	0.201	0.364	0.497	0.642	0.609	0.638
2008	0.028	0.109	0.214	0.386	0.524	0.626	0.780	0.830
2009	0.026	0.117	0.206	0.395	0.549	0.653	0.689	0.951
2010	0.034	0.119	0.228	0.420	0.560	0.679	0.815	0.836
2011	0.024	0.126	0.239	0.444	0.613	0.811	0.954	1.211
2012	0.039	0.096	0.225	0.461	0.649	0.808	0.967	1.088
2013	0.053	0.130	0.209	0.358	0.600	0.704	0.915	0.864
2014	0.038	0.142	0.254	0.397	0.554	0.662	0.759	1.007
2015	0.018	0.102	0.220	0.375	0.573	0.778	0.671	0.929
2016	0.052	0.149	0.217	0.358	0.577	0.685	0.746	0.784

Table 6. Whiting in Divisions 7.bc,e–k. Q1 Stock weights-at-age (kg) from Rivard corrected annual mean catch weights.

	Age							
	0	1	2	3	4	5	6	7+
1999	0.0170	0.1034	0.1659	0.2804	0.3724	0.3834	0.4674	0.6230
2000	0.0167	0.0432	0.1713	0.2960	0.4152	0.4905	0.5055	0.5868
2001	0.0180	0.0592	0.1131	0.2886	0.4575	0.5658	0.6541	0.7775
2002	0.0146	0.0551	0.1481	0.2549	0.4481	0.6117	0.7229	1.0133
2003	0.0125	0.0507	0.1428	0.2662	0.3981	0.5782	0.7663	1.0873
2004	0.0248	0.0671	0.1463	0.2763	0.3946	0.4711	0.5810	0.7846
2005	0.0079	0.0648	0.1741	0.2859	0.4254	0.4666	0.4889	0.6744
2006	0.0174	0.0494	0.1484	0.2742	0.4405	0.5427	0.5237	0.6750
2007	0.0259	0.0636	0.1577	0.2768	0.4379	0.5877	0.5982	0.6382
2008	0.0139	0.0677	0.1612	0.2788	0.4370	0.5582	0.7076	0.8298
2009	0.0119	0.0575	0.1502	0.2908	0.4604	0.5850	0.6571	0.9506
2010	0.0180	0.0553	0.1631	0.2946	0.4704	0.6108	0.7296	0.8356
2011	0.0123	0.0659	0.1688	0.3179	0.5077	0.6739	0.8049	1.2106
2012	0.0211	0.0482	0.1684	0.3320	0.5366	0.7040	0.8856	1.0881
2013	0.0327	0.0710	0.1412	0.2835	0.5258	0.6762	0.8599	0.8644
2014	0.0232	0.0870	0.1820	0.2877	0.4449	0.6304	0.7310	1.0072
2015	0.0063	0.0622	0.1767	0.3090	0.4767	0.6562	0.6666	0.9295
2016	0.0516	0.0518	0.1486	0.2807	0.4655	0.6261	0.7615	0.7836

Table 7. Whiting in Divisions 7.e–k. Summary of landings and discard data in 2015 provided to the Working Group.

	WEIGHT IN TONNES								
DISCARDS	**COUNTRY**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7+**	**GRAND TOTAL**
	Belgium	0.1	92.7	108.5	265.5	17.1	4.3	7.6	2.3	498.1
	France	22.5	412.7	432.0	838.4	53.1	12.7	15.6	20.7	1807.7
	Ireland	39.0	663.2	1003.3	2146.6	184.6	85.7	41.2	59.3	4222.9
	UK (England)	0.5	119.2	150.5	399.5	17.8	3.5	5.5	2.6	699.0
	Other	0.4	8.5	11.7	26.3	1.8	0.7	0.4	0.5	50.2
	Total	62.6	1296.2	1706.0	3676.3	274.4	106.8	70.1	85.4	7277.9
Landings	Belgium	0.0	2.5	8.7	114.1	24.8	9.4	16.4	10.1	186.0
	France	0.7	142.9	464.0	2907.8	1130.0	572.6	332.0	777.2	6327.2
	Ireland	0.0	15.7	331.1	3431.5	1574.0	1411.6	381.6	592.9	7738.4
	UK (England)	0.0	14.9	50.3	518.3	86.5	30.9	59.0	39.6	799.6
	Other	0.0	0.5	6.0	57.1	25.9	22.2	6.4	9.5	127.7
	Total	0.7	176.6	860.1	7028.8	2841.1	2046.8	795.4	1429.3	15178.8

