1 Introduction

1.1 Terms of Reference

2013/2/ACOM15 The **Working Group on Widely Distributed Stocks** (WGWIDE), chaired by Katja Enberg, Norway, will meet in ICES HQ, Denmark, 26 August to 1 September 2014 to:

a) Address generic ToRs for Regional and Species Working Groups (see table below).

The assessments will be carried out on the basis of the stock annex in National Laboratories, prior to the meeting. This will be coordinated as indicated in the table below.

WGWIDE will report by 9 September 2014 for the attention of ACOM.

Fish Stock	Stock Name	Stock Coord.	Assess. Coord. 1	Assess. Coord. 2	Advice
boc-nea	Boarfish in the Northeast Atlantic	Ireland			Update
her-noss	Herring in the Northeast Atlantic (Norwegian spring-spawning herring)	Norway	Norway	Russia	Update
hom-nsea	Horse mackerel (Trachurus trachurus) in Division IIIa, Division IVb,c and VIId (North Sea stock)	Spain	Netherlands	UK (England & Wales)	Multiyear
hom-west	Horse mackerel (Trachurus trachurus) in Divisions IIa, IVa, Vb, VIa,, VIIa-c, e-k, VIIIa-e (Western stock)	Spain	UK (England & Wales)	Netherlands	Update
mac-nea	Mackerel in the Northeast Atlantic (combined Southern, Western and North Sea spawning components)	Ireland	Netherlands	UK (Scotland)	Update
whb-comb	Blue whiting in Subareas I-IX, XII and XIV (Combined stock)	Spain	Denmark	Russia	Update

In addition to these specific requests to WGWIDE the group is also tasked with addressing generic ToRs described below for each of the stocks where appropriate:

a) If no stock annex is available this should be prepared prior to the meeting, based on the previous year advice basis or on the data limited advice basis proposed as the basis for advice this year.

b) Audit the assessments and forecasts carried out for each stock under consideration by the Working Group and write a short report.

c) Propose specific actions to be taken to improve the quality and transmission of the data (including improvements in data collection).

d) Propose indicators of stock size (or of changes in stock size) that could be used to decide when an update assessment is required and suggest threshold % (or absolute) changes that the EG thinks should trigger an update assessment on a stock by stock basis.

e) Consider target categories for stocks in the medium term as proposed and revise as needed

f) Consider ecosystem overviews where available, and propose and possibly implement incorporation of ecosystem drivers in the analytical basis for advice

g) For the ecoregion or fisheries considered by the working group, produce a brief report summarising for the stocks and fisheries where the item is relevant:

   i) Mixed fisheries overview and considerations;

   ii) Species interaction effects and ecosystem drivers;

   iii) Ecosystem effects of fisheries;

   iv) Effects of regulatory changes on the assessment or projections;

h) Prepare planning for benchmarks next year, and put forward proposals for benchmarks of integrated ecosystem, multi or single species for 2015

i) Draft the required elements of the Popular Advice for each stock.

j) In the autumn, where appropriate, check for the need to reopen the advice based on the summer survey information and the guidelines in AGCREFA (2008 report). The relevant groups will report on the AGCREFA 2008 procedure on reopening of the advice before 14 October and will report on reopened advice before 29 October.

For update advice stocks:

k) Produce a first draft of the advice on the fish stocks and fisheries under considerations according to ACOM guidelines and implementing the generic introduction to the ICES advice (Section 1.2). If no change in the advice is needed, one page 'same advice as last year' should be drafted.

l) For each stock , when possible prior to the meeting:

   i) Update, quality check and report relevant data for the stock:

Load fisheries data on effort and catches (landings, discards, bycatch, including estimates of misreporting when appropriate) in the INTERCATCH database by fisheries/fleets, either directly or, when relevant, through the regional database. Data should be provided to the data coordinators at deadlines specified in the ToRs of the individual groups. Data submitted after the deadlines can be incorporated in the assessments at the discretion of the Expert Group chair; Abundance survey results; Environmental drivers.

   ii) Produce an overview of the sampling activities on a national basis based on the INTERCATCH database or, where relevant, the regional database,

   iii) Update the assessment using the method (analytical, forecast or trends indicators) as described in the stock annex.

   iv) Produce a brief report of the work carried out regarding the stock, summarising for the stocks and fisheries where the item is relevant:

      1. Input data (including information from the fishing industry and NGO that is pertinent to the assessments and projections);

      2. Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;

      3. Stock status and catch options for next year;

4. Historical performance of the assessment and brief description of quality issues with the assessment;
5. In cooperation with the Secretariat, update the description of major regulatory changes (technical measures, TACs, effort control and management plans) and comment on the potential effects of such changes including the effects of newly agreed management and recovery plans. Describe the fleets that are involved in the fishery.

m) On basis of the outcomes of WKMSYREF calculate F_{msy} for stocks where the information exists but the calculations have not been done yet, resolve inconsistencies between F_{msy} and MSY $B_{trigger}/B_{lim}$ and if possible, fill in the Precautionary Approach reference points where they are missing

For re-examine advice stocks

n) Consider the advice for 2013 and review data and/or method to ascertain if there is reason to update advice for 2014.
   i) Where an update is required, revert to an update procedure
   ii) Where no advice update is required, produce a brief report of the work carried out regarding the stock, indicating why the advice is not updated. A one page, 'same advice as last year' should be drafted.

For stocks with multiyear advice or biennial 2nd year advice

o) In principle, there is no reason to update this advice. The advice should be drafted as a one page version referring to earlier advice. If a change in the advice (basis) is considered to be needed, this should be agreed by the working group on the first meeting day and communicated to the ACOM leadership. Agreement by the ACOM leadership will revert the stock to an update procedure.

1.2 List of participants

WGWIDE 2014 was attended by 31 delegates from Netherlands, Ireland, Spain, Norway, Portugal, Iceland, United Kingdom (England and Scotland), Faroe Islands, Greenland, Denmark, Russia and Germany. Other fisheries scientists participated by correspondence. The full list of participants is in Annex 1.

1.3 Quality and Adequacy of fishery and sampling data

1.3.1 Sampling Data from Commercial Fishery

The working group again carried out a brief review of the sampling data and the level of sampling on the commercial fisheries. Sampling coverage for mackerel is 89%. In comparison to last year the proportion of the horse mackerel catch sampled increased from 68% to 77% but there is still only a limited number of countries providing data. Norwegian spring spawning herring and blue whiting sampling covers 91% and 96% of the total catch, respectively. Following the memorandum of understanding agreement between the EU and ICES boarfish (*Capros aper*) was included into WGWIDE since 2011 and tables on the sampling level for this species are added in this section.

In general, to facilitate age-structured assessment, samples should be obtained from all countries with catches of the relevant species.

The sampling programmes on the various species are summarised as follows:

Mackerel

Year	TOTAL CATCH (wg catch)	% catch covered by sampling programme*	No. samples	No. Measured	No. Aged
1992	760000	85	920	77000	11800
1993	825000	83	890	80411	12922
1994	822000	80	807	72541	13360
1995	755000	85	1008	102383	14481
1996	563600	79	1492	171830	14130
1997	569600	83	1067	138845	16355
1998	666700	80	1252	130011	19371
1999	608928	86	1109	116978	17432
2000	667158	76	1182	122769	15923
2001	677708	83	1419	142517	19824
2002	717882	87	1450	184101	26146
2003	617330	80	1212	148501	19779
2004	611461	79	1380	177812	24173
2005	543486	83	1229	164593	20217
2006	472652	85	1604	183767	23467
2007	579379	87	1267	139789	21791
2008	611063	88	1234	141425	24350
2009	734889	87	1231	139867	28722
2010	869451	91	1241	124695	29462
2011	938819	88	923	97818	22817
2012	892762	89	1216	135610	38365
2013	931732	89	1092	115870	25178

***Percentage related to working group catch.**

Sampling activity in 2013 covered 89% of the working group catch, in line with previous years, despite a reduction in the number of samples. It should be noted that this figure is based on the total sampled catch and thus the largest catching nations that can sample 100% of their catch mask any deficiencies at national level and with more widely dispersed fisheries. This is especially true when a large proportion of the total catch is taken in large, directed fisheries which are relatively straightforward to sample.

Denmark, Iceland, Ireland, Norway, Portugal, Russia, Scotland and Spain all sampled over 95% of their catch. As in previous years, England & Wales sampled a small fraction of their total catch, corresponding to the handline fishery in area VIIe. The freezer trawler fleet operating out of the Netherlands, Germany, England and France is covered by the Dutch and German sampling programs as the fleet is principally Dutch-owned. Individual samples within this fishery consist of only 25 aged fish which can be limiting when only a single sample is available in a particular area and quarter. In particular, there is a lack of sampling activity in the fourth quarter for this fleet. The Dutch program also provided samples for English registered freezer trawlers landing into the Netherlands. Of the remaining countries with significant catches Northern Ireland and Sweden did not provide any sampling information. France conducted length-frequency sampling but no ageing was carried out. Greenland conducted length frequency sampling of commercial catch but could not complete the ageing of the samples in time for the working group. The ALK from the ecosystem survey was used to convert to numbers at age.

