MSC Final Report and Determination

for

DFPO and DPPO North Sea, Skagerrak and Kattegat Sandeel, Norway Pout, and Sprat fisheries

MRAG Americas, Inc.

Jake Rice, Ken Haste Andersen, and Amanda Stern-Pirlot

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1 Executive Summary

This Final Report and Determination (FRD) sets out the results of the Marine Stewardship Council (MSC) assessment of the DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, Norway pout, and sprat fisheries against the MSC Principles and Criteria for Sustainable Fishing.

MRAG Americas was contracted in 2015 by DFPO to undertake an MSC assessment of the DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, Norway pout, and sprat fisheries.

The assessment was undertaken in accordance with the MSC Fisheries Certification Requirements (v. 2.0, April 1, 2015) and using the MSC Guidance to the MSC Fisheries Certification Requirements (v. 2.0, April 1, 2015) which sets out the assessment process, and using the default assessment tree contained within the MSC Certification Requirements v1.3. The site visit for this assessment was carried out in combination with a site visit for the separate assessment of the DFPO/DPPO/SPPO Skagerrak, Kattegat and Western Baltic herring fishery: https://www.msc.org/track-a-fishery/fisheries-in-the-program/in-assessment/north-east-atlantic/sppo-dppo-and-dfpo-western-baltic-spring-spawning-herring/assessment-downloads.

The following steps have been undertaken as part of the fishery assessment process:

- Announcement of the assessment, including assessment team, use of the default assessment tree (v1.3), and notification of the site visit.
- Undertaking of the site visit
- Production of the client draft scope extension report that describes the background to the fisheries, the fishery management operations and the evaluation procedure and results.
- The stakeholder consultation on proposed peer reviewers
- Peer Review Confirmation
- Production of the Peer Review Report
- Response to peer review comments
- Production and publication of the Public Comment Draft Report
- Response to public comments and MSC Technical Oversight
- Production and publication of the Final Report and Determination

The assessment of the DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, Norway pout, and sprat fisheries was undertaken by Jake Rice (Principle 1) Ken Haste Andersen (Principle 2) and Amanda Stern-Pirlot (Principle 3). Amanda Stern-Pirlot was the Assessment Team Leader.

A site visit was conducted in Copenhagen and Skagen, Denmark during June 9-12, 2015. During that time, the assessment team met with scientists, fishery managers and stakeholders as well as clients and harvester representatives. The site visit served a dual purpose: for this assessment and for the assessment of the DPPO and SPPO Skagerrak, Kattegat and Western Baltic herring fisheries. There was one meeting requested from additional stakeholders from the industrial fish processing sector, and no written submissions were received.

The following strengths and weakness were identified with respect to the three Principles:

Principle 1:

Strengths:

- Good stock assessments and supporting information for all three species except sandeel in Areas 4 and 6, where harvests are appropriately precautionary in these data-deficient areas.
- Accounting for the importance of these species in the ecosystem by incorporating the demands of predation mortality into the stock assessments and TAC setting decisions.

Weaknesses:

- No formalized harvest control rule or long term management plan is available for any of the stocks.
- The sandeel complex is dominated by *A. marinus*, but made up of several species. Relatively little is known about most of them and only *A. marinus* is managed.

Principle 2:

Strengths:

- State-of-the-art assessments of the impact of ecosystem effects of how the fishery impacts dependent predators, including birds and mammals.

Weaknesses:

- The Norway pout fishery is conducted on a muddy bottom, which in some places (Fladen ground) harbors sensitive sea pen communities.

Principle 3:

Strengths:

- Robust and transparent management based on good, readily available scientific information at both the European and national levels.
- Good stakeholder involvement in management through advisory committees and other forums.

Weaknesses:

- Lack of long term management plans for all three target species.
- Discrepancies between logbook reporting and official statistics.

Based on the information available to date, the North Sea, Skagerrak and Kattegat sandeel, sprat and Norway pout fishery, achieved overall scores as follows:

Final Principle Scores			
Principle	**Sandeel**	**Sprat**	**Norway Pout**
Principle 1 – Target Species	81.5	84.4	81.3
	Purse seine	**Trawl**	
Principle 2 – Ecosystem	85.0	82.3	
Principle 3 – Management System	87.5		

As such, MRAG Americas has determined that the fishery **should be certified** against the MSC Fisheries Standard, as no indicator scored less than 60, and all overall principle scores were above 80.

Eleven conditions of certification were placed on the fishery and the conditions and milestones for the fishery are detailed in Appendix 1.3 of this report.

2 Authorship and Peer Reviewers

The assessment of North Sea, Skagerrak and Kattegat sandeel, sprat and Norway pout fishery was undertaken by Dr. Ken Haste Anderson, Dr. Jake Rice, and Ms. Amanda Stern-Pirlot. Amanda Stern-Pirlot was the Assessment Team Leader.

Dr. Ken Haste Andersen. Ken H Andersen is professor in theoretical marine ecology at the Technical University of Denmark, where he is also head of section and deputy director of the centre of excellence: Ocean Life. The overarching aim of his research understand how marine ecosystems are affected by perturbations, in particular fishing. He has been a pioneer in developing size-based model techniques to describe fish communities, and for applying them to make ecosystem-based impact assessments of fisheries. A particular interest is how fishing on one part of the ecosystem affects the fisheries in other parts of the ecosystem, such as forage fisheries. A key aim of his research is to link developments in basic science with applications for fisheries. To this end he is active in ICES advice forming, EU fisheries related projects and collaborative projects with the Danish fishing industry.

Dr. Jake Rice. Dr. Jake Rice is Chief Scientist for the Department of Fisheries and Oceans, Canada. He previously served as Director of Peer Review and Science Advice and held senior DFO Science positions in Pacific and Newfoundland Regions. He received BSc. from Cornell (1970 Conservation) and Ph. D. from University of Toronto (1974 - Ornithology). He has more than 270 publications in the scientific and technical literature, primarily on the ecosystem approach to integrated management. He is a member of the Group of Experts for the UN Regular Process for Global Marine Assessments, and a Lead Authors for the chapter on Drivers, Trends and Mitigation, for the next IPCC Assessment Report. He has been active as an expert or delegate to many UN meetings and agencies (FAO, CBD, GEF, UNEP, UNESCO-IOC, ICP, BBNJ etc.).

Ms. Amanda Stern-Pirlot is an M.Sc graduate of the University of Bremen, Center for Marine Tropical Ecology (ZMT) in marine ecology and fisheries biology. Ms. Stern-Pirlot joined MRAG Americas in mid-June, 2014 as MSC Certification Manager, and is currently serving on the assessment team for New Zealand Orange Roughy. She has worked together with other scientists, conservationists, fisheries managers and producer groups on international fisheries sustainability issues for the past 10 years. With the Institute for Marine Research (IFM-GEOMAR) in Kiel, Germany, she led a work package on simple indicators for sustainable within the EU-funded international cooperation project INCOFISH, followed by five years within the Standards Department at the Marine Stewardship Council (MSC) in London, developing standards, policies and assessment methods informed by best practices in fisheries management around the globe. Most recently she has worked with the Alaska pollock industry as a resources analyst, within the North Pacific Fisheries Management Council process, focusing on bycatch and ecosystem-based management issues, and managing the day-to-day operations of the offshore pollock cooperative. She has co-authored a dozen publications on fisheries sustainability in the developing world and the functioning of the MSC as an instrument for transforming fisheries to a sustainable basis.

The assessment report was reviewed by two peer reviewers selected through the MSC Peer Review College process.

Dr Mike Pawson Dr Mike Pawson has 45 years' experience as a fisheries scientist carrying out biological research and providing expert advice in relation to fish stock assessment and fisheries management and regulation to the UK government and the EC. Between 1974 and 1980 Mike initiated and led acoustic surveys on blue whiting and mackerel west of UK and trawl surveys in the North Sea, worked as UNESCO expert with the Libyan fisheries laboratory 1979 to 1981, and from 1980 to 1990 initiated and managed Cefas's coastal fisheries programme. From 1990 to 2002 Mike led the Western demersal team providing analytical assessments and management advice for 12 finfish stocks in the English Channel, Irish Sea and Celtic Sea. He was chairman of ICES Southern Shelf Demersal Stock Assessment Working Group 1996-98, Sea bass Study Group 2000-04 and Elasmobranch Study Group 2001-02, and initiated and co-ordinated of EC-funded multi-national projects on methods for egg-production stock biomass estimation in Irish Sea (plaice, sole and cod:1995 & 2000), bio-geographical identity of English Channel fish stocks, bio-economic modelling of Channel fisheries, development of assessment methods for elasmobranchs, marine recreational fishing etc. Between 2002 and 2007 Mike directed and managed monitoring and assessment of England and Wales salmonid and eel stocks. In 2007 Mike retired from Cefas, having published 71 formal papers and 13 book chapters, and contributed to numerous technical and assessment reports. He continues to acts as scientific consultant, including specialist input to MSC assessments (14 to date) and peer review of research papers, project applications and MSC assessments (45 to date).

Dr Lisa Borges. Dr Borges has been a fishery scientist for the last 18 years and now runs her own consultancy firm. Lisa has a BSc in Marine Biology & Fisheries from the University of the Algarve (Portugal), an MSc in Fisheries from the University of Porto (Portugal), and a PhD on discards from demersal fisheries from the National University of Ireland. She has worked for three national fisheries research institutes, which include IPIMAR (Portugal), the Marine Institute (Ireland), and IMARES (The Netherlands). Lisa has extensive knowledge and experience of assessing the environmental impact of fisheries, with a particular focus on discards and bycatch in particular. She also has knowledge and experience of fisheries management policies, including harvest control rules, management plans and discard policy development. Lisa developed conservation policies for Atlantic fish stocks when she worked for the European Commission in Belgium. Lisa has experience in both pelagic and demersal stock assessments, and is familiar with MSC assessment procedures, having participated as a principle 1 and 2 expert on four different assessments over the last year.

3 Description of the Fishery

3.1 Unit(s) of Assessment (UoA) and Scope of Certification Sought

3.1.1 UoA and Proposed Unit of Certification (UoC)

MRAG Americas confirms that this fishery is within scope for MSC assessment.

There are 4 Units of Assessment: 3 trawl and 1 purse seine. The sandeel unit consists of six subunits, treated as 'scoring elements' for efficiency of reporting and scoring—one each for the five sandeel management areas as well as one for the 'other sandeel' stock complex.