Number in 000's

	Country	0	1	2	3	4	5	6	7	Grand Total
Discards	Belgium	2.1	787.3	874.2	1096.9	42.0	9.2	16.8	5.7	2834.3
	France	138.9	2051.6	1741.5	2952.2	125.5	31.3	29.3	38.0	7108.3
	Ireland	1055.4	5535.8	5907.0	10027.6	675.9	261.5	105.4	146.8	23715.4
	UK (England)	15.1	863.1	945.2	1611.8	43.0	7.9	12.0	5.9	3504.0
	Other	8.9	60.7	63.2	113.9	5.9	2.1	0.9	1.3	256.9
	Total	1220.4	9298.6	9531.1	15802.4	892.4	312.0	164.4	197.6	37418.8
Landings	Belgium	0.0	10.4	28.5	260.1	42.1	13.5	18.0	14.1	386.7
	France	3.3	462.6	1235.3	5655.0	1794.0	789.5	444.2	969.3	11353.2
	Ireland	0.0	53.1	842.2	6859.5	2484.3	1960.8	457.1	688.9	13345.9
	UK (England)	0.0	64.7	174.2	1180.2	144.0	39.1	69.4	51.4	1723.0
	Other	0.0	1.8	16.2	113.1	40.5	30.5	7.6	11.6	221.3
	Total	3.3	592.7	2296.4	14067.9	4504.8	2833.3	996.3	1735.4	27030.1

Table 8. Whiting in Divisions 7.bc,e–k. Combined survey abundance indices of age groups 0–5.

	IGFSEVHOE No/Hr					
	Age					
	0	1	2	3	4	5
2003	207.826	201.071	73.602	26.557	13.911	0.658
2004	698.971	186.364	79.658	19.396	7.531	5.387
2005	195.372	89.18	21.949	7.791	3.758	5.495
2006	459.365	144.858	70.157	14.538	6.327	1.488
2007	895.572	126.044	31.128	8.434	1.512	0.689
2008	536.87	199.458	62.553	11.364	3.787	1.175
2009	755.508	267.503	52.211	12.282	2.666	1.082
2010	108.815	282.721	120.372	26.99	4.408	1.341
2011	432.351	205.258	208.778	71.683	14.117	3.000
2012	261.964	147.137	88.25	77.797	10.675	2.054
2013	1229.544	90.559	64.323	20.139	27.93	8.694
2014	112.842	314.208	38.057	19.858	9.104	12.72
2015	273.468	97.528	144.185	11.552	6.13	7.197
2016	280.238	117.811	72.835	38.436	7.998	4.413

Table 9. Whiting in Divisions 7.bc,e–k. XSA Diagnostics.

Run 1

FLR XSA Diagnostics 2017-05-15 15:48:58

CPUE data from indices

Catch data for 18 years 1999 to 2016. Ages 0 to 7.

	fleet	first age	last age	first year	last year	alpha	beta
1	IGFSEVHOENo/Hr	0	5	2003	2016	<NA>	<NA>

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability independent of size for all ages

Catchability independent of age for ages > 5

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 3 oldest ages.