The sampling summary of the mackerel catching countries is shown in the following table:

COUNTRY	OFFICIAL CATCH	% catch covered by sampling programme*	NO. SAMPLES	NO. MEASURED	NO. AGED
Belgium	62	0	0	0	0
Denmark	33218	97	12	1132	1075
Estonia	1367	0	0	0	0
Faroe Islands	143001	79	18	1178	1141
France	14643	0	0	0	0
Germany	20931	68	69	20454	1187
Greenland	52783	99	147	15943	224
Guernsey	9	0	0	0	0
Iceland	151235	99	151	3266	3208
Ireland	56511	100	49	8643	1980
Isle of Man	8	0	0	0	0
Netherlands	21159	28	21	1707	525
Norway	164607	99	154	4483	4456
Portugal	254	100	52	2958	463
Russia	80817	100	73	26806	749
Spain	16414	96	222	13597	6617
Sweden	2906	0	0	0	0
UK (England & Wales)	16542	40	74	9145	2016
UK (Northern Ireland)	12348	0	0	0	0
UK (Scotland)	134909	99	50	6558	1537
Total	923732	89	1092	100427	25178

*** Percentage based on Working Group catch,**

- unknown

The following table describes the mackerel sampling intensity levels in terms of catch in each ICES division. Only areas with relatively minor catches are insufficiently sampled.

AREA	OFF. CATCH	WG CATCH	NO SAMPLES	NO AGED	NO MEAS.	NO AGED/ kT*	NO MEAS/ kT*
IIa	216643	216643	121	2729	28850	13	133
IIb	8	8	0	0	0	0	0
IIIa	650	650	0	0	0	0	0
IIIc	1	1	0	0	0	0	0
IIId	1	1	0	0	0	0	0
IVa	258461	258791	174	6009	10362	23	40
IVb	1346	1346	4	100	427	74	317
IVc	463	466	1	25	101	54	217
Va	129245	129245	136	2713	2766	21	21
Vb	49313	49313	5	434	438	9	9
VIa	131932	132206	81	2253	19625	17	149
VIb	129	129	0	0	0	0	0
VIIa	54	54	0	0	0	0	0
VIIb	18988	19140	14	277	2384	15	126
VIIc	277	409	0	0	0	0	0
VIId	5423	5632	16	492	1473	91	272
VIIe	770	1020	28	862	3269	1119	4245
VIIf	339	339	32	804	3988	2372	11764
VIIg	14	30	0	0	0	0	0
VIIh	164	500	1	25	58	152	354
VIIj	15711	16206	43	705	8964	45	571
VIIIa	2456	2456	1	25	79	10	32
VIIIb	5813	5669	21	708	1171	122	201
VIIIcE	13 449	13 681	169	2 786	10 478	207	779
VIIIcW	1 388	583	26	1 884	3 244	1 357	2 337
VIIId	4	4	0	0	0	0	0
IXaN	372	4 448	26	3 244	1 884	8 720	5 065
IXaCN	257	873	52	463	2 958	1 801	11 510
IXaS	788	1 176	0	0	0	0	0
XIVb	69 141	69 154	159	523	16 243	8	235

*** Based on official catches**

Horse Mackerel

The following table shows a summary of the overall sampling intensity on horse mackerel catches in recent years in all areas 1992-2009 and in the western and North Sea areas for the following years. The Southern horse mackerel is now dealt with by ICES WGHANSA.

Year	TOTAL CATCH (wg catch)	% catch covered by sampling programme*	No. samples	No. Measured	No. Aged
1992	436 500	45	1 803	158447	5797
1993	504190	75	1178	158954	7476
1994	447153	61	1453	134269	6571
1995	580000	48	2041	177803	5885
1996	460200	63	2498	208416	4719
1997	518900	75	2572	247207	6391
1998	399700	62	2539	245220	6416
1999	363033	51	2158	208387	7954
2000	272496	56	1610	186825	5874
2001	283331	64	1502	204400	8117
2002	241336	72	1768	235697	8561
2003	241830	79	1568	200563	12377
2004	216361	68	1672	213066	16218
2005	234876	78	2315	241629	15866
2006	215277	72	1623	231344	12009
2007	187995	62	1321	174897	10749
2008	198085	77	1362	186800	11915
2009	247637	87	1258	92846	13345
2010	224462	78	703	48465	13984
2011	222415	62	502	40964	7604
2012	186432	68	501	41148	8220
2013	179382	77	686	87300	9776

*** Percentage related to Working Group catch**

The large numbers of measured fish 1992—2009 were due to intensive length measurement programs in the southern areas. In 2008, 76% of the horse mackerel measured were from Division IXa.

Countries that usually carried out sampling were Ireland, the Netherlands, Germany, Norway and Spain and they covered 18—97% of their respective catches. In 2013 Germany, Ireland, the Netherlands, Norway, UK (England) and Spain provided samples and age distributions. The lack of sampling data for relatively large portions of the horse mackerel catches continues to have a serious effect on the accuracy and reliability of the assessment and the Working Group remain concerned about the low number of fish that are aged.

The horse mackerel sampling intensity for the Western stock in 2013 was as follows:

COUNTRY	OFFICIAL CATCH	% CATCH SAMPLED*	NO. SAMPLES	NO. MEASURED	NO. AGED
Belgium	14	0	0	0	0
Denmark	6829	0	0	0	0
France	3593	0	0	0	0
Germany	24835	80	99	35034	1340
Ireland	35791	99	50	9581	2021
Netherlands	53697	71	46	7808	1150
Norway	6596	88	17	935	510
Spain	22541	100	426	25599	3355
Sweden	1	0	0	0	0
UK (England)	3959	76	18	3194	450
UK(Northern Ireland)	2325	0	0	0	0
UK(Scotland)	503	0	0	0	0
Total	160686	78	656	82151	8826

*** Percentage based on Working Group catch**

The horse mackerel sampling intensity for the North Sea stock in 2013 was as follows:

COUNTRY	OFFICIAL CATCH	% CATCH SAMPLED*	NO. SAMPLES	NO. MEASURED	NO. AGED
Belgium	51	0	0	0	0
Denmark	1020	0	0	0	0
France	1010	0	0	0	0
Germany	2941	47	2	224	252
Ireland					
Netherlands	8725	86	15	2889	373
Norway	377	0	0	0	0
Spain	4401	100	13	2036	325
UK (England)	172	0	0	0	0
UK(Scotland)	8725	86	15	2889	373
Total	18696 **	71	30	5149	950

*** Percentage based on Working Group catch**

The horse mackerel sampling intensity by division was as follows:

Area	Official Catch	WG Catch	N samples	N aged	N measured	N aged per 1000t	N measured per 1000t
IIa	30	30					
IIIa	19	19					
IIIc	183*	-					
IVa	6720	6720	19	560	1123	83	167
IVb	801	800	3	73	852	91	1065
IVc	677	677					
VIa	43264	43266	42	1435	8500	33	196
VIb	98*	-					
VIIa	1	1					
VIIb	32784	32786	44	1420	11169	43	341
VIIc	4120	4121	2	94	331	23	80
VIId	17202	17202	27	877	4297	51	250
VIIe	17980	17980	31	775	6040	43	336
VIIf	7	7					
VIIg	2	2					
VIIh	10909	10909	10	453	2067	42	189
VIIj	17751	17752	77	609	26672	34	1503
VIIk	129	128	2	50	227	390	1771
VIIIa	3023	3023					
VIIIb	6186	6187	99	420	7052	68	1140
VIIIcE	6326	6324	237	2301	15045	364	2379
VIIIcW	11447	11447	93	709	3925	62	343
VIIId	3	2					
Total	179381	179382	686	9776	87300	1328	9761

*** not used in the assessment as not officially assigned to a stock**

Norwegian Spring Spawning Herring (NSSH)

Year	TOTAL CATCH	% catch covered by sampling programme	No. samples	No. Measured	No. Aged
2000	1207201	86	389	55956	10901
2001	766136	86	442	70005	11234
2002	807795	88	184	39332	5405
2003	789510	71	380	34711	11352
2004	794066	79	503	48784	13169
2005	1003243	86	459	49273	14112
2006	968958	93	631	94574	9862
2007	1266993	94	476	56383	14661
2008	1545656	94	722	81609	31438
2009	1686928	94	663	65536	12265
2010	1457015	91	1258	124071	12377
2011	992.997	95	766	79360	10744
2012	825.999	93	649	59327	14768
2013	684.743	91	402	33169	11431

91% of the total catch was covered by national sampling programmes. The following table gives a summary of the sampling activities of the NSSH catching countries. The sampling coverage by country is between 42 and 100%. No sampling was carried by Scotland, Greenland and Sweden representing together 3 % of the total catch.