Unit number	Target Stocks	Methods of Catch	Management
1a	Sandeel *(Ammodytes marinus*) SA 1 (See Figure 1 for the location of the Sandeel management areas in the North Sea)	Trawl	DFPO, Danish and EU management
1b	Sandeel (*A. marinus*) SA 2		
1c	Sandeel (*A. marinus*) SA 3		
1d	Sandeel (*A. marinus*) SA 4		
1e	Sandeel (*A. marinus*) SA 6 (Skaggerak)		
1f	Other sandeel species, all areas.		
2	Norway pout (*Trisopterus esmarki*) in Divisions IV and IIIa (Skagerrak and Kattegat)		
3	Sprat (*Sprattus sprattus*) in Division IV (North Sea)		
4	Sprat (*S. sprattus*) in Division IV (North Sea)	Purse Seine	

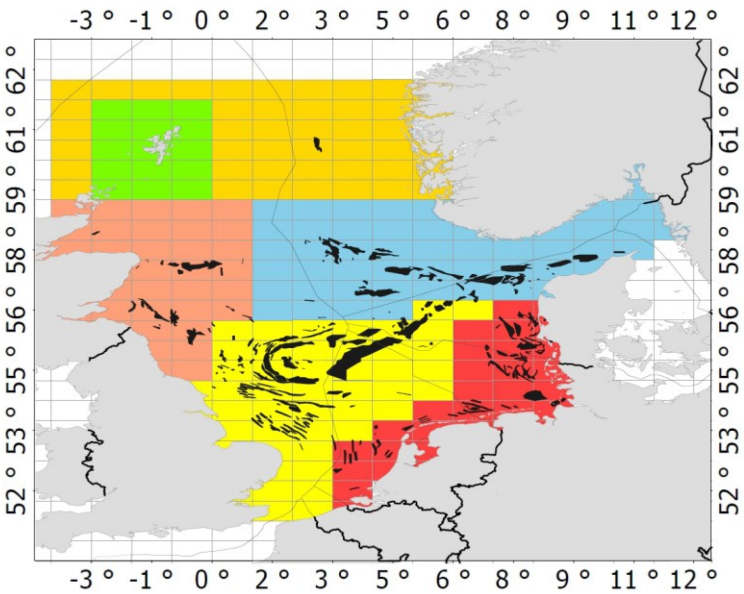


Figure 1. Sandeel assessment regions as defined by ICES(s) (2009). Black patches represent locations of suitable habitat for sandeels and the colours represent the different management units. Yellow denotes area 1, red area 2, blue area 3, pink area 4, orange area 5 and green area 7. Area 6 is in the eastern Skagerrak, east of Jutland and not pictured on this map.

All vessels that are members of Danish POs fishing on the above-named stocks using the above-named gears are part of the UoAs.

These UoAs were chosen because they reflect the range of the stocks where they interact with the DFPO registered fishing fleet.

3.1.2 Final UoC(s)

(PCR ONLY)

The PCR shall describe:

a. The UoC(s) at the time of certification.
b. A rationale for any changes to the proposed UoC(s) in section 3.1(c).
c. Description of final other eligible fishers at the time of certification.

(References: FCR 7.4.8-7.4.10)

3.1.3 Total Allowable Catch (TAC) and Catch Data

Table 1. TAC and Catch Data

Sandeel

TAC (all areas combined)	**Year**	**2014**	**Amount**	**207,219 t**
UoA share of TAC	**Year**	**2014**	**Amount**	**207,219 t**
UoC share of total TAC	**Year**	**2014**	**Amount**	**195,471 t**
Total green weight catch by UoC	**Year (most recent)**	**2014**	**Amount**	**156,541 t**
	Year (second most recent)	**2013**	**Amount**	**208,656 t**

Sprat

TAC	Year	2014	Amount	144,000 t
UoA share of TAC	Year	2014	Amount	135,000 t
UoC share of total TAC	Year	2014	Amount	122,383 t
Total green weight catch by UoC	Year (most recent)	2014	Amount	135,906 t
	Year (second most recent)	2013	Amount	65,548 t

Norway Pout

TAC	Year	2014	Amount	128,250 t
UoA share of TAC	Year	2014	Amount	106,250 t
UoC share of total TAC	Year	2014	Amount	106,152 t
Total green weight catch by UoC	Year (most recent)	2014	Amount	28,448 t
	Year (second most recent)	2013	Amount	38,354 t

3.1.4 Scope of Assessment in Relation to Enhanced Fisheries

This fishery is not an enhanced fishery.

3.1.5 Scope of Assessment in Relation to Introduced Species Based Fisheries (ISBF)

These are not fisheries based on introduced species.

3.2 Overview of the fishery

The Danish sandeel, sprat and Norway pout fishery is considered an “industrial fishery,” as the catches are almost exclusively processed upon landing for “reduction” into fishmeal and fish oil, mainly as an aquaculture feed ingredient.

Initially, Industrial fishing using trawlers began in the 1940s with herring fishing in the North Sea. Over time, other fish species included sand eel, Norway pout, blue whiting and sprat. By 1993, the percentage of sandeel was about 70%, and the total industrial fish catch was 1.2 million tons. In recent years, the total industrial fishery catch is around half a million tons, with the the lower landings mainly the result of a more restrictive regulatory approach, as can be seen in the ICES graphs particularly for sandeel in section 3.3 of this report. For example, fishing mortality has been consistently lower in the last 10 years than in the 20 previous years. Because sandeel was always the most important species, the reduction in TAC (in combination with ITQs) lead to a strong decrease in fleet capacity which has contributed to some quota under-shoot in the Norway Pout fishery as well.

The sandeel fishery developed in the 1970’s and peaked in the late 1980’s and late 1990’s with landings over 1,000,000 t. Since 2003 landings have generally been in the range of 200-400,000 t for the entire area. Since 2011 ICES advice has been sub-area based (SA 1-7). The sprat fishery peaked in the 1970’s with landings of up to 700,000 t. Since early 1990’s, landings have been in the range of 100 – 200,000 t.

The Norway pout fishery developed in the late 1960’s and peaked in the 1970’s with landings of up to 700,000 t. Since 2000 landings have generally been below 100,000 t.

The Danish industrial fishing fleet comprises the majority of the fishery on these three species in these areas. There are a few other EU vessels from Sweden and Germany who target these stocks, as well as a Norwegian fishery in the Norwegian waters of SA 3 for sandeel and for Norway pout in the North Sea.

The fishery is prosecuted using pelagic trawl vessels (with the sprat fishery also using purse seines). These vessels use fish pumps to pump the catch on board from the cod end of the net after it is hauled back. The catch goes through a sorting grate then directly into the hold. With the exception of some basket sampling for catch composition, there is no handling of the fish on board by the crew.

The fishery is prosecuted according to the EU: Common Fisheries Policy (including discard/slipping ban from Jan 1 2015), annual TACs (set in-year for sandeel), technical rules (mesh size, catch composition, closed areas), Natura2000 and Marine Strategy Framework (MSFD) directives. Denmark is responsible for allocating national quota, implementing Natura 2000 and the MSFD, and monitoring, control and surveillance. Scientific advice is provided by the International Council on the Exploration of the Seas (ICES), including annual stock assessment and coordinated research surveys.

3.3 Principle One: Target Species Background

Lower trophic level fish species (such as sandeel, sprat and Norway pout) rely on copepods for food, while they themselves provide food for higher trophic level species such as adult predatory fish, marine mammals, and birds (Figure 32). In this context, the species targeted by the reduction fishery, together with juvenile herring, form a complex where the function of each species is partly substitutable by the other species (Table 26). Even though many species eat the forage fish, no single predator rely fully on one forage fish species. Therefore, none of the forage fish can be considered keystone species, but the forage fish community as a whole can be considered a *key trophic level*. Therefore the assessment team has decided to evaluate each of these species as key LTL species under Principle 1 of this assessment. Much of the description of how these fisheries are managed for ecosystem needs, including dependency of predators, is covered under the Principle 2 narrative at the beginning of section 3.4.

SANDEEL

General Considerations

The North Sea sandeel stock complex subject to certification assessment comprises a large suite of population units. Sandeel concentrations are found on suitable shallow sand bottom habitat throughout the North Sea (Wright et al.2000), but these habitats are localized spatially (Figure 1) . Although sandeels on individual undersea sand banks are not thought to be independent populations, several lines of evidence suggest post-settlement dispersal of sandeel is limited (ICES(s) 2009). Sandeel eggs are demersal and the larvae are only pelagic for 50–90 days, such that dispersal or transport by currents makes exchange of larvae across the entire North Sea unlikely (Wright and Bailey, 1996; Proctor et al., 1998; Jensen et al., 2001; Munk et al., 2002; Christensen et al., 2008). Once settlement has occurred the maximum distance travelled by tagged individuals was only 64 km over 1–3 years (Gauld, 1990a). Combining this information in model simulations that consider spawning sites and larval transport suggest that aggregations of banks at scales from 50–300 kms apart can be connected by the annual dispersal and advection of larvae (Proctor et al., 1998; Christensen et al., 2008).

A review in 2009 (ICES(s) 2009) first distinguished the northwest North Sea as hydrographically isolated from other grounds in the North Sea. Further subdivisions were less fully isolated hydrographically, but the differentiations are supported by other evidence. Productivity differences among the unit areas area divisions have been indicated from differences in size, maturity and fecundity-at-age, particularly with respect to area 4 and other areas (Gauld 1990b, Jensen *et al*., 2001; 2010, Boulcott *et al*., 2007; Boulcott and Wright, in press). The ICES review concluded that seven management units were a reasonable compromise of localized stock distribution and transport with the scales of fishery operations and management requirements (ICES(s) 2009). However, even within these management units there is evidence of restricted movement between habitat patches on scales of a few tens of kms. (Jensen et al., 2010). This indicates that management needs to protect against local depletion of localized sub-population units. The fishery is concentrated in areas 1, 2 and 3, that are the main units for this certification assessment. Units 4 and 6 are considered using the MSC Risk-Based Framework and are managed under highly restrictive catch limits (see Appendix 1.2).

Stock structure is made more complex because sandeel in the North Sea actually comprise a mixture of at least five species. At least 75% of the sandeel are *Ammodytes marinus*, with the larger greater sandeel (*Hyperoplus lanceolatus*) the majority of remainder of the biomass. However, the unquantified balance of the sandeel biomass is comprised of three other species (*A. tobianus, Hyperoplus immaculatus*, and *Gymnammodytes semisquamatus*) that cannot be morphologically distinguished from *A. marinus* without expert knowledge and microscopy or genetic tools. Although *A. marinus* comprise the large majority of harvests, particularly in the first half of the year when most of the catch is usually taken, fisheries in the eastern North Sea have some potential to take the minor sandeel species in mixed catches (ICES 2015a-s). All species of sandeel that are not *A. marinus* are considered under Principle 1 as a “scoring element” using the Risk-Based Framework because they are indistinguishable in the catch from the target sandeel and caught in unknown quantities, thus making them ineligible as “Inseparable or Practicably Inseparable species”, see Appendix 1.2.

Management currently does not recognize this species complex and manage as if there is just one species caught (*A. marinus*). This management practice corresponds to an implicit assumption that the four species maintain the relative abundance within the stock complex (i.e. assuming that fishery targets all species equally and that they have similar productivity). Taking into account that it appears very likely that the complex is by far dominated by *A. marinus*, and that lesser sandeel is less targeted because it prefers shallower habitats than where the fishery is concentrated, this implicit assumption likely avoids putting the minor species under immediate threat.