S.E. of the mean to which the estimates are shrunk = 1

Minimum standard error for population
estimates derived from each fleet = 0.5

prior weighting not applied

Regression weights

age	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
all	1	1	1	1	1	1	1	1	1	1

Fishing mortalities

age	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.105	0.045	0.033	0.011	0.030	0.033	0.009	0.033	0.035	0.066
2	0.774	0.236	0.281	0.117	0.050	0.096	0.097	0.106	0.149	0.239
3	0.783	0.456	0.333	0.340	0.157	0.117	0.214	0.210	0.356	0.410
4	1.071	0.710	0.483	0.474	0.412	0.202	0.240	0.407	0.493	0.557
5	0.976	0.636	0.456	0.555	0.408	0.279	0.309	0.359	0.380	0.513
6	0.633	0.467	0.348	0.341	0.392	0.244	0.299	0.285	0.429	0.360
7	0.633	0.467	0.348	0.341	0.392	0.244	0.299	0.285	0.429	0.360

XSA population number (Thousand)

year	0	1	2	3	4	5	6	7
2007	986692	228997	92809	28979	9993	2758	890	818
2008	1301691	291301	87281	22341	8029	2229	697	217
2009	1897256	384298	117887	35973	8586	2569	791	814
2010	829944	560127	157387	46485	15642	3445	1091	417
2011	855666	245024	234420	73066	20072	6335	1326	310

```
 2012  634499 252618 100633 116434 37868  8650  2823  640
 2013 2097669 187323 103386  47722 62828 20134  4385  997
 2014  637380 619295  78568  49001 23368 32151  9911 1695
 2015  808397 188174 253528  36878 24084 10119 15050 2736
 2016  749497 238663  76917 113987 15669  9574  4638 7592


 Estimated population abundance at 1st Jan  2017
     age
year  0     1    2    3    4   5   6   7
 2017 0 221277 94560 31609 45874 5840 3842 2212


 Fleet:  IGFSEVHOENo/Hr

 Log catchability residuals.

   year
age   2003   2004   2005  2006   2007  2008   2009   2010  2011   2012   2013   2014   2015   2016
 0 -0.558  0.637 -0.541 0.460  0.887 0.098  0.063 -1.048 0.301  0.099  0.450 -0.748 -0.100  0.000
 1  0.528  0.203 -0.635 0.056 -0.008 0.161  0.167 -0.172 0.350 -0.010 -0.217 -0.149 -0.126 -0.149
 2  0.519  0.452 -0.845 0.342 -0.216 0.096 -0.349  0.062 0.158  0.181 -0.162 -0.404 -0.208  0.377
 3 -0.007  0.432 -0.333 0.252 -0.101 0.185 -0.317  0.220 0.593  0.175 -0.204 -0.247 -0.383 -0.265
 4 -0.196 -0.251  0.099 0.845 -0.418 0.418 -0.188 -0.293 0.570 -0.519 -0.032 -0.025 -0.379  0.370
 5 -0.719 -0.283  0.538 0.440 -0.087 0.376  0.002  0.005 0.079 -0.718 -0.096 -0.141  0.463  0.140


 Mean log catchability and standard error of ages with catchability
 independent of year class strength and constant w.r.t. time

             0      1      2      3      4      5
Mean_Logq -6.8746 -6.6929 -6.5974 -6.9712 -7.1275 -7.0606
S.E_Logq   0.3864  0.3864  0.3864  0.3864  0.3864  0.3864


 Terminal year survivor and F summaries:

 ,Age 0 Year class =2016

source
            scaledWts survivors yrcls
IGFSEVHOENo/Hr         1    221277  2016

 ,Age 1 Year class =2015

source
            scaledWts survivors yrcls
IGFSEVHOENo/Hr     0.789     81489  2015
fshk               0.211    219486  2015

 ,Age 2 Year class =2014

source
            scaledWts survivors yrcls
IGFSEVHOENo/Hr     0.759     46070  2014
fshk               0.241     79708  2014

 ,Age 3 Year class =2013

source
            scaledWts survivors yrcls
IGFSEVHOENo/Hr     0.726     35208  2013
fshk               0.274     97215  2013
```