COUNTRY	OFFICIAL CATCH	% catch covered by sampling programme	NO. SAMPLES	NO. MEASURED	NO. AGED
Denmark	17159,85	100%	3	339	153
Faroe Islands	105037,58	71%	9	767	756
Germany	4243,85	55%	4	278	261
Greenland	11787,63	0%	0	0	0
Iceland	90729,00	100%	100	4350	2943
Ireland	3814,76	94%	2	115	80
Netherlands	5625,90	42%	6	418	150
Norway	359458,00	99%	144	6064	5764
Russia	78521,00	98%	134	20838	1324
Scotland	8342,15	0%	0	0	0
Sweden	23,00	0%	0	0	0
Total for Stock	684742,74	91%	402	33169	11431

Shown in the following table are the NSSH sampling levels by relating numbers measured and aged to the size of the catch in each ICES division.

Area	Official Catch	WG Catch	No Samples	No Aged	No Measured	No Aged/ 1000 tonnes*	No Measured/ 1000 tonnes*
IIa	564741	564741	300	8829	26118	16	46
IIb	37690	37690	32	455	3985	12	106
IVa	3403	3403	0	0	0	0	0
Va	45811	45811	69	2097	3016	46	66
Vb	29993	29993	1	50	50	2	2
XIVa	3089	3089	0	0	0	0	0
Total	684743	684743	402	11431	33169	17	48

*** Based on official catches**

Blue Whiting

Year	TOTAL CATCH	% catch covered by sampling programme	No. samples	No. Measured	No. Aged
2000	1412928	*	1136	125162	13685
2001	1780170	*	985	173553	17995
2002	1556792	*	1037	116895	19202
2003	2321406	*	1596	188770	26207
2004	2377569	*	1774	181235	27835
2005	2026953	*	1833	217937	32184
2006	1966140	*	1715	190533	27014
2007	1610090	87	1399	167652	23495
2008	1246465	90	927	113749	21844
2009	635639	88	705	79500	18142
2010	524751	87	584	82851	16323
2011	103591	85	697	84651	12614
2012	373937	80	1143	173206	15745
2013	625837	96	915	111079	14633

*** no figures given**

96% of the total catch was covered by national sampling programmes which is the highest coverage of the last six years. The sampling summary of the blue whiting catching countries is shown in the following table. No sampling was carried out by France and the UK (England, Wales and Northern Ireland) representing together 2,25% of the total catches (France 1,4%, UK 0,85%).

COUNTRY	OFFICIAL CATCH	% catch covered by sampling programme	NO. SAMPLES	NO. MEASURED	NO. AGED
Denmark	2167	85	3	112	112
Faroe Islands	85678	100	9	845	644
France	8978	0	0	0	0
Germany	11418	43	29	2033	155
Iceland	104918	94	37	2049	2743
Ireland	13205	94	11	3751	900
Netherlands	51635	99	75	12090	1874
Norway	196246	100	214	7861	1340
Portugal	2056	100	23	2105	725
Russia	120674	100	280	56951	4138
Spain	15274	100	227	22323	1766
UK(England + Wales)	4100 8166	0	0	0	0
UK(Scotland)	8166	100	7	959	236
UK(Northern Ireland)	1232	0	0	0	0
Total	625837	96	915	111079	14633

The following table describes the blue whiting sampling levels by relating numbers measured and aged to the size of the catch in each ICES division.

Area	Official Catch	No Samples	No Aged	No Measured	No Aged/ 1000 tonnes*	No Measured/ 1000 tonnes*
IIa	27238	261	2520	22463	92	822
IIb	922	19	303	3120	328	3382
IIIa	89	0	0	0	0	0
IVa	8590	3	100	364	12	42
IVb	70	0	0	0	0	0
IXa	5053	99	1072	8893	212	1760
Va	3324	3	150	297	45	89
Vb	226911	123	3328	21602	15	95
VIa	88088	56	2160	5731	25	65
VIb	46690	41	580	8012	12	172
VIIb	6485	0	0	0	0	0
VIIc	113009	110	2449	19994	22	177
VIIg	0	0	0	0	0	0
VIIh	0	0	0	0	0	0
VIIIa	1136	0	0	0	0	0
VIIIb	669	0	0	0	0	0
VIIIc	12051	151	1414	15535	118	1289
VIIId	685	0	0	0	0	0
VIIj	296	29	155	2033	524	6868
VIIk	84084	20	397	3035	5	36
XII	253	0	0	0	0	0
XIVa	174	0	0	0	0	0
XIVb	10	0	0	0	0	0
Total	625387	915	14633	111079	1409	14798

*** Based on official catches**

Boarfish

Year	TOTAL CATCH	% catch covered by sampling programme	No. samples	No. Measured	No. Aged
2001	120	0	0	0	0
2002	91	0	0	0	0
2003	11387	0	0	0	0
2004	5151	0	0	0	0
2005	5959	0	0	0	0
2006	7137	0	0	0	0
2007	21576	NA	3	217	0
2008	34751	NA	1	152	0
2009	90370	NA	9	1 475	0
2010	144047	NA	95	10 675	403*
2011	37096	NA	27	4 066	704
2012	87355	NA	80 (68)***	9 656 (8 565)***	814**
2013	75409	NA	76	9 392	0****

***A common ALK was developed from fish collected from both commercial and survey samples. This comprehensive ALK was used to produce catch numbers at age data for pseudo-cohort analyses.**

****A common ALK was developed from fish collected from samples from Danish, Irish and Scottish commercial landings. This comprehensive ALK was used for all métiers to produce catch numbers-at-age data for pseudo-cohort analyses. Only aged fish measured to 0.5cm were included in the ALK.**

***** Only Irish collected samples were used for length frequency, see stock annex.**

****** 2012 ALK used.**

COUNTRY	OFFICIAL LANDINGS (excluding discards)	% landings covered by sampling programme	NO. SAMPLES	NO. MEASURED	NO. AGED
Denmark	13182	NA	14	1221	0*
Ireland	52250	NA	62	8818	0*
UK(Scotland)	4380	0	0	0	0*
Total	75409	NA	76	9392	0*

*** 2012 ALK used.**

Area	Official Landings	No Samples	No Aged	No Measured	No Measured/ 1000 tonnes*
VIa	553	1	0	123	222
VIIb	10505	17	0	2235	213
VIIe	883	0	0	0	0
VIIg	1808	0	0	0	0
VIIh	14038	14	0	2060	147
VIIj	39529	40	0	5105	129
VIIIa	2224	4	0	516	232
VIIId	270	0	0	0	0
Total	69811	76	0	10039	144

1.3.2 Catch Data

Recent working groups have on a number of occasions discussed the accuracy of the catch statistics and the possibility of large scale under reporting or species and area misreporting.

The working group considers that the best estimates of catch it can produce are likely to be underestimates.

1.3.3 Discards

Discarding in pelagic fisheries is more sporadic than in demersal fisheries. This is because the nature of pelagic fishing is to pursue schooling fish, creating hauls with low diversity of species and sizes. Consequently, discard rates typically show extreme fluctuation (100% or zero discards). High discard rates occur especially during ´slippage´ events, when the entire catch is released. The main reasons for ´slipping´ are daily or total quota limitations, illegal size and mixture with unmarketable by-catch. Quantifying such discards at a population level is extremely difficult as they vary considerably between years, seasons, species targeted and geographical region.

Discard estimates of pelagic species from pelagic and demersal fisheries have been published by several authors. Discard percentages of pelagic species from demersal fisheries were estimated between 3% to 7% (Borges *et al.*, 2005) of the total catch in weight, while from pelagic fisheries were estimated between 3% to 17% (Pierce *et al.* 2002; Hofstede and Dickey-Collas 2006, Dickey-Collas & van Helmond 2007, Ulleweit & Panten 2007, Borges *et al.* 2008, van Helmond *et al.* 2009, 2010, 2011, van Overzee *et al.* 2013). Slipping estimates have been published for the Dutch freezer trawler fleet only, with values at around 10% by number (Borges *et al.* 2008) and around 2% in weight (van Helmond *et al.* 2009, 2010 and 2011) over the period 2003—2010. Nevertheless, the majority of these estimates were associated with very large variances and composition estimates of ´slippages´ are liable to strong biases and are therefore open to criticism.