Outside the North Sea, sandeel extend to the east into the Baltic Sea, west around the British Isles and south to Iberian waters, and north and northwest at suitable depths around the North Atlantic and down the eastern coast of North America. Species and stock affinities of these larger scales has not been established.

Sandeel are harvested primarily with specialized bottom trawls, and bycatches of other species are tightly regulated (ICES 2014a-s, Stock Annex section 3.1). Since the 1990s, Denmark has accounted for at least 80% of sandeel landings from the North Sea, with Norway taking most of the remainder. See section 3.2 for more information on the fishery. Figure 2 shows the aggregate landings between 1999 and 2013. The lower landings since the early 2000s reflect in part a more restrictive regulatory approach to managing harvests, but largely a reduction in recruitment to the stock. The breakdown of total catches (landings plus ICES estimates of discarding) by management unit is shown in Table 1. The dominance of areas 1-3 in the catches is apparent from the table, although the distribution of catches among those areas varies among years. Landings in years prior to 1983 show similar interannual variation, and in some years reached 800,000 t, but reliable information on spatial allocation of management unit areas is not available.

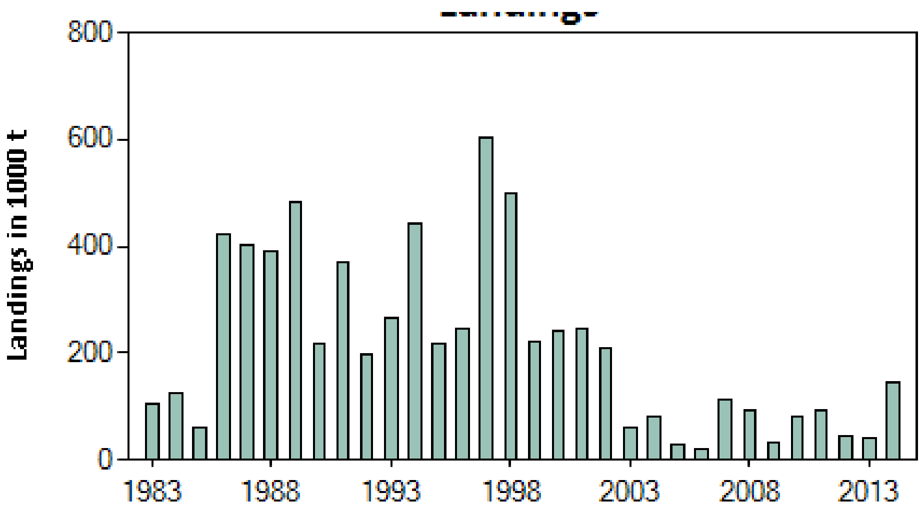


Figure 2. Catches of sandeel in the North Sea by year. Taken from ICES 2015a-s Table 6.3.39.1 panel b.

Table 1. Total catches (including discards) of North Sea sandeel by management area since 1983. Taken from table 11.1.2 of ICES 2015a-s.

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	All
1983	377558	80482	105974	2796	0	0	0	566810
1984	491950	66352	123639	2570	6587	0	0	691098
1985	436214	99428	59090	38123	3004	0	0	635858
1986	389081	94604	420304	12706	11277	0	0	927973
1987	360867	53761	403897	8179	1713	0	0	828417
1988	401551	121394	391050	1335	0	0	0	915330
1989	445586	109691	492395	4384	3353	909	0	1056318
1990	283259	100960	219103	3314	374	499	0	607508
1991	346621	107663	368324	41372	3697	17	0	867694
1992	564285	69848	195733	68905	4554	4277	0	907600
1993	136538	59820	296118	133136	666	4490	0	630768
1994	209631	50648	444084	159789	2765	3748	0	870666
1995	410687	60143	266720	52759	150637	1830	0	942776
1996	324561	80205	250252	162338	6176	1263	0	824796
1997	431871	102730	608164	59353	11279	2373	2068	1217839
1998	371060	68950	507269	58460	2984	936	5182	1014841
1999	431774	32377	229914	52743	141	134	0	747083
2000	365702	52573	257802	37875	327	680	0	714959
2001	522315	58711	253350	47883	1689	312	0	884260
2002	599971	35576	209448	12221	10	2378	0	859604
2003	150887	56328	62632	63885	44	869	73	334718
2004	206696	71426	87695	6915	0	570	0	373302
2005	103777	41447	29667	1486	0	262	0	176640
2006	238296	35392	18867	85	0	161	0	292802
2007	109363	5910	113905	11	4	661	0	229855
2008	238523	13065	94576	1201	0	472	0	347836
2009	308596	10177	33889	0	0	260	0	352922
2010	301304	31750	80724	273	0	132	0	414183
2011	311945	29874	95190	272	0	481	0	437761
2012	45636	8098	45109	2546	0	211	0	101599
2013	209811	23599	39251	5238	0	90	0	277989
2014	95730	8652	153746	4278	0	79	0	262485
arith. mean	319426	57551	217434	32701	6603	878	229	634822

The variation in year-class strength of North Sea sandeel has been subject of substantial research and attention during assessments. The benchmark sandeel review in 2010 (ICES(s) 2010) concluded that there is strong evidence that sandeel stocks are affected by oceanographic conditions both directly due to variation in transport processes and indirectly through oceanographic effects on zooplankton community dynamics. However, the information on the processes that may be involved is not consistent either over time or on different spatial scales. The annual degree of match between hatching and the onset of zooplankton production may be an important factor in explaining variation in sandeel year-class strengths (Wright and Bailey, 1996) as may be the total abundance of phytoplankton and zooplankton on the scales of tens to a few hundreds of km^2 (Frederiksen et al. 2005). However, there is conflicting evidence on the species of zooplankton that may be involved, and the spatial scale of the relationships (Van der Kooij et al. 2008).

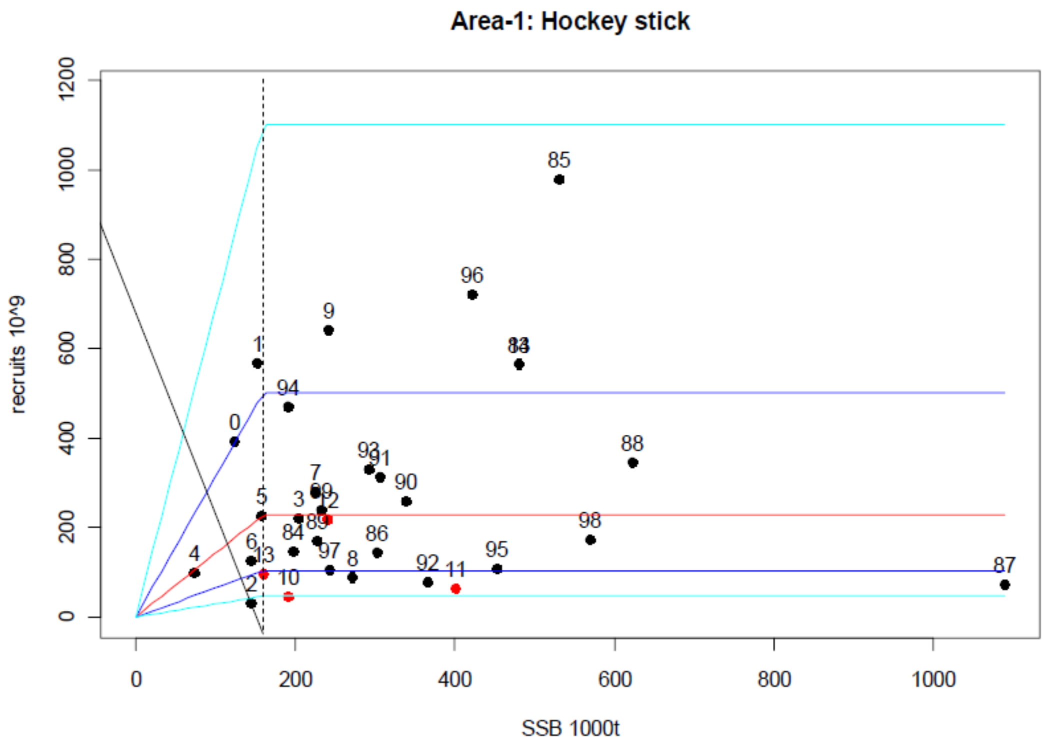
Van Deurs et al.(2009). concluded that production of particularly strong year-classes depends on the abundance of *Calanus finmarchicus* but not on other Calanus species, and that these strong year-classes are high anomalies in an otherwise positive spawning stock–recruitment relationship. They argued that the processes involved competition between 0-group sandeels and older sandeels for copepods, with recruitment reduced by the presence of high abundance of older (normally predominantly 1-group) sandeels. However, studies of just the 1980s and 1990s did not find evidence of a pattern of substantial competition between age groups (Arnott and Ruxton 2002). Rather, there was a significant positive relationship between sandeel recruitment and total *Calanus* density over the entire earlier time period.

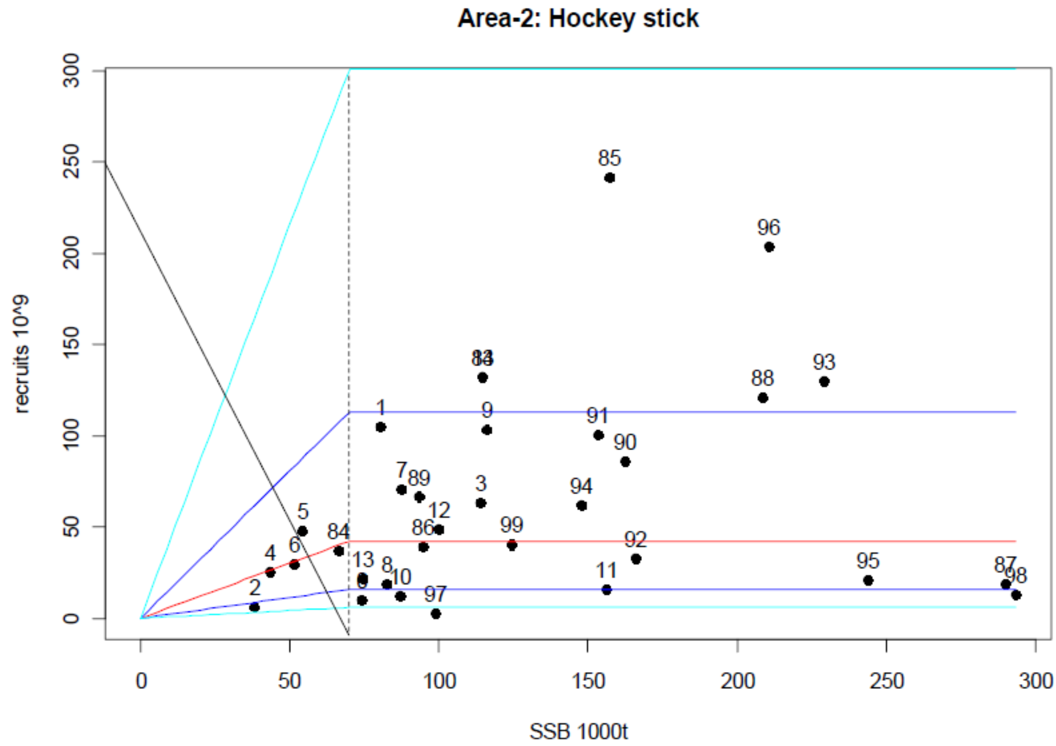
It is suggested by Van Deurs et al. (2009) that this changed pattern of correlation reflects coincidence of the switch in *Calanus* species at the same time as a run of poor year-classes of sandeels in the early 2000s.