,Age 4 Year class =2012

source	scaledWts	survivors	yrcls
IGFSEVHOENo/Hr	0.696	8456	2012
fshk	0.304	10160	2012

,Age 5 Year class =2011

source	scaledWts	survivors	yrcls
IGFSEVHOENo/Hr	0.705	4418	2011
fshk	0.295	6095	2011

,Age 6 Year class =2010

source	scaledWts	survivors	yrcls
fshk	1	1473	2010

Table 1. Whiting in Divisions 7.b, c, e–k. Fishing mortality (F)-at-age. F_{bar} range is 2–5.

	0	1	2	3	4	5	6	7+	F_{BAR}2–5
2007	0.000	0.105	0.774	0.783	1.071	0.976	0.633	0.633	0.901
2008	0.000	0.045	0.236	0.456	0.710	0.636	0.467	0.467	0.510
2009	0.000	0.033	0.281	0.333	0.483	0.456	0.348	0.348	0.388
2010	0.000	0.011	0.117	0.340	0.474	0.555	0.341	0.341	0.372
2011	0.000	0.030	0.050	0.157	0.412	0.408	0.392	0.392	0.257
2012	0.000	0.033	0.096	0.117	0.202	0.279	0.244	0.244	0.174
2013	0.000	0.009	0.097	0.214	0.240	0.309	0.299	0.299	0.215
2014	0.000	0.033	0.106	0.210	0.407	0.359	0.285	0.285	0.271
2015	0.000	0.035	0.149	0.356	0.493	0.380	0.429	0.429	0.345
2016	0.000	0.066	0.239	0.410	0.557	0.513	0.360	0.360	0.430

Table 11. Whiting in Divisions 7.b, c, e–k. Stock number-at-age ('000).

YEAR	0	1	2	3	4	5	6	7
2007	986692	228997	92809	28979	9993	2758	890	818
2008	1301691	291301	87281	22341	8029	2229	697	217
2009	1897256	384298	117887	35973	8586	2569	791	814
2010	829944	560127	157387	46485	15642	3445	1091	417
2011	855666	245024	234420	73066	20072	6335	1326	310
2012	634499	252618	100633	116434	37868	8650	2823	640
2013	2097669	187323	103386	47722	62828	20134	4385	997
2014	637380	619295	78568	49001	23368	32151	9911	1695
2015	808397	188174	253528	36878	24084	10119	15050	2736
2016	749497	238663	76917	113987	15669	9574	4638	7592

Table 12. Whiting in Divisions 7.b, c, e–k. Summary table.

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	F_{BAR} 2–5
1999	2295542	120208	50345	20180	0.508	0.719
2000	1357759	94357	42405	15644	0.473	0.703
2001	623570	85535	50581	13196	0.456	0.781
2002	717424	77903	57285	13640	0.366	0.581
2003	971252	67854	44974	11098	0.326	0.428
2004	988436	82673	38920	10188	0.428	0.410
2005	897849	66603	40600	12207	0.466	0.723
2006	775656	60904	34313	9660	0.632	0.781
2007	986692	69829	29709	9086	0.590	0.901
2008	1301691	63539	25724	5859	0.340	0.510
2009	1897256	79592	34918	6572	0.306	0.388
2010	829944	95885	49971	8514	0.231	0.371
2011	855666	105371	78700	9498	0.146	0.257
2012	634499	110772	85208	9812	0.144	0.173
2013	2097669	161303	79409	12402	0.188	0.215
2014	637380	136679	68013	12847	0.247	0.271
2015	808397	103688	86890	13174	0.222	0.344
2016	749497	117231	66195	15179	0.339	0.430
Geomean	1005.961					
Mean	1098.628	94440	53565	11598	0.356	0.499
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 13. Whiting in Divisions 7.b, c, e–k. Management options table.