Borges *et al.* (2008) show that for the Dutch freezer trawler fleet between 2002 and 2005, the most important commercial species discarded is mackerel, accounting for 40% of total pelagic discards. Other important discarded species are herring (18%), horse mackerel (15%) and blue whiting (8%). These discards are also the consequence of fisheries targeted at other species (*e.g.* mackerel in the horse mackerel and herring targeted fisheries). Boarfish was found to account for 5% of the discards. Total amount of discards by species in this fleet were estimated by van Overzee *et al.* (2013) for the years 2003—2012. They indicate that discards in these years for blue whiting (3.5%; range 1—16%), herring (NSSH and other stocks: 3%; range 1-7%) and horse mackerel (1.4%; range 1—5%) are low, but higher for mackerel (24.2%; range 16—37%). Dutch-owned freezer-trawlers also operate in European waters under German, UK, and French flags. Van Overzee *et al.* (2013) showed for the German pelagic fishery directed on mackerel for the years 2011 and 2012 0% discards rates for North Sea herring, horse mackerel and mackerel. For the herring directed fishery (NSSH and North Sea herring) the discards rates for blue whiting were between 0% for 2011 and 42% for 2012, for mackerel between 0 and 50% and for herring in both years 0%.

From 2015 onwards a landing obligation for European Union fisheries will be in place for fisheries directed on small pelagic fish including mackerel, horse mackerel, blue whiting and herring. To date it cannot be foreseen to which amount this will influence the discarding behaviour of the fisheries. A general discard ban is already in place for Norwegian, Faroese and Icelandic fisheries.

Because of the potential importance of significant discarding levels on pelagic species assessments the **Working Group again recommends that observers should be placed on board vessels in those areas in which discarding occurs, and existing observer programmes should be continued. Furthermore agreement should be made on sampling methods and raising procedures to allow comparisons and merging of dataset for assessment purposes.**

Mackerel

The Netherlands, Spain, Germany, Ireland, Denmark, Greenland and Portugal provided discard data on mackerel to the working group. Age disaggregated data was available from Spain, Portugal and Germany which indicates that the discarded catch is dominated by age 0 and 1 fish (>85% by number). For 2013 the total mackerel discards reported were 4664 t. The working group considers this to be an underestimate (see section 2.3.1) and the discard sampling to be incomplete.

Horse Mackerel

In the past discards of juvenile horse mackerel have been thought to constitute an in the past discards of juvenile horse mackerel have been thought to constitute a problem. However, in recent years a targeted fishery has developed on juveniles, including 1-year old fish and discarding of juveniles is now thought to be small. Over the years the Netherlands, Germany, Ireland and Spain have provided discard data. However, based on these data it is impossible to estimate the total discard rate in the horse mackerel fishery, since the discard rates reported are quite different. In 2013 discard data were available from Spain, the Netherlands and Germany. Ireland observed zero discard during observed trips.

Norwegian Spring Spawning Herring

The Working Group has no comprehensive data to estimate discards of herring. Although discarding may occur on this stock, it is considered to be very low and a minor problem to the assessment. This is confirmed by estimates from sampling programmes carried out by some EU countries in the Data Collection Framework. Estimates on discarding in 2008 and 2009 of about 2% in weight were provided for the trawl fishery carried out by the Netherlands. In 2010 and 2012, this metier was sampled by Germany. No discarding of herring was observed (0%).

The Norwegian coast guard maintains a close presence with the pelagic fishing fleet in Norwegian waters with several vessels and a plane. IMR has a co-operation with a number of reference vessels in the pelagic fleet, primarily for the purposes of biological sampling but also recording losses through gear damage or slipping. These data indicate that the frequency of slipping and the total quantities of fish slipped are low and, although the quantity remains unknown, are too small to have a significant effect on the reliability of the assessment.

Blue Whiting

Overall discards of blue whiting are thought to be small. Estimates from the DCF discard sampling programme for 2013 were available from Germany (2%), the Netherlands (1%), Portugal (25%) and Spain (26%). Discards in the Dutch and German fishery (pelagic freezer trawlers) are mostly by-catch in fisheries not directed on blue whiting. No discards were observed within the Irish sampling programme. Most of the other blue whiting fishing countries assume their discards to be zero (Denmark, Faroe, France, Russia, Norway and Iceland) due to existing discard bans in these countries and/or information from the industry.

Boarfish

Discard data were available from Dutch and German pelagic freezer trawlers and from Irish and Portuguese demersal fleets for the period 2003-2013. The Portuguese data relate to Division IXa and are not relevant to this stock. No Spanish discard data were submitted to the WG this year so the average of the previous ten years was used. Discards were not obtained from UK or French freezer trawlers, though discard patterns in these fleets are likely to be similar to the Dutch fleet. It is to be expected that discarding occurred before 2003, in demersal fisheries, however it is difficult to predict what the levels may have been.

1.3.4 Age-reading

Reliable age data are an important pre-requisite in the stock assessment process. The accuracy and precision of these data, for the various species, is kept under constant review by the Working Group.

Mackerel

Following the recommendation of the workshop on age reading of mackerel in 2010 (WKARMAC) a small scale otolith exchange was carried out by TI-SF between December 2013 and April 2014. The exchange was based on 164 otolith images and analysed using the WebGR application. A report of the exchange was available to WGWIDE.

Overall agreement between all readers was 68.2%. Good agreements were reached for age 1 and 2 (93 and 92%, resp.), for age 3 and 4 agreements were between 74 and 76%, agreement for age 5 was 61% and for age 6 and 7 57%. Only very low agreement was found for the older ages 8 to 14 (between 47% for age 8 and 31% for age 13).

Taking the results of the exchange in account the carrying out of a workshop in 2016 is recommended dealing with the generic terms of references for workshops on age calibration in order to increase the agreement between the laboratories involved in stock assessment especially for older fish.

Furthermore, it was recommended that WGWIDE will update the study on the influence of aging errors on the NEA mackerel assessment outputs which was carried out in 2011 (Brunel, 2011) in order to again validate the effect on the SSB estimation.

Horse mackerel

A Workshop on age reading of horse mackerel (*Trachurus trachurus*), Mediterranean horse mackerel (*Trachurus mediterraneus*) and blue jack mackerel (*Trachurus picturatus*) (WKARHOM) exchanged information by correspondence in 2011 and met in April 2012 to review information on age determination, compare different otolith-based age determination methods, identify sources of age determination error, provide specific guidelines for the interpretation of growth structures in otoliths, create a reference collection and data base of otolith images, and address the generic ToRs adopted for workshops on age calibration.

A total of 25 scientists and technicians, from 11 laboratories in 8 countries (France, Germany, Ireland, Italy, Norway, Portugal, Romania and Spain) participated in the workshop. For the assessment of the sources of age determination error, 16 age readers participated in the otolith exchange, 7 of the institutions read sectioned otoliths, 3 read whole otoliths, 2 read broken burnt whole otoliths and 3 read sectioned otoliths and whole otoliths. There were 10 sets of images of *Trachurus trachurus*, *T. mediterreaneus* and *T. picturatus*, from Ireland, North Spain, South Spain, Azores, Mauritania and Adriatic Sea. Percentage of agreement ranged from 36% to 67% for different otolith sets. The effect of otolith preparation techniques on age determination showed significant differences between readers and between otolith preparation methods, and also showed that the differences between methods were not the same across age readers. There were differences in interpretation primarily in the old individuals, with estimated age from sliced otoliths being higher than estimated age from whole otoliths.

A selection of 30 otoliths from horse mackerel (n = 23), Mediterranean horse mackerel (n = 5) and blue jack mackerel (n = 2) were selected for the reference collection. All otoliths for the reference collection were chosen by the most experienced readers during the workshop and covered an age span from 0 to 18 years old. Ages were agreed on by all participants. The main achievements of the workshop were the inclusion, for the first time, of *T. picturatus* and *T. mediterraneus*, a review on current otolith preparation and lab procedures, a quantification of disagreement between readers, the clarification of different ageing criteria previously used, an agreement on common criteria for ageing, the update of an ageing manual, and the assembling of an otolith reference collection for future use. Therefore, WKARHOM has set the basis for training of new readers and future improvement on otolith reading agreement. Preparations for the follow-up workshop in 2015 have already started. The workshop will be chaired by Teresa Garcia (Spain) and Alba Jurado (Spain) and will take place Sta. Cruz de Tenerife (Canary Islands, Spain), 26—30 October 2015.

Norwegian Spring Spawning Herring

Following a recommendation of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS) a small scale exchange was carried out by IMR in 2013. As Norwegian spring spawning herring is aged based on scales or otoliths depending on the institute reading, the small scale exchange aimed to determine the agreement between these two age-reading methods. Therefore 129 otoliths and scales were chosen from the same fish to be included in the exchange. Readers were allowed to read both structures, and it was taken into account which structure they were used to reading. A report of the exchange was available to WGWIDE.