In an attempt to take account of the differences in findings among the various studies, ICES concluded that there was likely to have been a change in the ecological productivity regime in or soon after 1997. This resulted in a series of comparatively weaker year-classes to be produced in the 2000s and early 2010s. The lower productivity was explained by environment changes and not initially an insufficient size of the spawning biomass in any of the management areas (ICES(s) 2010, 2015a-s). It is also consider with other studies of a possible general regime shift in the North Sea around that time, the strong effects on both species composition and phenology of the North Sea macro-zooplankton community (Beaugrand et al., 2002; Drinkwater 2010; Reid et al. 2001).

In addition to the impacts of oceanographic conditions and bottom up processes on sandeel productivity, sandeel are also important prey for many fish, bird and mammal predators. These relationships are important to some dependent predators and are reviewed later in Principle 1 as well as Principle 2. However, in terms of the potential for top-down control of sandeel production, ICES concluded that there is no evidence for depletion of sandeels by seabirds or marine mammals, even locally at major breeding colonies (ICES(s) 2010). However some predatory fish consume very large amounts of sandeels and some evidence that sandeel stocks increased in abundance in the North Sea following major reductions in the stocks of cod, haddock, whiting, herring, and mackerel in earlier decades (Sherman et al., 1981). However, variation in top-down predation impacts on sandeel recruitment is also expected to occur on long time scales, reflecting the multi-year population fluctuations of populations of most piscivorous fish (ICES(s) 2010). Hence, these factors would not account for large inter-annual variation in year-class strength, but may be a contributing factor to more regime-scale variation in sandeel productivity.

The possibility of regime-scale factors contributing to variation in year-class strengths increasing the difficulty of extracting clear stock recruit relationships for the sandeel management units. The fitted stock recruitment relationships have large variation, as indicated by the stock recruitment plots (Figure 3). This makes clear identification of management reference points difficult as well, although for each management unit probability of above average year-classes is low at relatively low SSBs. However, moderate or large SSBs do not ensure average or above year classes. Clearly the environmental signals are important to stock productivity.


Area-1: Hockey stick
recruits 10^9
SSB 1000t


Area-2: Hockey stick
recruits 10^9
SSB 1000t

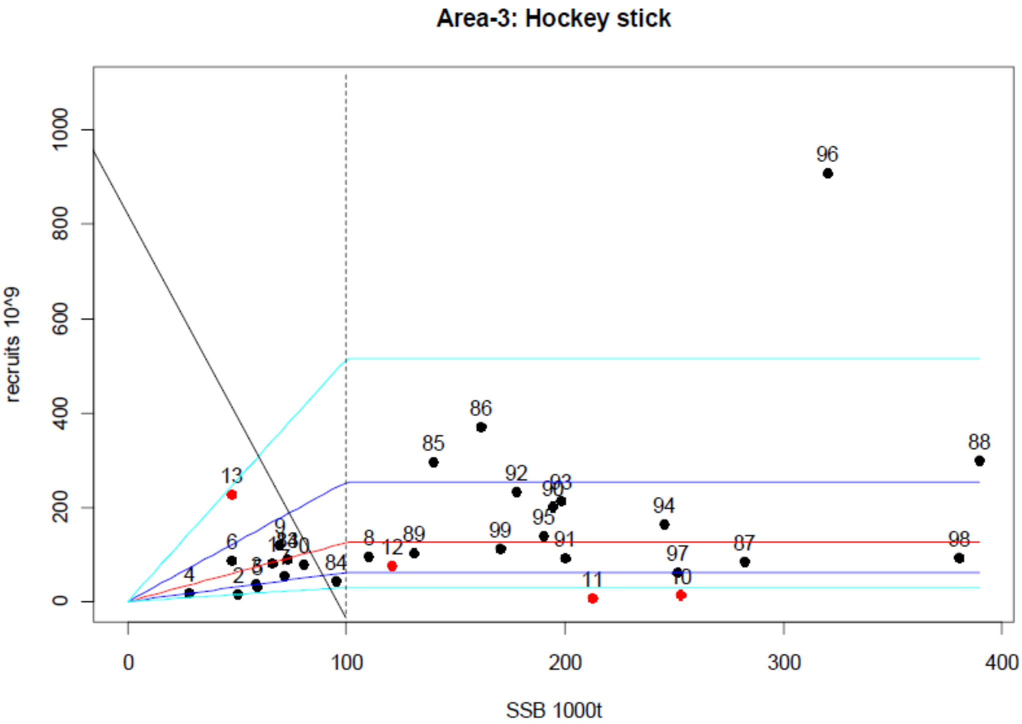


Figure 3. Stock recruit plots for management units 1, 2, and 3, respectively, taken from ICES 2014a-s figures 4.2.7, 4.3.7. and 4.4.11. Red lines are the median expected recruits, with the dark and light blue lines one and two standard deviations from the medians, as estimated according to Mesnil and Rochet (2008).

Combined across all management units, the North Sea sandeel recruitment time series shows the large multiyear pattern expected if the environmental regime explanation is correct (Figure 4). The 1996 year-class stands out as an exceptional anomaly. Recruitments prior to that year were generally larger than any year-classes after 1996, with the six smallest year classes in the time series all occurring in the ten years between 2002 and 2011. In the years from 2012 onward, however, year-class strength is improving and currently is again comparable to productivity in the 1980s.

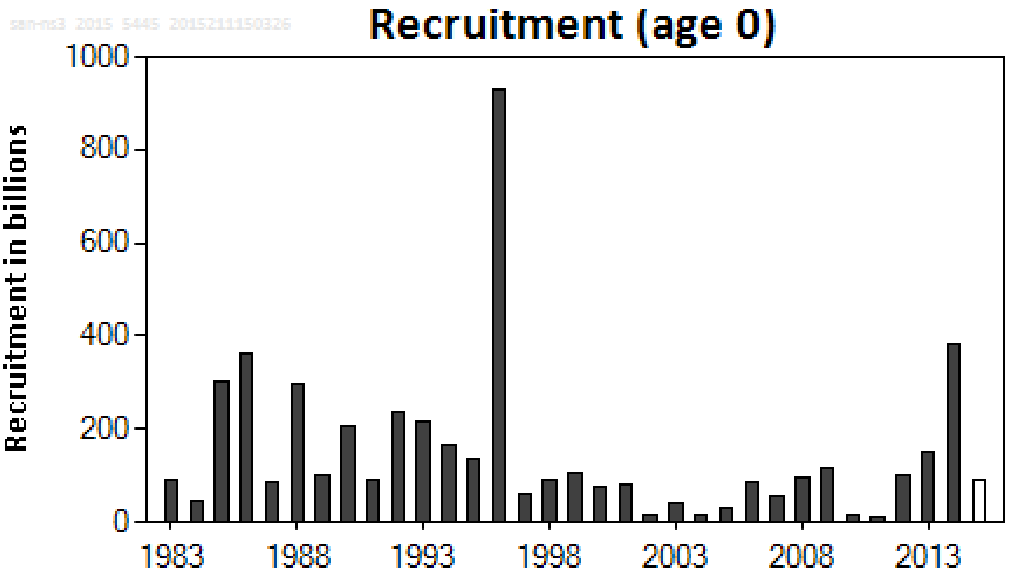


Figure 4. Year-class strengths for North Sea sandeel, taken from ICES 2015a-s, Figure 6.3.39.1.

Recruitment is only one component of stock productivity. Growth and weight at age also show evidence of multiyear and possibly regime-driver variation (Bergsted et al. 2002, Boulcott et al. 2007). At the time when year class strengths were weakest in the period 2003-2005, weight at age was also lowest in the time series for all three management areas, but particularly areas 1 and 2. Although weight-at-age has improved in the later 2000s and 2010s in all three management units, in none of them has it returned to weight-age-age values seen in the 1980s and early 1990s. This is additional evidence that environmental factors are a major driver of stock productivity, because the weights-at-age were higher at a time when stock biomasses were also much larger than at present. This is inconsistent with stock density-dependence being the major determinant of stock productivity. However, changes in weights at age have not been analytically tied to any specific oceanographic driver or potential prey item.

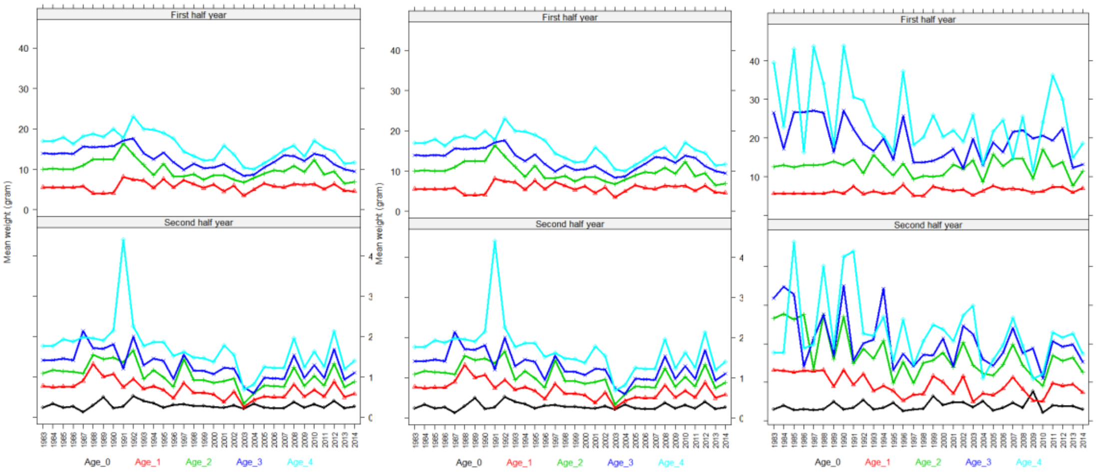


Figure 5. Time series of weights at age for first (upper) and second (Lower) halves of each year, for management units 1 (left), 2 (middle) and 3 (right). Black lines are age 0, red are age 1, green are age 2, dark blue are age 3, and light blue are older sandeel. Figures table form ICES 2015a-s, figure 11.2.2 (left), 11.3.2 (middle) and 11.4.2 (right).