FMULT	CATCH18	LAND18	DIS18	FCATCH18	FLAND18	FDIS18	SSB19
0	0	0	0	0	NA	NA	63499
0.1	1956	1422	534	0.043	0.030	0.013	61778
0.2	3840	2785	1055	0.086	0.059	0.027	60126
0.3	5653	4091	1563	0.129	0.089	0.040	58540
0.4	7400	5342	2058	0.172	0.118	0.053	57017
0.5	9084	6542	2542	0.215	0.148	0.067	55554
0.6	10706	7692	3015	0.258	0.178	0.080	54149
0.7	12271	8795	3476	0.301	0.207	0.094	52799
0.8	13779	9853	3927	0.344	0.237	0.107	51502
0.9	15235	10868	4367	0.387	0.267	0.120	50254
1	16640	11842	4798	0.430	0.296	0.134	49055
1.1	17995	12777	5219	0.473	0.326	0.147	47901
1.2	19305	13674	5630	0.516	0.355	0.160	46790
1.3	20569	14536	6033	0.559	0.385	0.174	45722
1.4	21791	15364	6427	0.602	0.415	0.187	44693
1.5	22972	16160	6812	0.645	0.444	0.200	43702
1.6	24114	16924	7190	0.688	0.474	0.214	42748
1.7	25219	17659	7560	0.731	0.504	0.227	41828
1.8	26287	18366	7922	0.774	0.533	0.241	40942
1.9	27321	19045	8276	0.817	0.563	0.254	40087
2	28322	19699	8624	0.860	0.592	0.267	39263

Additional Catch Options							
Basis18	Catch18	Land18	Dis	FCatch18	FLand18	FDis18	SSB19
FMSY	19548	13841	5707	0.524	0.361	0.163	46584
F = 0	0	0	0	0.000	NA	NA	63499
F = Fpa	26923	18784	8139	0.800	0.551	0.249	40416
F = Flim	33753	23165	10589	1.120	0.772	0.348	34852
Blim	46510	30624	15886	2.004	1.381	0.623	25000
Bpa	33569	23050	10520	1.110	0.765	0.345	35000
Btrigger	33569	23050	10520	1.110	0.765	0.345	35000
F = F2017	16640	11842	4798	0.430	0.296	0.134	49055
Min FMSY	13053	9344	3709	0.323	0.223	0.100	52126
Max FMSY	23647	16612	7035	0.670	0.462	0.208	43138
Stable SSB	16982	12078	4903	0.441	0.304	0.137	48763
-15% TAC	34090	23375	10715	1.138	0.784	0.354	34582

Input units are thousands and kg output in tonnes.

Table 14. Whiting in Divisions 7.b, c, e–k. Input values for the catch forecast.

WHITING IN THE CELTIC SEA (7.B,C, E–K), WGCSE 2017, COMBSEX									
F_{bar} age range: 2–5									
nyears +1									
Age	N	M	Mat	PF	PM	SWt	Sel	CWt	DSel	DCWt
0	1005961	1.22	0	0	0	0.027	0	0.098	0	0.036
1	221274	0.86	0	0	0	0.067	0.003	0.265	0.041	0.119
2	94559	0.65	1	0	0	0.169	0.041	0.369	0.124	0.187
3	31609	0.5	1	0	0	0.292	0.238	0.506	0.087	0.245
4	45873	0.43	1	0	0	0.462	0.453	0.651	0.033	0.297
5	5840	0.4	1	0	0	0.638	0.408	0.742	0.009	0.396
6	3842	0.38	1	0	0	0.72	0.344	0.826	0.014	0.376
7	5906	0.36	1	0	0	0.907	0.353	0.948	0.005	0.505