The percentage agreement in all the comparisons in the exchange was quite low compared to what could be expected. The results comparing age readings of the readers usually reading the structures showed an agreement of only 67.4%. Agreements were higher in readings containing only one structure – even when readers not used to the structure participated, than the agreement found combining both structures in one EFAN-sheet, while only including the readers used to the structures. The ATAQCS-sheet comparing otoliths and scales showed a high percentage of disagreeing otoliths/scales, and up to six years difference between the modal ages of the two structures. These results are quite disturbing and it is important to continue this small scale exchange with a large scale exchange including both images and the real structures.

Since few institutes collect both structures by default, a request is made for institutes to collect a sample for the next exchange, especially in areas outside IIa.

Blue Whiting

A workshop (WKARBLUE) on age reading of blue whiting (*Micromesistius poutassou*) took place in Bergen, Norway, from 10—14 June 2013 chaired by Jane Amtoft Godiksen and Manuel Meixide.

A sample of 158 otoliths was annotated by the participants previously to the meeting, using WebGR, and a sub-sample of 50 of them was re-annotated at the meeting. Two new samples from Faeroes and Russia of 50 otoliths each were available at the meeting, together with pictures that were uploaded to WebGR.

The overall agreement obtained in the workshop were very poor in all samples with the exception of the Faroese one, showing that biased readings were present in many cases, even in experienced readers.

WKARBLUE recommends a new workshop in 2017, and the survey group recommended that the age readers look closer into a discrepancy problem for ages 1-3 in the 2014 blue whiting age reading material. Furthermore, PGCCDBS proposed an age calibration of blue whiting otoliths in 2016.

Boarfish

This stock is not part of the EU data collection framework so there is momentary no funding for age reading available. Age length keys were produced in 2012. The age reading was conducted by DTU Aqua on samples from all three countries in the fishery: Ireland, Denmark and UK (Scotland).

1.3.5 Biological Data

No specific issues were reported regarding biological data for this section.

1.3.6 Quality Control and Data Archiving

Current methods of compiling fisheries assessment data

Information on official, area misreported, unallocated, discarded and sampled catches have again this year been recorded by the national laboratories on the WG-data exchange sheet (MS Excel; for definitions see text table below) and sent to the stock co-ordinators or uploaded on the WGWIDE SharePoint. Co-ordinators collate data using the either the *sallocl* (Patterson, 1998) application which produces a standard output file (*Sam.out*) or the InterCatch hosted application.

There are at present no defined criteria on how to allocate samples of catch numbers, mean length and mean weight at age to unsampled catches, but the following general process is implemented by the species co-ordinators. Searches are made for appropriate samples by gear (fleet), area, and quarter. If an exact match is not available the search will move to a neighbouring area, if the fishery extends to this area in the same quarter. More than one sample may be allocated to an unsampled catch, in this case a straight mean or weighted mean of the observations may be used. If there are no samples available the search will move to the closest non-adjacent area by gear (fleet) and quarter, but not in all cases. For example, in the case of NEA mackerel samples from the southern area are not allocated to unsampled catches in the western area. It would be very difficult to formulate an absolute definition of allocation of samples to unsampled catches which was generic to all stocks, however full documentation of any allocations made are stored each year in the data archives (see below). It was noted that when samples are allocated the quality of the samples may not be examined (i.e. numbers aged) and that allocations may be made notwithstanding this. The Working Group again encourages national data submitters to provide an indication of what data could be used as representative of their unsampled catches. Definitions of the different catch categories as used by the WGWIDE:

Official Catch	Catches as reported by the official statistics to ICES
Unallocated Catch	Adjustments (positive or negative) to the official catches made for any special knowledge about the fishery, such as under- or over-reporting for which there is firm external evidence.
Area misreported Catch	To be used only to adjust official catches which have been reported from the wrong area (can be negative). For any country the sum of all the area misreported catches should be zero.
Discarded Catch	Catch which is discarded
WG Catch	The sum of the 4 categories above
Sampled Catch	The catch corresponding to the age distribution

Quality of the Input data

Primary responsibility for the accuracy of national biological data lies with the national laboratories that submit such data. Each stock co-ordinator is responsible for combining, collating, and interpolating the national data where necessary to produce the input data for the assessments. A number of validation checks are already incorporated in the data submission spreadsheet currently in use, and these are checked by the co-ordinators who in the first instance report anomalies to the laboratory which provided the data.

The working group acknowledges the effort some members have made to provide "corrected" data, which in some cases differ significantly from the officially reported catches. Most of this valuable information is gathered on the basis of personal knowledge of the fishery and good relations between the responsible scientist and the fishermen. The WG is aware of the problem that this knowledge might be lost if the scientist resigns, and asks the national laboratories to ensure continuity in data provision. In addition the working group recognises and would like to highlight the inherent conflict of interest in obtaining details of unallocated catches by country and increasing the transparency of data handling by the Working Group.

Overall, data quality has improved and sampling deficiencies have been reduced compared to earlier years, partly due to the implementation of the EU sampling regulation for commercial catch data. However, some nations have still not or inadequately aged samples. Others have not even submitted any data, so only catch data from Eurostat are available, which are not aggregated quarterly but are yearly catch data per area. Sampling deficiencies are documented by the data transmission tables which were filled in by the stock coordinators. These tables can be found on the WGWIDE SharePoint.

The Working Group documents sampling coverage of the catches in two ways. National sampling effort is tabulated against official catches of the corresponding country (section 1.3.1). Furthermore, tables showing total catch in relation to numbers of aged and measured fish by area give a picture of the quality of the overall sampling programme in relation to where the fisheries are taking place. These tables are shown in section 1.3.1 as text tables under the species sections.

Transparency of data handling by the Working Group and archiving past data

The national data on the amount and the structure of catches and effort are archived in the ICES Intercatch database. The data are provided directly by the individual countries and are highly aggregated for the use of stock assessments. In the past three years ICES maintained records of submission, use, quality and relevance of data, use of data in assessment provided by the individual countries, named as "Data Tables". The intention of this information was to fulfil ICES' obligations as a scientific organisation to make the data used in the assessment fully transparent but also to comply with ICES' obligations to the EU. These data were also used by the EC to evaluate whether EU member states have complied with EU data regulations and have submitted the data to ICES. It was decided by ICES that no data tables are supplied since 2013.

The subject of transmission of data to ICES and other end-users has been discussed by STECF in 2011 (STECF PLEN 11—02 and STECF EWG 11—08) in the context of the introduction of regional data bases (RDB) to support international co-operation in data collection by EU member states. The RDBs are now nearly implemented. STECF and ICES expects that the RDBs will develop rapidly and that in the near future it will be possible to use the RDB to aggregate data accommodating the data needs of end-users like ICES. The STECF EWG has presented a roadmap for the expected transmission routes and procedures for the submission of data by EU member states to ICES. The roadmap aims for submission of member state data to ICES through the RDB.

In recent years, ICES has implemented a Sharepoint solution for the storage and sharing of working group data and documentation. **The WG recommends all historical data and WG files are available through the appropriate Sharepoint site.**

The WG continues to ask members to provide any kind of national data reported to previous working groups (official catches, working group catches, catch-at-age and biological sampling data), to fill in missing historical disaggregated data. However, there was little response from the national institutes. **The WG recommends that national institutes increase national efforts to gain historical data, aiming to provide an overview which data are stored where, in which format and for what time frame.** The Working Group still sees a need to raise funds (possibly in the framework of a EU-study) for completing the collection of historic data, for verification and transfer into digital format.

Stock data problems relevant to data collections

A number of other stock data problems were brought forward to the contact person and are listed in Annex 05 for the information of ICES, RCMs and PGCCDBS.

InterCatch

Acceptance test of InterCatch

All stock coordinators should make sure that catch data are imported into InterCatch and use InterCatch, following the Generic Terms of Reference. InterCatch is the standardised documentation system for stock assessment expert groups and a part of the ICES Quality Assurance Program. Therefore it is suggested that stock coordinators request national data submitters to import catch data into InterCatch over the internet in the InterCatch format to ease the stock coordinators work. Stock coordinators should verify that InterCatch fulfils the needs of their stocks and gives the expected output. Hereby the stock coordinator can also approve InterCatch as the system, which can be use in the future.

Table of Use and Acceptance of InterCatch

Stock code for each stock of the expert group	InterCatch used as the: 'Only tool' 'In parallel with another tool' 'Partly used' 'Not used'	If InterCatch have not been used what is the reason? Is there a reason why InterCatch cannot be used? Please specify it shortly. For a more detailed description please write it in the 'The use of InterCatch' section.	Discrepancy between output from InterCatch and the so far used tool: Non or insignificant Small and acceptable significant and not acceptable Comparison not made	Acceptance test. InterCatch has been fully tested with at full data set, and the discrepancy between the output from InterCatch and the so far used system is acceptable. Therefore InterCatch can be used in the future.
mac-nea	'In parallel with another tool'			Can be used
her-noss	In parallel with another tool		Small and acceptable	Can be used
hom-nsea	Only tool		Comparison not made	Can be used
hom-west	Only tool		Comparison not made	Can be used
whb-comb	Only tool	InterCatch was used last years		Can be used

1.4 Comment on update and benchmark assessments

For this year, ICES had scheduled update assessments for Blue Whiting, Norwegian Spring Spawning Herring, Western horse mackerel and NEA Mackerel. NEA mackerel assessment was now carried out for the second time after the benchmark process in February 2014 (WKPELA 2014). The boarfish assessment was also carried out for the second time (though this is not yet benchmarked) and for the North Sea horse mackerel data explorations were undertaken and some simple HCRs were examined (no accepted assessment for this stock).