Maturity at-age has been found to vary both regionally within the North Sea and among years (Boulcott et al 2007). The benchmark review did not find any specific environment signal to account for the variation, and concluded that data from the most recent years should be used to provide empirical estimates of proportion mature at age for assessments and forecasts of yields (ICES(s) 2010). In recent years the source has been the percent mature from the Danish dredge surveys held prior to commencement of the annual fisheries. The data on percent mature at age are presented in Table 2. Note that the proportion mature at age 2 is low for some of the cohorts produced when recruitment was improving (e.g. the 2008 year class in 2010), and higher for the weakest cohorts (e.g. the 2005 year class in 2007).

Table 2. Proportion mature at age for sandeel in management units 1, 2, and 3. The consistency of proportion mature at age 2 for management unit 2 is due to insufficient sampling to estimate annual values. For all management units proportion mature at age 3 and older is 1.00, except possibly in management unit 1 in 2015. Data taken from Tables 11.2.3, 11.3.3 and 11.4.3.

	Management Unit 1			UNIT 2		UNIT 3	
	AGE 1	AGE 2	AGE 3	AGE 1	AGE 2	AGE 1	AGE 2
1983-2004	0.02	0.83	1.00	0.02	0.83	0.05	0.77
2005	0.06	0.98	1.00	0.02	0.83	0.12	0.96
2006	0.01	0.90	1.00	0.02	0.83	0.08	0.78
2007	0.01	0.94	1.00	0.02	0.83	0.02	0.80
2008	0.02	0.97	1.00	0.02	0.83	0.03	0.69
2009	0.00	0.61	1.00	0.02	0.83	0.01	0.48
2010	0.01	0.56	1.00	0.02	0.83	0.04	0.92
2011	0.00	0.58	1.00	0.02	0.83	0.04	0.92
2012	0.03	0.77	1.00	0.02	0.83	0.01	0.70
2013	0.01	0.85	1.00	0.02	0.83	0.04	0.88
2014	0.00	0.70	1.00	0.02	0.83	0.02	0.25
2015	0.07	0.87	0.98	0.02	0.83	0.02	0.87

Spawning of North Sea sandeel occurs primarily in December to February with possibly a minor latitudinal gradient so that there is earlier spawning in more southern areas (Gauld and Hutcheson 1990, Bergsted et al 2001). Sandeel has a prolonged spawning season ranging from early spring to late autumn, with the main season in April–June (ICES 2015a-s). Spawning is widespread through the southern and central North Sea and occurs across a broad range of depths, but with eggs deposited on the sea bed. From there transport processes play a role in dispersion of larvae , which drift in the currents for one to three months before setting on the sandy seabed (deSilva 1973, Baumann et al. 2006).

Natural mortality is high, with predation playing a large role at all ages. Estimates of natural mortality at age by quarter and year are available from multispecies assessment models, and are updated regularly. Recent average values are used in assessment projections (see tables 11.2.19.3.10 and 11.4.10 if ICES 2015a-s). There is a lack of contrast among management units is because the predation mortality of the piscivorous predators is not disaggregated spatially in the multispecies model.

The diet of sandeel has been studied and is exclusively planktivorous at all ages. It eats a variety of zooplankton, with the lipid-rich larger *Calanus* and related species well represented in the diet (Frederiksen et al. 2007; Van Deurs et al. 2009, Van der Kooij et al. 2008). The importance of food supply to sandeel productivity was discussed above in the context of variation in sandeel recruitment.

Assessment methods

The information on the sandeel assessment methods and stock status is taken from ICES 2010, 2014, and 2015, with some reference to prior ICES assessments. Consistent with ICES practice, the sandeel benchmark assessment meeting investigated many aspects of the assessment data and methods in depth, agreeing treatments of data and analytical methods that become the standard practice for annual assessments until the next benchmark meeting. New information can be considered and assimilated as appropriate into assessments at any time, but the entire framework is only reviewed at the benchmark assessments usually held every five years (ICES(s) 2010, Section 2).

Key Data Sets

For commercial catches the main data available come from the Danish and Norwegian fisheries. Both countries have programs for dockside sampling of landings. In addition, in the Danish fishery, since 1999 samples are taken by skippers on board vessels and frozen immediately The Danish samples cover both age and length distributions whereas the Norwegian samples cover only length distribution prior to 1997 and both age and length samples after 1997. Danish samples measured both length and weight distributions whereas only aged sandeel were weighed from the Norwegian samples and weight-at-length for Norwegian samples were calculated by standard regression equations ($W = aL^b$). All data are combined in the analyses, corresponding to the assumption that the composition of catches taken in a given year and month did not differ between countries and that no differences in age reading existed. These approaches were examined in the benchmark assessment review and considered to be appropriate (ICES(s) 2010, Sections 4.1.1.1-3). The review also concluded that sampling levels in the seasons when the fishery were operating were high enough to provide reliable length, weight and age data for assessments (ICES(s) 2010.Section 4.1.1.6).

Total catch is recorded by month and statistical rectangle for the North Sea. For Danish catches before 1989, only logbook information stating the catch in directed Danish sandeel fishery by location and date is known. As the large majority of the catch in the sandeel fishery consists of sandeel, the distribution of catches in the directed sandeel fishery on rectangle and months were assumed to represent the distribution of sandeel catches. The process for allocating total historical catch in tonnes was developed and tested by the working group on the assessment of Norway pout and sandeel (ICES 1995, 1996) and these data have been maintained in subsequent assessments. For subsequent years the logbooks were used directly to provide the catches by rectangle and month, with data from 1990 to 1999 requiring some intermediate calculations to fill gaps in months when no Danish catches were reported for some rectangles. After 1999, international sandeel catches in ton per rectangle per month and year are available directly (ICES(s) 2010, Section 4.1.1.4). All catches were scaled in order to sum to official ICES landing statistics. Total catches per area are seen in Figure 6.

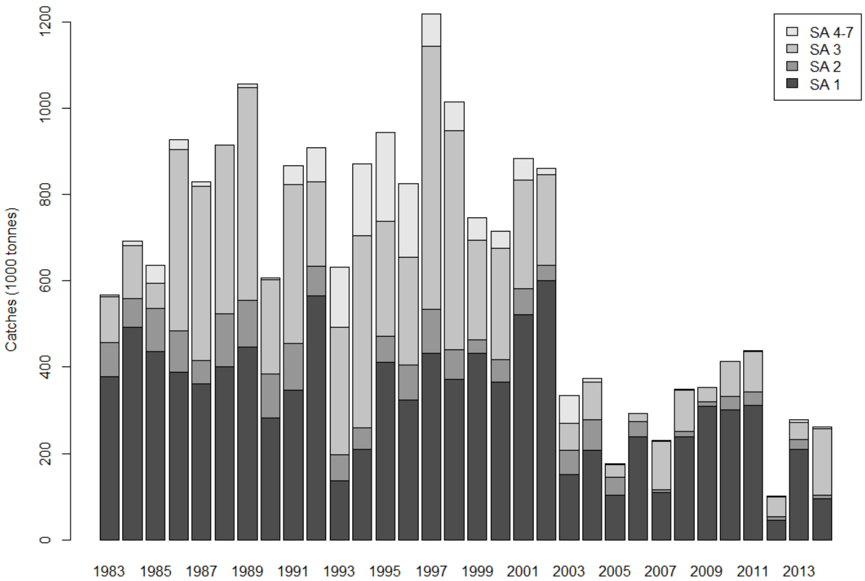
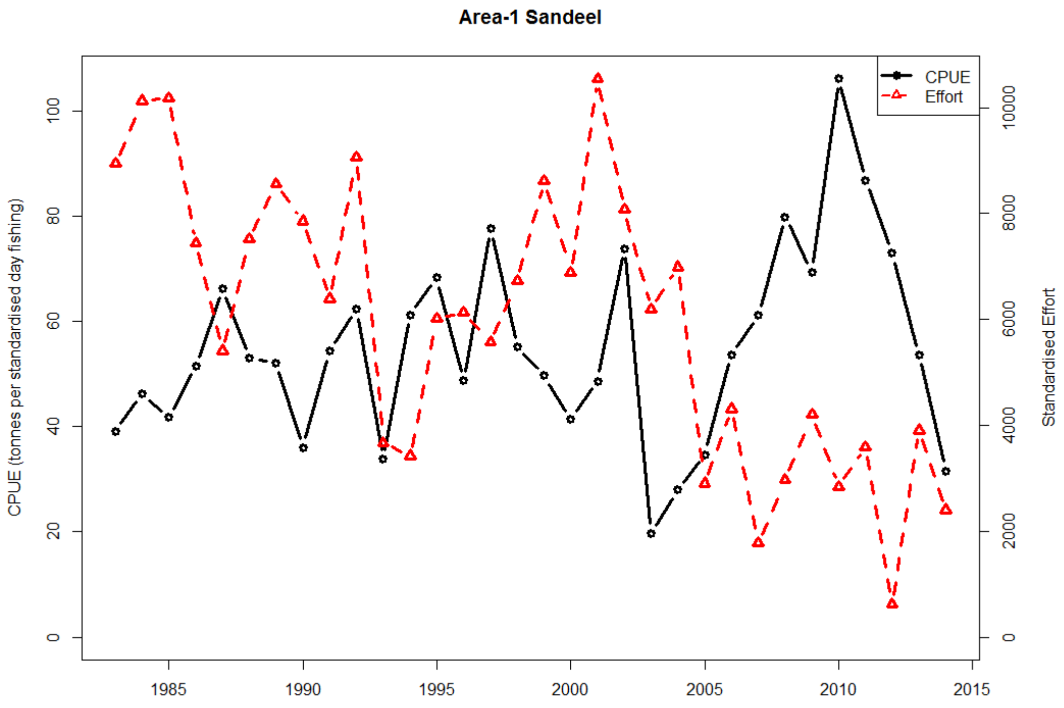
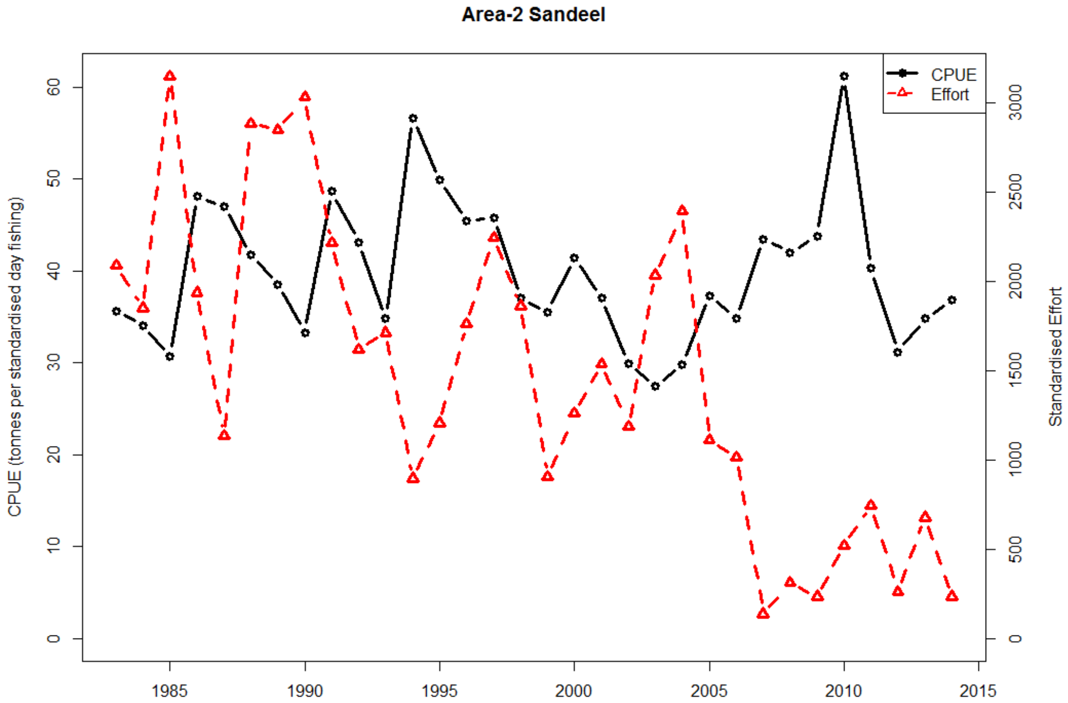