nyears +2

AGE	N	M	MAT	PF	PM	SWT	SEL	CWT	DSEL	DCWT
0	1005961	1.22	0	0	0	0.027	0	0.098	0	0.036
1	296990	0.86	0	0	0	0.067	0.003	0.265	0.041	0.119
2	88629	0.65	1	0	0	0.169	0.041	0.369	0.124	0.187
3	40269	0.5	1	0	0	0.292	0.238	0.506	0.087	0.245
4	12830	0.43	1	0	0	0.462	0.453	0.651	0.033	0.297
5	16392	0.4	1	0	0	0.638	0.408	0.742	0.009	0.396
6	2339	0.38	1	0	0	0.72	0.344	0.826	0.014	0.376
7	4337	0.36	1	0	0	0.907	0.353	0.948	0.005	0.505

nyears +3

AGE	N	M	MAT	PF	PM	SWT	SEL	CWT	DSEL	DCWT
0	1005961	1.22	0	0	0	0.027	0	0.098	0	0.036
1	296990	0.86	0	0	0	0.067	0.003	0.265	0.041	0.119
2	118956	0.65	1	0	0	0.169	0.041	0.369	0.124	0.187
3	37744	0.5	1	0	0	0.292	0.238	0.506	0.087	0.245
4	16345	0.43	1	0	0	0.462	0.453	0.651	0.033	0.297
5	4584	0.4	1	0	0	0.638	0.408	0.742	0.009	0.396
6	6565	0.38	1	0	0	0.72	0.344	0.826	0.014	0.376
7	2972	0.36	1	0	0	0.907	0.353	0.948	0.005	0.505

Input units are thousands and kg output in tonnes.

Table 15. Whiting in Divisions 7.e–k. The detailed output for the *status quo* F forecast by age group.

NYears+1

Age	F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos	SSB
0	0	0	0	0	0	0	981125	19884	0	0
1	0.004	573	137	0.027	3587	386	203425	14938	0	0
2	0.031	1235	448	0.096	3521	636	53879	8980	53879	8980
3	0.188	12287	6105	0.108	10953	2707	113887	33426	113887	33426
4	0.347	2536	1663	0.055	710	218	11877	5733	11877	5733
5	0.323	1791	1341	0.029	196	80	8024	5249	8024	5249
6	0.329	998	866	0.026	225	107	4872	3666	4872	3666
7	0.336	1762	2051	0.018	97	42	7344	6854	7344	6854
Total	0.222	21182	12611	0.072	19289	4176	1384433	98730	199883	63908

NYears+2

Age	F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos	SSB
0	0	0	0	0	0	0	981125	19884	0	0
1	0.004	816	195	0.027	5108	550	289658	21271	0	0
2	0.031	1914	694	0.096	5454	985	83463	13910	83463	13910
3	0.188	2673	1328	0.108	2383	589	24774	7271	24774	7271
4	0.347	10970	7192	0.055	3073	942	51381	24802	51381	24802
5	0.323	1153	863	0.029	126	52	5165	3379	5165	3379
6	0.329	774	672	0.026	175	83	3781	2845	3781	2845
7	0.336	1423	1657	0.018	79	34	5934	5538	5934	5538
Total	0.222	19723	12601	0.072	16398	3235	1445281	98900	174498	57745

NYears+3

Age	F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos	SSB
0	0	0	0	0	0	0	981125	19884	0	0
1	0.004	816	195	0.027	5108	550	289658	21271	0	0
2	0.031	2725	988	0.096	7765	1403	118843	19807	118843	19807
3	0.188	4140	2057	0.108	3691	912	38376	11263	38376	11263
4	0.347	2386	1565	0.055	668	205	11177	5395	11177	5395
5	0.323	4987	3735	0.029	545	224	22344	14617	22344	14617
6	0.329	498	433	0.026	112	53	2434	1831	2434	1831
7	0.336	1132	1318	0.018	63	27	4720	4405	4720	4405
Total	0.222	16684	10291	0.072	17952	3374	1468677	98473	197894	57318