1.4.1 Latest benchmark results

NEA mackerel was benchmarked in February 2014 (WKPELA 2014). The benchmark was successful in producing a state-space assessment model with three fisheries-independent survey series and tagging data, in addition to the catch-at-age data from ages 0—12 (plus group). After the benchmark, a WGWIDE subgroup run the assessment in April 2014 and update advice for 2013 was released in May 2014. The benchmarked assessment was thus run second time in WGWIDE 2014 in August.

1.4.2 Planning future benchmarks

Norwegian spring spawning herring is scheduled for a benchmark in 2016. NEA mackerel benchmark should take place no later than 2017. Boarfish has not been benchmarked yet at all, and there is a need for a benchmarked assessment. However, work is ongoing regarding genetic structure of the stock, and this is supposed to be finished such that a benchmark could take place in 2016. However, the assessment is highly dependent on an acoustic survey, which only has 3 years of estimates at the moment. By spring 2017 there would be 5 points from this survey, which could be better for a benchmark. Thus, for boarfish, WGWIDE would like to keep an option available for benchmark in 2016, but it might be that 2017 will be better suited. For the Western and North Sea horse mackerel, a joint benchmark is needed, as it might even be discussed whether these stocks should be assessed as one or keep them as separate units. Table 1.4.2.1 summarizes the benchmark planning for WGWIDE stocks.

Table 1.4.2.1. Benchmark planning for WGWIDE stocks.

Stock	Year benchmark planned
Norwegian spring-spawning herring	2016
NEA mackerel	At latest 2017
Boarfish	2016/2017
Western horse mackerel	2017
North Sea horse mackerel	2017

1.5 Special Requests to ICES

1.5.1 EU Request for Western horse mackerel management plan evaluation

A special request related to Western horse mackerel management plan evaluation was issued to ICES by the EU in December 2013. The request states the following:

Request

1) ICES is requested to fully evaluate the plan, and ascertain whether it is precautionary in the long term as well as in the short term.

2) Should the plan be found not to be precautionary in the long term, ICES is requested to identify reinforcements in the harvesting rules that would resolve the plan's shortcomings in that respect.

3) ICES is furthermore requested to identify what TAC should apply in 2013 in accordance with a revised harvesting rule under point 2 above.

The request is being address at present by a task group of scientists convened by ICES. A brief narrative of progress to date is presented in section 5.7.2 of this Report.

1.5.2 NEAFC Request for advice regarding blue whiting

Special request related to blue whiting forecast was issued to WGWIDE in spring 2014. The request states the following:

Request:

The North-East Atlantic Fisheries Commission (NEAFC) has noted that ICES in its blue whiting forecast for 2014, assumed the level of recruitment in 2013 to be the same as that in 2012 rather than the geometric mean of the years 1981—2010, which means the spawning biomass in 2015 might be overestimated.

Furthermore, NEAFC noted that the distribution of spawning biomass estimates using the stochastic forecast model is both wide and skewed, which in its view could lead to an overestimation of the F values that are deemed precautionary.

ICES is requested to review the assumptions and performance of the stochastic forecast model. ICES is also requested to assess whether or not there are any implications with respect to the reliability of its previous evaluations of the various options to revise the management plan, as outlined in special requests 9.3.3.1 and 9.3.3.7 of June and October 2013 respectively.

The SAM model provides uncertainty of fishing mortality and stock numbers in the final year estimates that can only be fully applied in a stochastic short-term forecast. The default stochastic projections applied for SAM assessments are carried out by projecting the final year's SAM estimates of stock numbers (log(N)) and fishing mortality (log(F)). Using the variance-covariance matrix of those estimates, a high number (1000) of replicates of the initial stock numbers and fishing mortalities are randomly drawn, such that the variance and co-variance between stock N and F are maintained. Due to additional information affecting recruitment (qualitative use of recruitment indices from surveys not used by SAM), the initial stock estimate for age 1 and age 2, and future recruitment can optionally be raised by an input factor. The 1000 replicates are then simulated forward according to the management options. The forecast result presented in the option table is finally derived from the median of the 1000 replicates.

Compared to a deterministic forecast the stochastic forecast gives slightly higher estimates of TAC and SSB. For this year's advice the TAC for 2015 is estimated 4—5% higher and SSB in 2016 is 8—9% higher. The difference is due to the assumed log-normal distributed stock number. The median of the projected stock N is unbiased compared to the stock N from a deterministic forecast, but the median of quantities like yield and SSB, which is the sum of several age groups N weighted by e.g. F, mean weight and proportion mature, will be higher. The difference between the stochastic and deterministic values increases by when there is more uncertainty around the stock numbers and fishing mortalities used for the forecast.

In the evaluations carried out to answer special requests 9.3.3.1 and 9.3.3.7 the HCS software was used (ICES 2013). These simulations did not directly run a SAM model for each year. Instead, assessment errors were generated matching the level observed in the most recent (at the time) SAM assessment for the stock. This was done by taking the true stock numbers according to the population model and using an autoregressive model with a combination of a year factor and an age factor noise terms to generate errors in the terminal stock numbers. This is to mimic not only year to year uncertainty in the 'assessed' stock numbers, but also some retrospective error.

As is done in practice, the 'assessed' stock numbers are projected forward to the TAC year to get the TAC. This projection is deterministic, based on the point estimates, with specified assumptions for catches or fishing mortalities, according to the harvest rule under study.

At WGWIDE, the default SAM stochastic forecast has been applied for the last three years. For this year however, a deterministic version was applied for advice to match that used in the MSE evaluation (ICES advice 2013). The conclusion that a HCR with target F=0.30 is precautionary, is sensitive to the choice of forecast model. This conclusion is dependent on the use of a deterministic forecast, and may no longer be valid should a stochastic forecast, with a TAC estimated 4—5% higher than in the MSE, is applied in reality. Due to time constraints it was not possible to correct the evaluation and re-estimate a precautionary target F. Therefore ICES uses a deterministic forecast this year which is consistent with the assumptions in the management strategy evaluation.

1.6 Ecosystem considerations for widely distributed and migratory pelagic fish species

It has been known for more than a century that ecosystem factors have a determinant effect on the productivity of fish stocks, and may therefore be a source of variation as important as exploitation by fisheries. Various biological aspects of fish stocks such as recruitment, growth or natural mortality, are influenced by ecosystem factors (Skjoldal *et al.* 2004). Geographical distribution of stocks and species migration patterns may also vary according to environmental conditions (Sherman and Skjoldal 2002). Ecosystem factors influencing fish stocks include:

- Physical (temperature, salinity) conditions
- Hydrographical (turbulence, stratification) conditions
- Large scale circulation patterns
- Inter-species and intra-species relationships
- Bottom-up effect of zooplankton on pelagic fishes
- Competition for food or space between pelagic species
- Top-down control of pelagic species by predator abundance

An important challenge for the future meetings of this working group will be to take ecosystem considerations into account in stock assessment methods in order to reduce levels of uncertainty regarding the status and prediction of stocks. WGWIDE encourages further work to be carried out on ecosystem considerations linked to widely distributed fish stocks including NEA mackerel, Norwegian spring-spawning herring, blue whiting and horse mackerel. Emphasis should be on how ecosystem considerations from scientific studies and knowledge may be implemented and applied for management considerations. A close collaboration with the Working Group on Integrated Assessment on Norwegian Sea (WGINOR) will help in operationalizing ecosystem approach for the widely distributed pelagics assessed in WGWIDE.

Climate variability and climate change

Climate, in its wider sense, refers to the state of the atmosphere, for instance in terms of partitioned air masses (IPCC 2001; 2007). Climate variability, caused by the variations of atmospheric characteristics around the average climatic state, occurs via recurrent and persistent large-scale patterns of pressure and circulation anomalies. The North Atlantic Oscillation (NAO) is the recurrent pattern of variability in circulation of air masses over the North Atlantic region, corresponding to the alternation of periods of strong and weak differences between Azores high and Icelandic low pressure centers. Variations in the NAO influence winter weather over the North Atlantic (storm track, precipitations, strength of westerly winds) and hence have a strong impact on oceanic conditions (sea temperature and salinity, Gulf Stream intensity, wave height). Since 1996 the Hurrell winter NAO index has been fairly weak but mainly positive, except for during 2001, 2004 and 2006 (ICES, 2007). The Iceland Low and the Azores High were both weaker than normal in 2007 and 2008, and the centre of the Iceland Low was displaced towards the southwest to the entrances to the Labrador Sea (ICES 2007, 2008, 2009). The 2011 winter NAO index was negative although not as low as 2010 but lower than the long-term average (1950—2010). Hence, favourable winds supporting a strong Atlantic influence in the waters west of the British Isles and other regions continued to be lower than during high NAO years.