Figure 6. Total landings by management unit from logbook reports, as allocated by ICES, from 1983 to 2014. Taken from ICES 2015a-s, Figure 11.1.3.

The reliance on logbook data for catch reporting of location of fishing allows for misreporting of catches. Amount of catch is verified by matching logbook reports to recorded offloadings, but that still allows opportunity of misreporting of catches by management unit. The ICES assessment group considers this possibility in the annual assessments, and when there are anomalies in the reported catch data relative to historical patterns of distribution of catches in space and time or informal reports on misreporting catch by management area, the assessment group can consult a variety of sources for additional information on catch locations. It may adjust catches as it considers necessary to have accurate catch data by area and month (ICES 2015a-s, Section 11.1.6), and the adjustments are generally found to be consistent in subsequent retrospective analyses.

Effort data are also important to the sandeel assessment, and are not straightforward to estimate. The fleet includes vessels of different sizes, which affects their fishing power per hour of fishing. Moreover, aspects of the fishing technology and positioning over habitat patches has evolved over the time series, and at different rates for different sizes of vessels. The benchmark assessment reviewed the methods used to standardize effort data across the fleets in depth (ICES 2010(s), Section 4.1.2). The review noted that to obtain the total standardised effort in a given time interval, it is necessary to know the size of each vessel, the number of days fished and the value of a vessel-size-specific scaling coefficient linking reported catch to reported days fishing. The review accepted a revised set of scaling coefficients that provided a pattern of evolution of fishing effort over the historical time series that was generally consistent with the previously estimated pattern but considered to be more appropriate for the current fleet (figure 4.1.3 of ICES(s) 2010). Trends in effort and catch per unit of effort from 1983 to 2014 for each management unit contributing major catches are presented in Figure 7.





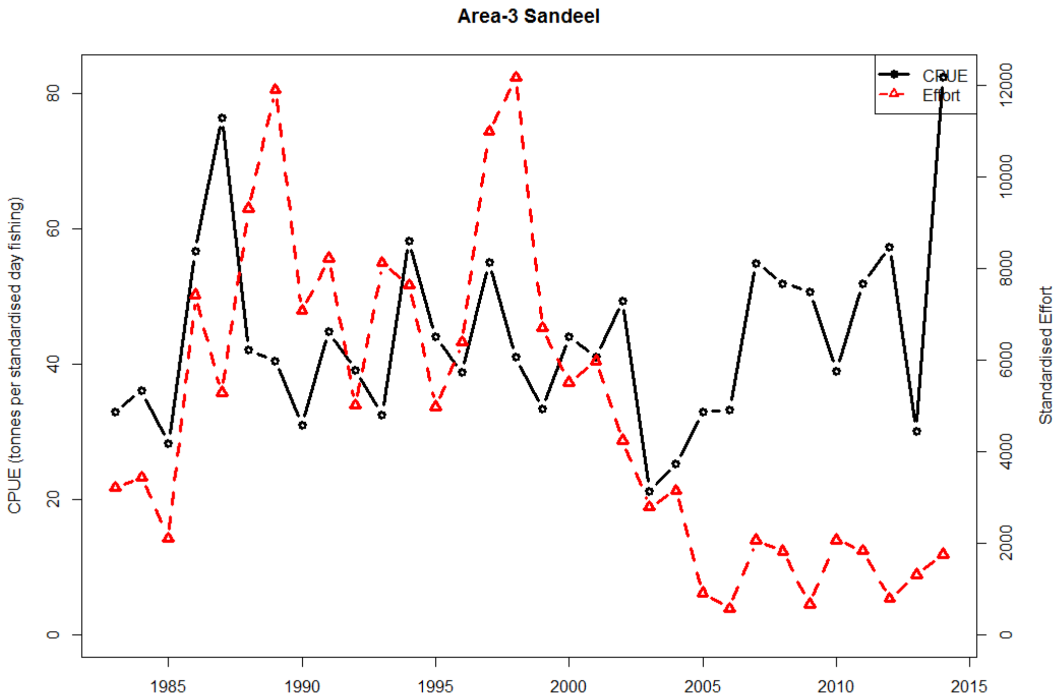


Figure 7. Trends in effort (red) and catch per unit of effort (black) of sandeel from 1983 to 2014 for management units 1 (top panel), 2 (middle panel), and 3 (bottom panel). Taken form ICES 2015a-s, Figures 11.2.3, 11.3.3 and 11.4.3.

All three panels of Figure 7 show both the increase in effort in the late 1990s and early 2000s, and the subsequent decrease in effort as TACs were reduced when the decrease in sandeel recruitment began, the effort reductions meant that the corresponding drops in catch per unit effort (CPUE) by management area were not as great as the drop in recruitment, and the increase in CPUE as the somewhat improved recruitment in the late 2000s entered the fishery. With the standardized effort levels kept low after the reduction in the 2000s, variation in CPUE has increased, making it a stronger reflection of variation in fishable biomass.

The multispecies IBTS trawl survey that is used as a fishery-independent index of stock abundance in many North Sea assessments is not considered to provide reliable information on sandeel dynamics. The major consideration is the very low catchability of sandeel with the IBTS gear, but the localized habitat-specific distribution of sandeel also makes a survey stratified only by statistical rectangle at the scale of the North Sea an inefficient and potentially high-variance index, whatever catchability there was for the gear.

However, since 2004, the Danish Technical University, with support from the Danish industrial fishing industry, has conducted a survey targeted at the shallow, sandy grounds where sandeels are found, and using a dredge specifically designed to provide an index of sandeel abundance in the sampled site.

The dredge survey is conducted in late November–early December when the 0-group sandeel have been recruited to the settled population and the entire population is assumed to reside in the seabed. The Sandeel Benchmark assessment reviewed the survey design (ICES(s)2010, Section 4.2.1), operational methods (ICES 2010(s), Section 4.2.2), spatial coverage (ICES(s) 2010, Section 4.2.3) and statistical properties of the index (ICES(s) 2010 Section 4.2.5) in detail. The results from 828 hauls over five years, primarily in Areas 1 and 3, made with four dredge types, were examined. It is a fixed station survey design, extending from Fisher Bank in the North Eastern North Sea, to the Dogger Bank in the South Western North Sea. Complementary data from a Marine Scotland Science dredge survey in 2008 was also examined to see if it could provide a year-class index for area 4, off the northeast UK coast.

The ICES review concluded that the ability of the survey to follow cohorts over years was high in all areas (r^2 from 0.54 to 0.99, for eight cohorts from the three management areas). External consistency between dredge catch rates and commercial CPUEs was very high for all but the very uncommon oldest ages in area 1 ($r^2 > 0.7$) but somewhat lower in area 3 ($0.3 < r^2$, 0.5). Spatial aggregation level of the data was a factor in the consistency between the dredge survey and catch rates with smaller spatial scales showing higher consistency. The ICES review concluded that the dredge survey could provide an age structured index including assessment year estimates of maturity ogives for areas 1, 3, and 4; whereas extension of the survey with more locations is needed for production of an index for area 2. However, recruitment estimates from area-based assessment show a high correlation between area 1 and 2 and thus indicate that the survey index from area 1 may be used as a fisheries independent index proxy for area 2 as well (ICES(s) 2010, Section 4.2.1.6).

In addition to the dredge survey, Norway conducts a hydroacoustic survey that provides information on small pelagics, including sandeels. The properties of that index were also reviewed in ICES(s) (2010). Although Norway uses the results as information in management decisions for sandeel fishing within the Norwegian EEZ, it is not used by ICES in the annual assessments of North Sea sandeel, nor by the EU in management decisions in the areas where the fishery associated with this assessment occur.

Results of the surveys, as input to assessments since the 2010 benchmark review, are presented in Figure 8.