41.13 Figures

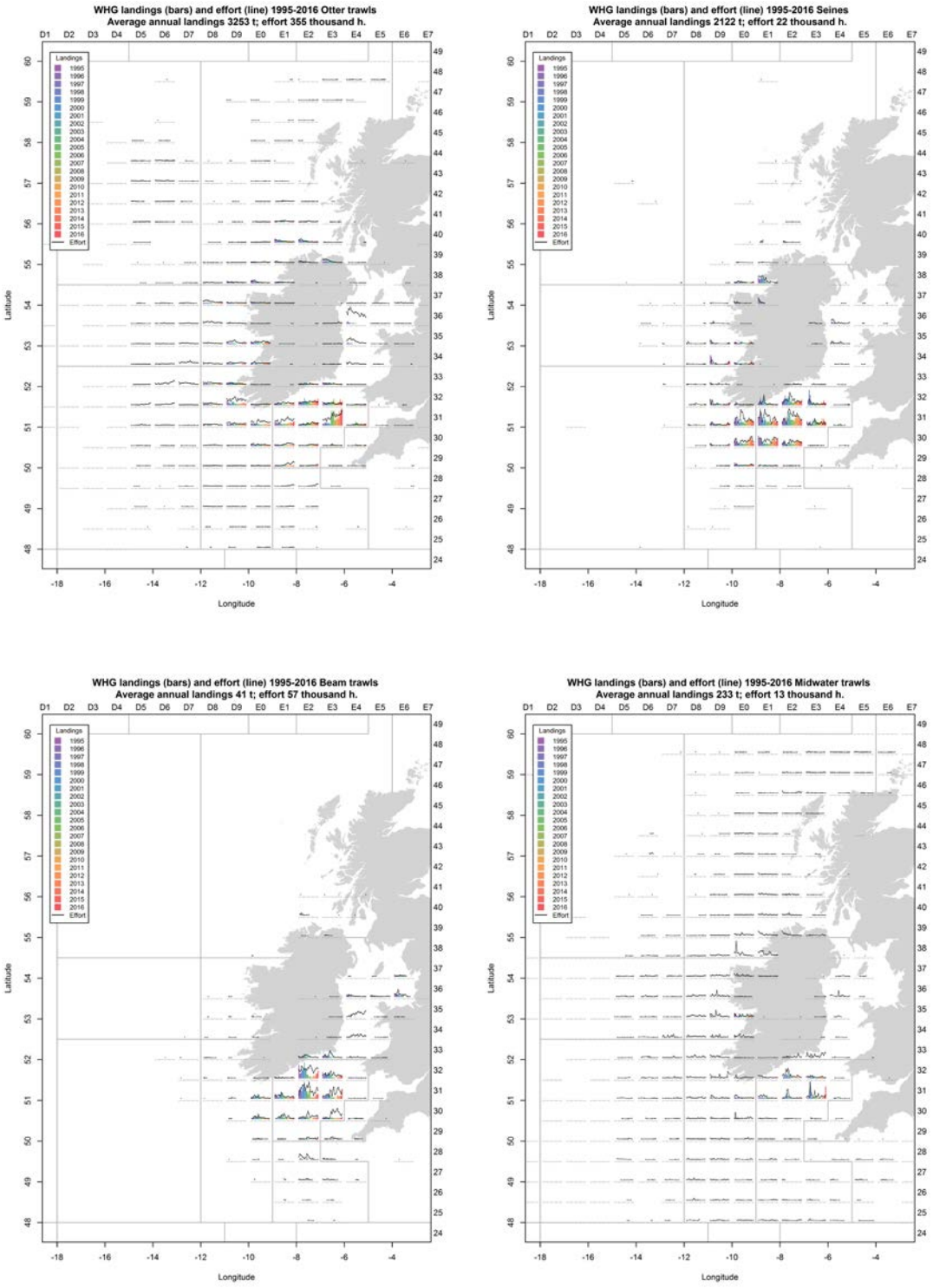

Figure 1. Irish landings for the main gear types in 1995–2015, along with annual average between 1995–2012.