Accumulation of anthropogenic greenhouse gases in the atmosphere is currently effecting climate change (IPCC 2001; 2007). The classical measure of global warming is the Northern Hemisphere Temperature anomaly (NHT) (Jones and Moberg, 2003) which is computed as the anomaly in the annual mean of sea water and land air surface temperature over the northern hemisphere. Since the early 1900s, a warming of the northern hemisphere is evident. A first period of increasing temperature occurred from the early 1920s to about 1945. The period from the 1950s to the middle of the 1970s, corresponded to a light decrease of the NHT. During the last three decades, NHT anomalies have exhibited a strong warming trend. Many fish species are long-lived and therefore the effects of oceanographic conditions may be buffered at the population scale and integrated over time, even at the individual scale (Tasker *et al.* 2008). Nevertheless, pelagic planktivorous species such as northeast Atlantic mackerel, Norwegian spring-spawning herring and blue whiting may take advantage of warming ocean ecosystems expending possible feeding opportunities, through increasing their geographical distribution area, e.g. in Arctic waters.

Circulation pattern

Large-scale circulation patterns set the stage for important processes influencing fish species and ecosystems covered by WGWIDE. The circulation of the North Atlantic Ocean is characterized by two large gyres: the *subpolar gyre* (SPG) and *subtropical gyre* (Rossby, 1999). When the SPG is strong it extends far eastwards bringing cold and fresh subarctic water masses to the NE Atlantic, while a weaker SPG allows warmer and more saline subtropical water to penetrate further northwards and westwards over the Rockall plateau area. Changes in the oceanic environment in the Porcupine/Rockall/Hatton areas have been shown to be linked to the strength of the subpolar gyre (Hátún *et al.*, 2005). In recent years the area has been dominated by the warmer and more saline Eastern North Atlantic Water (Hátún *et al.*, 2007). The large oceanographic anomalies in the Rockall region spread directly into the Nordic Seas, regulating the living conditions there as well as further south. Such changes are likely to have an impact on the spatial distribution of spawning and feeding grounds and on migration patterns of certain pelagic species.

Temperature

Temperature is well known to affect many aspects of fish biology, such as recruitment, growth, or mortality rates. Temperature affects fish both directly – through its effect on metabolic rates affecting growth and energy requirements - and indirectly – through its effect on the production of prey items and production and distribution of predators.

Feeding and spawning distributions and migration patterns of widely distributed species are also closely related to temperature: the timing of migration can be triggered by temperature and migration routes are related to temperature gradients (Harden Jones 1968; Leggett 1977). A better understanding of these effects could provide valuable information for both assessment and management of widely distributed stocks.

Time-series of sea surface temperature (SST) and salinity for the North Atlantic show generally rising trends in the recent years. An increasing trend in temperature and salinity was observed in the upper ocean during the period from 1996-2008 (ICES 2008), and during the period 2008-2010 the Atlantic Water surface temperatures were above the long term mean (NOAA 2010). This positive anomaly in the sea temperature in Northeast Atlantic continued in 2011-2013 (IESNS report 2013). The increase in SST at several of the stations in the NE Atlantic has been up to 3°C since the early 1980s. This rate of warming is very high relative to the rate of global warming (ICES 2007, 2008). The upper layers of the North Atlantic and Nordic Seas remained exceptionally warm and saline in 2006 and 2007 compared with the long-term average (ICES WGOH 2007, 2008), but also above the long-term average in 2008–2014. The largest anomalies were observed at high latitudes. The North Sea, Baltic Sea and Bay of Biscay had an unusually warm winter and spring. This was due to a combination of stored heat from the warm autumn in 2006, and high solar radiation in 2007 (ICES WGOH 2008). A similar trend was evident in 2008-2010, but not as extreme as the two years before. In 2011 this trend seems to have been further weakened.

Phytoplankton

Phytoplankton abundance in the NE Atlantic has increased in cooler regions (north of 55°N) and decreased in warmer regions (south of 50°N) (Tasker *et al.* 2008). These changes in the primary production are likely to have impacts on zooplankton because of tight trophic coupling (Richardson and Schoeman, 2004). In the Norwegian Sea the average phytoplankton concentrations have shown a reducing trend the last decade, whereas the North Sea has shown an increased trend in phytoplankton concentrations the last few years (Naustvoll *et al.* 2010).

Zooplankton

Indicators of zooplankton communities which have been developed over recent years reveal important changes in the pelagic ecosystems of the North East Atlantic (Beaugrand, 2005). A northwards shift of 10° of latitude of the biogeographical boundaries of copepod species has, for instance, occurred during the past four decades (Beaugrand *et al.* 2002). One well-known example of these changes is the decline in the North Sea of the sub-arctic copepod *Calanus finmarchicus*, an important food item for a number of fish species, and its replacement by *Calanus helgolandicus*, a temperate water species. This invasive species dominates at times along the southwestern coast of Norway (Ellertsen and Melle 2009). Due to a different life-strategy and the lack of suitability as food, any increase in the population of this species at the expense of *C. finmarchicus* might have a detrimental effect on pelagic planktivorous fish e.g. mackerel, herring and blue whiting. Progressive increases in abundance of warm water/subtropical phytoplankton species into more temperate areas of the northeast Atlantic (Beaugrand *et al.* 2005) have in turn influenced zooplankton communities. The average biomass of zooplankton in the Norwegian Sea has followed a decreasing trend since 2002, and reached a record low in 2009, but have shown an upward trend since then and was in 2014 just over the average of the time series 1997—2014 (IESNS report 2014). The overall distribution pattern of zooplankton biomass has changed during the recent years. Previously the highest biomass of zooplankton was usually observed in the cold waters of the East Icelandic Current, where high aggregations of adult herring and mackerel were also observed. From about 2009 these western high density areas are less pronounced (IESNS report, 2012).

The reason for a decline in the biomass index of zooplankton during the period 2002—2009 in Nordic Seas is unknown. A number of possible reasons could explain this decline and the present low level, including reduction in phytoplankton (Naustvoll *et al.* 2010; i.e. bottom-up), possible changes in phytoplankton community, possible changes in zooplankton community, and increased grazing pressure by pelagic fish stocks (i.e. top–down). Simultaneously to the recent (2009—2014) upward trend in the zooplankton index in May (IESNS report 2014), as well as in the IESSNS surveys in July/August (2011—2013; Nøttestad *et al.* 2013), the weight-at-age (this report) and length-at-age (WGINOR report 2013) in the Norwegian spring-spawning herring feeding in the area are showing increasing trend. It is an indication that the Norwegian Sea is neither being overgrazed at present by the pelagic fish stocks in the area, nor that the herring stock is starving (i.e. increased natural mortality) because of relatively low zooplankton indices in recent years, as was hinted at in recent WGWIDE report (ICES 2012). Further studies on this issue will take place within the ICES working group on integrated assessment in Norwegian Sea (WGINOR report 2013), where the zooplankton index will also be revised and produced for the different areas in the Nordic Seas. The goal of WGINOR is to come up with a holistic ecosystem assessment of the Norwegian Sea and it will be the task in the years to come.

Species interactions

A central element in ecosystem considerations is how different species interact with each other (Rothschild 1986, Skjoldal *et al.* 2004). The distribution of species considered by WGWIDE can overlap to a large extent during some part of the year and according to life history stages. Since these species are mainly planktivorous, density dependent competition for food could be expected. All the species are potential predators on eggs and larvae and the larger species (mackerel and horse mackerel) are also potential predators of the juveniles. Consequently, cannibalism and inter-specific interaction between pelagic species could play an important role in the dynamics of these pelagic stocks.

Various pelagic species (e.g. mackerel, horse mackerel, sardine, blue whiting) also represent an important food source for many top predators such as marine mammals, seabirds and other species of pelagic fish. Many pelagic ecosystems (particularly those in upwelling areas) are characterised by a wasp-waist control, where a few, but highly abundant fish species effectively regulate the populations of their prey (top-down control) but also of their predators (bottom-up control). This type of regulatory mechanism makes pelagic fish have a key role in ecosystem functioning (Skjoldal *et al.* 2004).