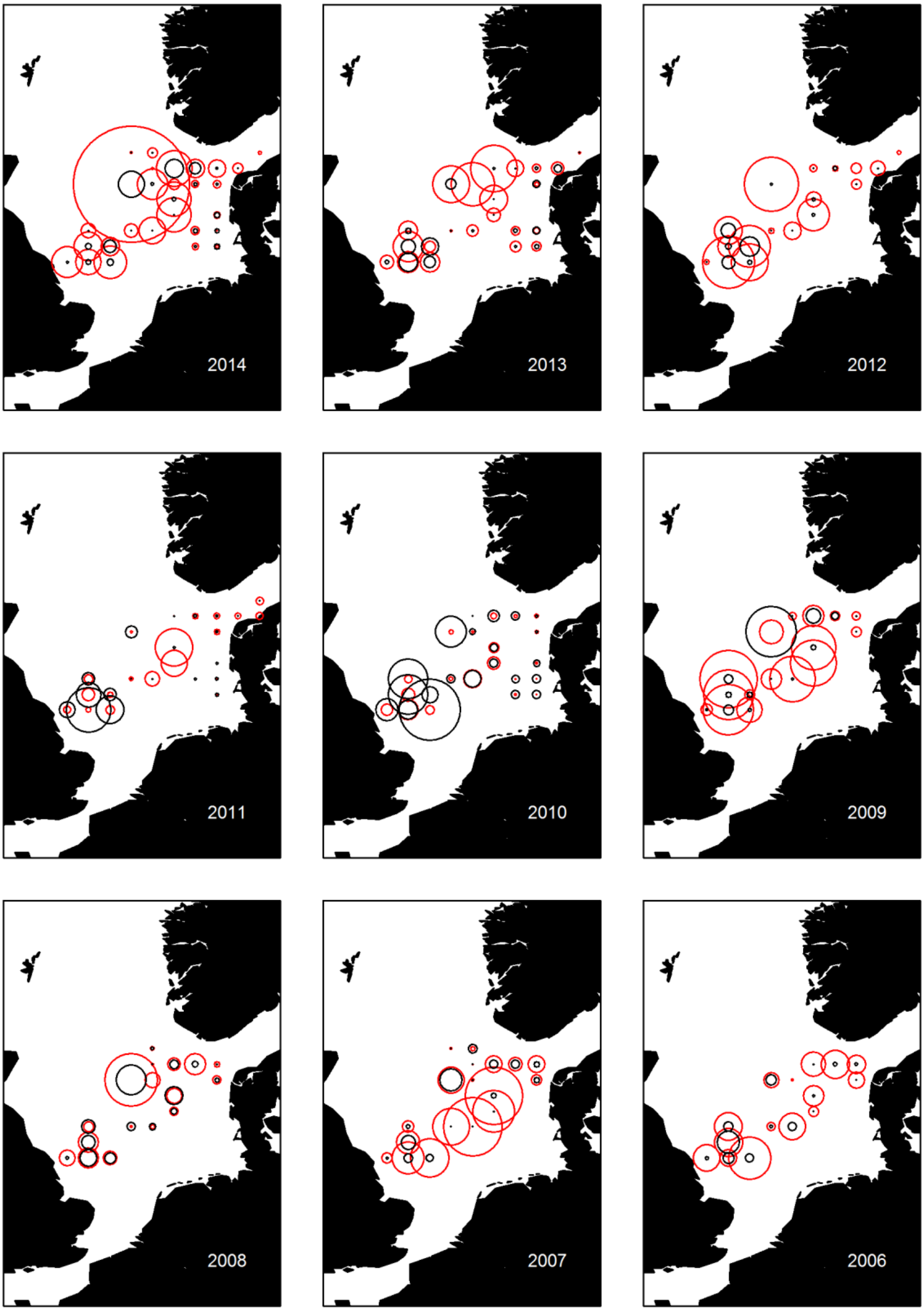


Figure 8. Catches in the sandeel dredge survey between 2006 (when coverage was considered sufficient) and 2014 for ages 0 (red circles) and 1 (Black circles). Size of the circle represents relative catch, center of the circle the location of the two. Taken from ICES 2015a-s Figure 11.1.4.

Harvest strategy

The B_{pa} and B_{lim} reference points used by ICES for sandeel and species with similar life histories have been reviewed several times, including at the 2010 sandeel benchmark assessment. The estimates arise basically from simple visual inspection of the stock–recruitment plots from area 1, 2 and 3 (Figure 3). It appears that recruitment declines at low SSB in all areas, or more accurately, strong recruitment ceases to be likely. However, each review concluded that no clear plateau was visible, consistent with finding very flat surfaces of the likelihood when attempting to estimate inflection point, regardless of stock recruit model. Since a review of methods for estimating reference points in data limited situation (ICES(s) SGPRP, 2003) ICES concluded that in cases where there is a relationship between R and SSB but no clear plateau, Blim should be set after a general evaluation of historic patterns (ICES(s) 2003, Section 6.4). The goal of the evaluation was to identify what are now called escapement goals. These goals represent biomasses below which the stock should not be allowed to fall, and if a poor recruitment meant a stock would fall below the escapement goal due to ecological processes, harvesting should be stopped.

Specifically for North Sea sandeel, the review concluded that the very low SSB in all areas in the early 2000s followed the poor recruitment years rather than the opposite. The benchmark review (ICES(s) 2010) recommended that for area 1 and 2, Blim should be set as the median biomass in these years of low SSB (2000–2006) giving the values 160 000 tonnes for area 1 and 70 000 tonnes for area 2. In area 3, Blim was set at 100 000 tonnes, the highest SSB observed in the period 2001–2007 (the period of low SSBs) because no really good recruitment years occurred in the latter half of the period. In each case the Bpa corresponding to the Blim value was based on the uncertainty in the assessments (ICES(s) 2010 and 2014a-s Stock Annex, Section Biological Reference Points).

In 2014 ICES further reviewed its reference points relative to consistency with MSY-based management outcomes (ICES 2014b-s). That review concluded that for short-lived species such as sandeel, the ICES interpretation of the MSY concept uses Bpa estimates as the value for $B_{msy\text{-}trigger}$. This means that advice should follow the same escapement strategy as previously used. That means B_{pa} is the default $B_{escapement}$, such that the fishing opportunities for year y must be set at a level which ensures that B_{msy} is achieved in year y+1. No fishery should be allowed if this level of escapement cannot be achieved (ICES 2014b-s).

The total of the B_{lim} estimates from areas 1, 2 and 3 is 330 kt and substantially below the historical level of 430 kt determined for the whole North Sea. This difference is partially due to not having areas 4 and 5 included. However, stock biomasses from these areas represent only a small fraction of the total biomass, so their contribution to the combined total Blim should be equally small. The difference is therefore mainly caused by two changes in the procedure used. Firstly, the new Stochastic Multispecies Model (SMS) assessments generate lower estimates of SSB compared to the old data and methodology and secondly, the revised maturity reduce the SSB estimates for the historical series (ICES 2014a-s, Stock Annex, Section “Biological reference points”. The resultant values are given in Table 3.

Table 3. . Biomass reference points for sandeel management units 1, 2 and 3. Taken from ICES 2014a-s, table 3).

Area	B_{lim}	SSB CV	B_{pa}
1	160 000	18%	215 000
2	70 000	23%	100 000
3	100 000	40%	195 000

The ICES review of reference points and harvest strategies in 2014 (ICES 2014c-s) looked in depth at escapement-based harvest strategies for short-lived species with high predation mortality and high variation in year-class strength. Although sprat was used as the model species, the review concluded that results would generalize to other species with similar life histories, including sandeel. The review concluded that for North Sea sprat, and likely more generally for species with similar life histories, only strategies applying an F limit control rule were found to be sustainable. Neither a Fixed Escapement-strategy, where the spawning stock is fished down to B_{pa} ($B_{escapement}$) every year, nor a constant F_{MSY} were sustainable. In order to make an Escapement-strategy sustainable, it must be applied with an upper limit on the fishing mortality. The simulations indicated that optimal control rules for this strategy was an Fc of around 1.2 for sprat, combined with the existing escapement goal to ensure exploitation progressively decreased as SSBs approached their biomass reference points (Annex 1 of ICES 2014c-s).

Preliminary analyses for North Sea sandeel suggest that F_{cap} in the neighborhood of 0.5 would definitely be precautionary, but further work would be needed to identify an optional F_{cap}, given stock dynamics (ICES 2014a-s, Stock Annex).

Assessment Model

The Benchmark assessment review (ICES(s), 2010) considered three alternative assessment models: a season version of the standard age-structured XSA model, a temporally-explicit catch-at-age mode (TED), and the SMS-effort, which is a model driven by fishing effort that takes account of predation mortality. The review concluded that SMS was the preferred model for North Sea sandeel in management units 1,2, and 3. The rationales included that although the SMS-effort and TED modelshad similar abilities to fit the available data was similar for both models, there was much more experience with the use of the SMS model in assessing other ICES stocks exposed to high predation mortality. Therefore it was concluded that interpretation of analytical results might be more robust, and clients better able to understand the outputs of the model. The SMS-effort model also had greater to handle uncertainty in the catch-at-age data compared to the XSA VPA-based approach. In addition the Seasonal XSA could not provide a satisfactory fit to some years of catch-at-age data, including the most years when productivity of the stock was thought to be changing (ICES(s) 2010, Section 5.4). Hence SMS-effort has been used subsequently for assessment of the management units with sufficient data.

Briefly, in general SMS models fishing mortality, $F_{y,q,a}$ is modelled as an extended separable model including seasonal, age and year effects. The new version substitutes the year effect by observed effort. In the SMS effort model observed annual effort is substituted for the year effect, with the time series otherwise maintained. The SMS-effort model uses three types of input data: the total international catch-at-age; research survey CPUE and stomach content observations. The stomach data are not used in the annual assessments, as natural mortality values from a more comprehensive SMS model run including more prey species as well as the full spectrum of predators are input to the annual sandeel assessments. For each type a stochastic model is formulated and the likelihood function is calculated. As the three types of observations are independent the total log likelihood is the sum of the contributions from three types of observations. A stock–recruitment (penalty) function is added as a fourth contribution. The population parameters are estimated using maximum likelihood (ML) to minimizing the negative log likelihood. The variance of functions of the estimated parameters (such as biomass and mean fishing mortality) has been calculated using the delta method. The SMS model was implemented using the AD Model Builder (ADMB Project 2009), (ICES 2014a-s, Stock Annex - Section “Methodology).

Model settings will be given separately for the three management units where SMS-effort was used, along with the key results.

Assessment Results

Management unit 1
In estimating the goodness of fit, equal weightings were given to fitting the catch at age and dredge survey data, and resultant coefficients of variation were comparable (0.37 and 0.30, respectively) whereas fitting the presumptive stock-recruitment relationship was given a much lower weight and more poorly fit (coefficient of variation = 0.8). Goodness of fit was considered to be acceptable and improved over some previous assessments (ICES 2015a-s, Section 11.2.5; their table 11.2.5). Retrospective performance was considered very good, (ICES 2015a-s, their table 11.2.8), so the assessments are consistent across recent years. Key results of trends in spawning biomass, year-class strength, and fishing mortality are shown in Table 4 and Figure 99, with their variances in Figure 10.
.

Table 4. Estimates of recruits, total stock biomass (TSB), spawning stock biomass (SSB), maximum yield consistent with the harvest strategy, and fishing mortality for management area 1 (table form ICES 2015a-s, Table 11.2.9).