There is a large body of literature on the diet of predator species feeding on pelagic fish in the Northeast Atlantic: sardine, mackerel, horse mackerel, blue whiting and herring have all been found in the diet of several cetacean and seabird species and are also part of the diet of other fish species (e.g. hake, tuna found with sardine and anchovy) (Anker Nilssen and Lorentzen, 2004; Nøttestad and Olsen 2004). Comparison of population estimates of pelagic fish with those of top predators (e.g. minke whale, fin whale, killer whales) suggests that predation on pelagic fish by other pelagic fish has a much bigger potential for impact in regulating populations than that the predation by marine mammals and seabirds (Furness (2002), in the context of the North Sea). Nevertheless, top predators could play a bigger role in pelagic fish dynamics at regional or local scales particularly when fish biomass is low (Holst *et al.* 2004; Nøttestad *et al.* 2004).

1.7 Future Research and Development Priorities

As part of the planning towards future benchmark assessments, the working group prepared a list of research priorities for each stock, and as a whole than can potentially improve the quality of the advice generated for each stock. We have considered scientific research, improvements to data collection and development of assessment techniques, both generally and on a stock-by-stock basis, as appropriate. The most important of these developments are described below.

1.7.1 General

Area where WGWIDE can improve considerably is work towards integrated ecosystem assessments. Some of WGWIDE members also participate in the work of the Working Group on Integrated Assessment for Norwegian Sea (WGINOR), which help in communication between these two groups. However, there are also other regional Integrated Ecosystem Assessment groups that could be relevant for WGWIDE and the stocks assessed by it. We hope to put more emphasis on this in the coming years.

1.7.2 NEA Mackerel

Although the stock was benchmarked this year (WKPELA 2014), there are already rather many issues for the next benchmark (2016/2017). These include:

- RFID tags, inclusion of the time series to the assessment model
- Recruitment index mackerel (model): Include additional gear effects in the recruitment model. Make use of existing French-Irish intercalibration data, to account for the two gear types ´GOV´ and ´French trawl´. (Teunis - IBP). Consider inclusion of first quarter NS-IBTS data in the model (Teunis - IBP)
- Continuous Plankton Recorder (CPR) for the mackerel survey.
- Examine whether the larvae data from the Continuous Plankton Recorder (CPR) from 1984—2004 can be used. [Cefas – Sophy Pittois].
- Alternative explanations for the drop in mean weight-at-age in recent years should be investigated, including the possibility of sampling bias due to shifting spawning timing, the effect of spatial expansion of the stock, and density-dependence.
- The IESSNS it still a short time-series (5 years) and the catchability estimated by the model is still very uncertain. The incorporation of this survey in the assessment should be re-evaluated in the near future when more survey years are available. Specifically WGWIDE should explore the use of the IESSNS index as multinomial in SAM (only use the age distributions, not the abundance).

- The triennial egg survey: WGWIDE should consider the influence of the lack of egg-survey data in inter-egg-survey year assessments, and propose settings to be added to the Stock Annex for future years.
- SAM model should be adapted so that the post tagging survival is modelled as a random walk, to allow for temporal variability of this parameter.
- Current M value was estimated using both tagging-recapture information and catches from the 1970, which are now known to be severely underestimated. The estimation of M should be revisited using most recent and accurate data.

1.7.3 Blue Whiting

- There is a need for more information regarding population structure in these stocks. Numerous scientific studies have suggested that blue whiting in the North Atlantic consists of multiple stock units. The ICES Stock Identification Methods Working Group (SIMWG) reviewed this evidence in 2014 (ICES SIMWG 2014) and concluded that the perception of blue whiting in the NE Atlantic as a single-stock unit is not supported by the best available science. SIMWG further recommended that blue whiting be considered as two units. However, there is currently no information available that can be used as the basis for generating advice on the status of the individual stocks. There is therefore a need to begin to collate information on these stocks in the leadup to a potential benchmark of this stock in the future. Potential data sources identified by the group include
    - Otolith-shape analysis has recently been shown to be able to reliably identify the stock-origin of sampled fish Keating *et al.* (2014). Use of this method in conjunction with age-reading in both scientific surveys and catch sampling can therefore provide a valuable source of information about the individual stocks. WGWIDE therefore recommends that during the next "Age Reading Workshop for Blue Whiting", otoliths from the whole area of this stock distribution should be collected to perform shape analysis, and used to both standardize the technique and plan for its roll-out.
    - The spatial and temporal coverage of the International Blue-whiting spawning stock survey (IBWSS) currently does not include the southern component, which spawns in the Porcupine Seabight in February-March (Pointin and Payne 2014). WGWIDE therefore recommends expansion of this survey to cover this component.
    - This Mackerel Egg Survey (MEGS) survey has previously been shown to provide valuable information about the distribution of fish spawning, including blue whiting (Ibaibarriaga *et al.* 2007). This survey covers the spatial and temporal distribution of spawning in both blue whiting stocks extremely well, and can therefore provide valuable information about their relative abundances. WGWIDE therefore requests that blue whiting larval be identified and counted per haul during the 2016 version of this survey.

1.7.4 NSS Herring

Norwegian spring spawning herring is scheduled for a benchmark in 2016. There are several issues with the current assessment model, and work is already being undertaken in national laboratories to improve the assessment of this stock. Last year WGWIDE set up the following issue list for benchmark, but these are all still open to discussion:

- exploration of alternative assessment models including different configurations of TASACS which produce more stable input values for the oldest age group
- investigate the bias in the assessment
- an analysis of variability or changes in the catchability of fleet 5. This is the major fleet used for tuning the assessment and seems to be causing retrospective patterns in the assessment
- the inclusion of a new tuning series (IESSNS) in the assessment
- the use of surveys in the assessment for tuning
- based on data, to be provided by the major fishing nations, whether estimates of slipping should be included in the assessment
- update maturity ogives for recent years following procedures as described by WKHERMAT.
- extend the time series used in the assessment with earlier years before 1988
- the need to continue the use of weighted average F in the assessment and advice. NSSH is one of the few stocks in which weighted F's are applied.
- the consequences for the reference points and management plans if the use of weighted F is discontinued.

1.7.5 Horse Mackerel

Generally speaking, management is most effective when its measures apply to all fisheries exploiting a stock and when catches can be identified as originating from that stock with some certainty. Considering the potential of mixing between Western and North Sea horse mackerel occurring in Division VIId/VIIe, better insight into the origin of catches from that area will be a major benefit, if not crucial, for improvement of the quality of future scientific advice and thus management of the North Sea and Western horse mackerel stocks.

- One way of possibly distinguishing between individuals of the two stocks is with the GCxGC-MS (Gas chromatography x Gas chromatography–mass spectrometry). A pilot project aimed at determining whether this technique could be used for distinguishing between Western and North Sea horse mackerel was planned at IMARES but due to funding restrictions this is unlikely to proceed further.
- Alternative methods for resolving the stock identity in the channel could be explored
- Methods for distinguishing between fish of North Sea or Western origin in the catches in this region (e.g. otolith shape analyses) should be explored

North Sea horse mackerel

There are numerous difficulties fitting an assessment model for this stock: unclear stock boundaries, limited fishery independent data sources, difficulty aging horse mackerel and lack of strong cohort signals in the catch at age data.

The IBTS survey used to develop indices for this stock is a bottom trawl survey targeting primarily ground fish (gadoids), but also catching pelagic species (e.g. horse mackerel). This survey does not cover the full distribution area of the stock. Though it covers the area of the North Sea where the population is thought to be in Quarter 3, it does not cover Division VIId where the majority of the fishery occurs (in Quarter 1 and 4). Alternative fishery independent data sources would be beneficial in developing an assessment model for this stock

- CPR larvae data in the stock distribution area could be analysed
- The French CGFS survey in VIId may provide information on horse mackerel abundance
- Ongoing projects at IMARES on utilizing commercial acoustics data for mackerel and blue whiting could be extended to horse mackerel
- Any other data on horse mackerel abundance in the channel would be useful

Improving the quality of age data for this species would help resolved some the lack of clear cohort signals in the catch data. Additionally, aging of horse mackerel caught in the IBTS survey (currently only length measures are taken) would improve the indices derived from this data source.

- Maintain regular age-reading workshops to ensure accuracy and consistency of age reading of this species (through ICES).
- Recommend age reading of horse mackerel caught in the IBTS survey

1.7.6 Boarfish

This stock would benefit immensely if it were included in the data collection framework. The advantages would be apparent in a number of different areas, primarily:

- Support for age reading of otoliths from catch samples of boarfish would allow the compilation of annual age-length keys for the fishery. This is of great importance if the stock is to move to a more appropriate age based assessment in the future.
- The boarfish acoustic survey could be conducted on a dedicated research vessel, which would allow the collection of multi-frequency acoustic data as well as oceanographic and other supplementary data.

As it is, the boarfish acoustic survey may not cover the entire area of this stock. Extending the survey coverage to the south or having a closer alignment with other surveys covering that area could answer many uncertainties about the fluctuations in the estimated biomass.

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