	Recruits (million)	TSB (tonnes)	SSB (tonnes)	Yield (tonnes)	Mean F1 2
1983	562353	662740	480314	349232	0.609
1984	148548	1357770	197045	467609	0.689
1985	972353	932097	527023	424114	0.698
1986	145804	2320270	301174	382735	0.528
1987	73150	1604880	1083510	357671	0.372
1988	348220	769164	621681	398271	0.534
1989	172062	770701	227186	445695	0.825
1990	256402	660936	339874	283040	0.751
1991	312929	1123230	307524	347096	0.585
1992	77823	1273520	364432	564298	0.856
1993	327071	543824	290834	124082	0.349
1994	470495	865866	189148	209538	0.328
1995	111001	1856290	449298	410513	0.573
1996	714145	706930	419711	298702	0.583
1997	105482	2193760	243092	431808	0.507
1998	175692	910516	564665	371117	0.646
1999	239541	592454	231090	427691	1.278
2000	386786	689259	124471	284521	1.024
2001	559020	820452	151279	513068	1.529
2002	31240	1376240	141090	596049	1.214
2003	219405	275954	198647	121863	0.923
2004	99359	480610	72820	195274	1.050
2005	222376	388237	155409	100835	0.447
2006	129394	647184	144669	231448	0.658
2007	280982	504943	222246	108600	0.276
2008	92961	938556	272757	237447	0.457
2009	627765	562321	242752	291247	0.639
2010	45959	1729070	194187	300954	0.435
2011	63898	715016	394970	311542	0.551
2012	190121	399136	238271	45642	0.098
2013	100134	503061	157920	209176	0.592
2014	228863	350779	139141	76077	0.371
2015			178712		
arith. mean	265354	922680	298998	309905	0.656
geo. mean	192733				

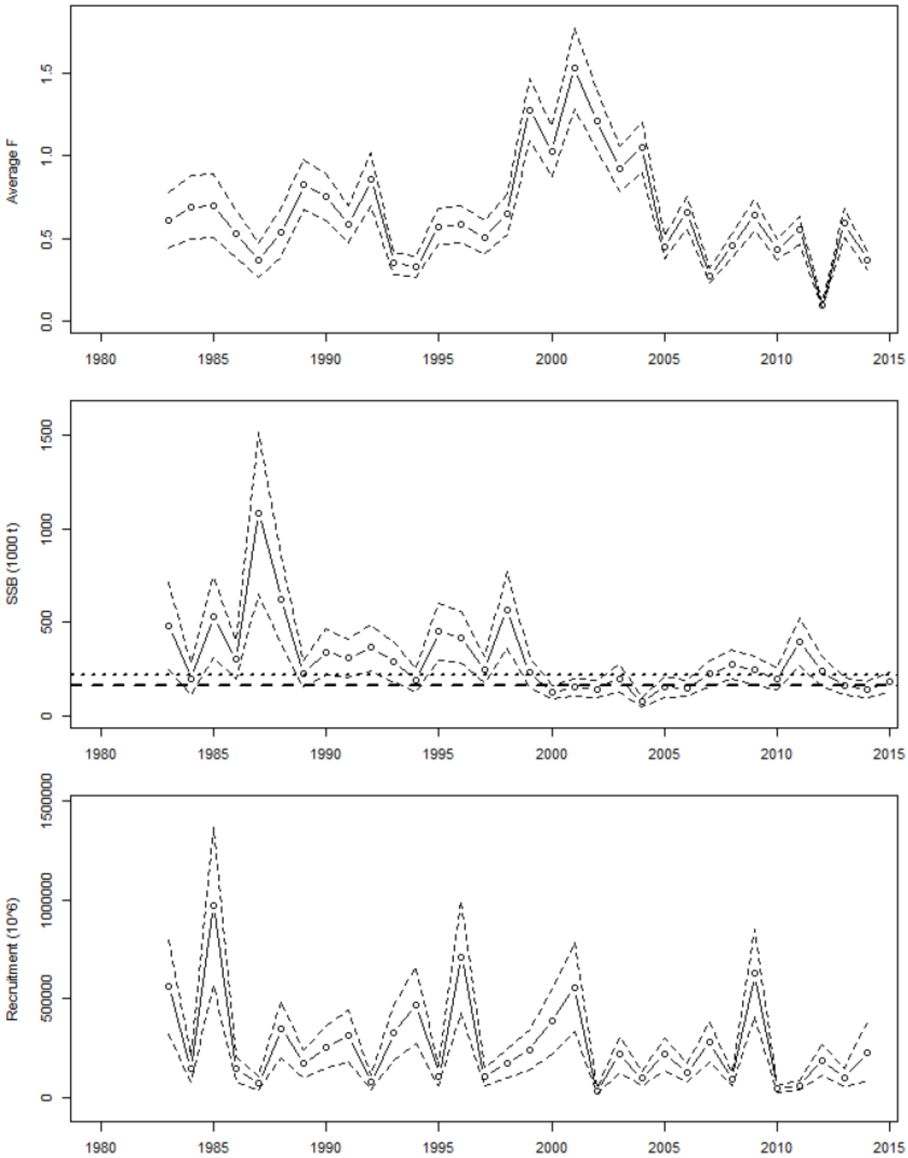


Figure 9. Time series of average fishing mortality ages 1 and 2 (top panel), spawning stock biomass (middle panel) and year class strength (lower panel) for sandeel in management unit 1. Dark lines are means, and dotted lines are 2 standard deviations from the mean). Table from ICES 2015a-s, figure 11.2.10).

Table 3 and Figure 9 illustrate the impact of recruitment variation on SSB, with the stock below B_{pa} and some years below B_{lim} for the years when recruitment (bottom panel of figure 9) was poor. The high values for fishing mortality in the late 1990s may have contributed to the stock decline, but the second decline around 2010 was clearly a response to poor recruitment, as fishing mortality had remained at some of the lowest levels in the time series. Moreover, since 2000 each spike of improved recruitment produced a subsequent spike in SSB, indicating that survivorship from fishing was high enough for recruitment signals to be passed on to the population reproductive potential. From Figure 10 it is apparent that the inclusion of the dredge surveys is reducing the uncertainty in estimates of spawning biomass, whereas catch documentation shows major improvements in 1989, again in 1999, and very consistent performance thereafter. Recent recruitment estimates are highly uncertain, which is almost always true for short-lived stocks where cohorts enter the fishery just a year or two after they were spawned. However SSB has already increased above B_{lim}

and is expected to be above $B_{escapement}$ when the large recruiting 2014 yearclass is fully mature.

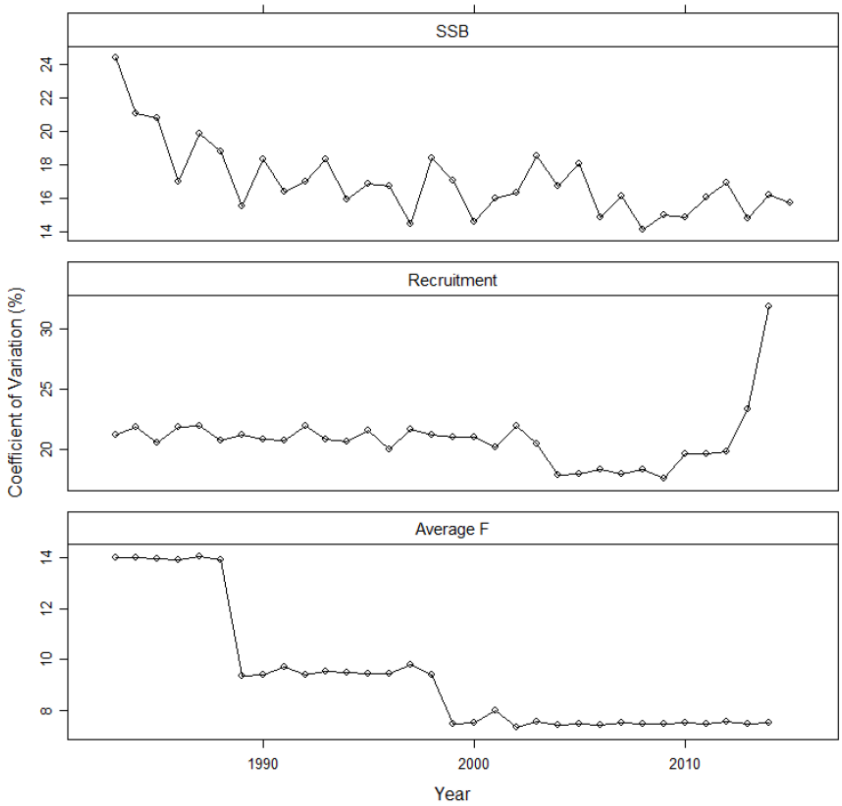


Figure 10. Coefficients of variation of the population parameters in figure 9. Coefficients of variation for SSB (top panel), recruitment (middle panel) and fishing mortality (Bottom panel), taken from ICES 2015a-s, figure 11.2.9).

Management Unit 2

In estimating the goodness of fit, equal weighting were given to fitting the catch at age and dredge survey data. The resultant coefficients of variation suggest a better fit for the dredge survey data in the first half of each year (CV = 0.3) than for the catch at age particularly for older sandeel and in the second half of the year for all ages (CV = .41 for ages 1 and 2 in the first half year and variable but higher for other ages and season). As in management unit 1, fitting the presumptive stock-recruitment relationship was given a much lower weight and more poorly fit (coefficient of variation = 0.98). The assessment was considered to be improved over most previous assessments, but affected by the short time series for the dredge survey data (ICES 2015a-s, Section 11.3.5 and their table 11.3.5). If this survey continues in unit 2, further improvement in the ability of the assessment to reflect dynamics of the stock is expected (ICES 2015a-s, Section 11.3.10). Retrospective performance was considered very good, particularly for recent years (ICES 2015a-s, their Figure 11.3.8), so the assessments are consistent across recent years.

Key results of trends in spawning biomass, year-class strength, and fishing mortality are shown in Table 5 and Figure 11, with their variances in Figure 12.

Table 5. Estimates of recruits, total stock biomass (TSB), spawning stock biomass (SSB), maximum yield consistent with the harvest strategy, and fishing mortality for management unit 2 (table from ICES 2015a-s, Table 11.3.8).

	Recruits (million)	TSB (tonnes)	SSB (tonnes)	Yield (tonnes)	Mean F1 – 2
1983	130213	156882	113244	74481	0.376
1984	36772	335564	65456	63046	0.301
1985	237782	254789	154275	96645	0.546
1986	38960	587619	92849	93146	0.330
1987	18755	418195	284086	53284	0.181
1988	119599	242974	204378	120382	0.526
1989	65995	279601	90668	109703	0.531
1990	84925	285281	159264	100917	0.578
1991	98644	423837	150293	107795	0.363
1992	32663	441644	162289	69825	0.292
1993	128158	358308	224304	59652	0.296
1994	61414	523073	144586	50656	0.136
1995	20949	458950	239038	60138	0.185
1996	201419	313479	206790	80012	0.295
1997	3064	650062	97017	102726	0.330
1998	13081	350759	289021	68953	0.291
1999	39973	177513	121841	32108	0.267
2000	10234	232800	73255	52228	0.368
2001	104184	131350	79780	56934	0.447
2002	6457	309020	37998	35494	0.341
2003	63313	155052	112694	55924	0.602
2004	26082	223891	43279	71413	0.704
2005	47656	133508	54155	41420	0.329
2006	30190	209865	52065	35351	0.296
2007	71529	198368	86901	5911	0.041
2008	19652	280659	83215	13064	0.092
2009	103073	183741	117151	10240	0.071
2010	12873	339853	88704	31747	0.152
2011	16487	218966	156475	29900	0.224
2012	53494	162612	100390	8098	0.079
2013	28187	252392	75905	23599	0.196
2014	46658	174481	85940	8651	0.072
2015			91545		
arith. mean	61639	295784	125420	56983	0.307
geo. mean	40588				

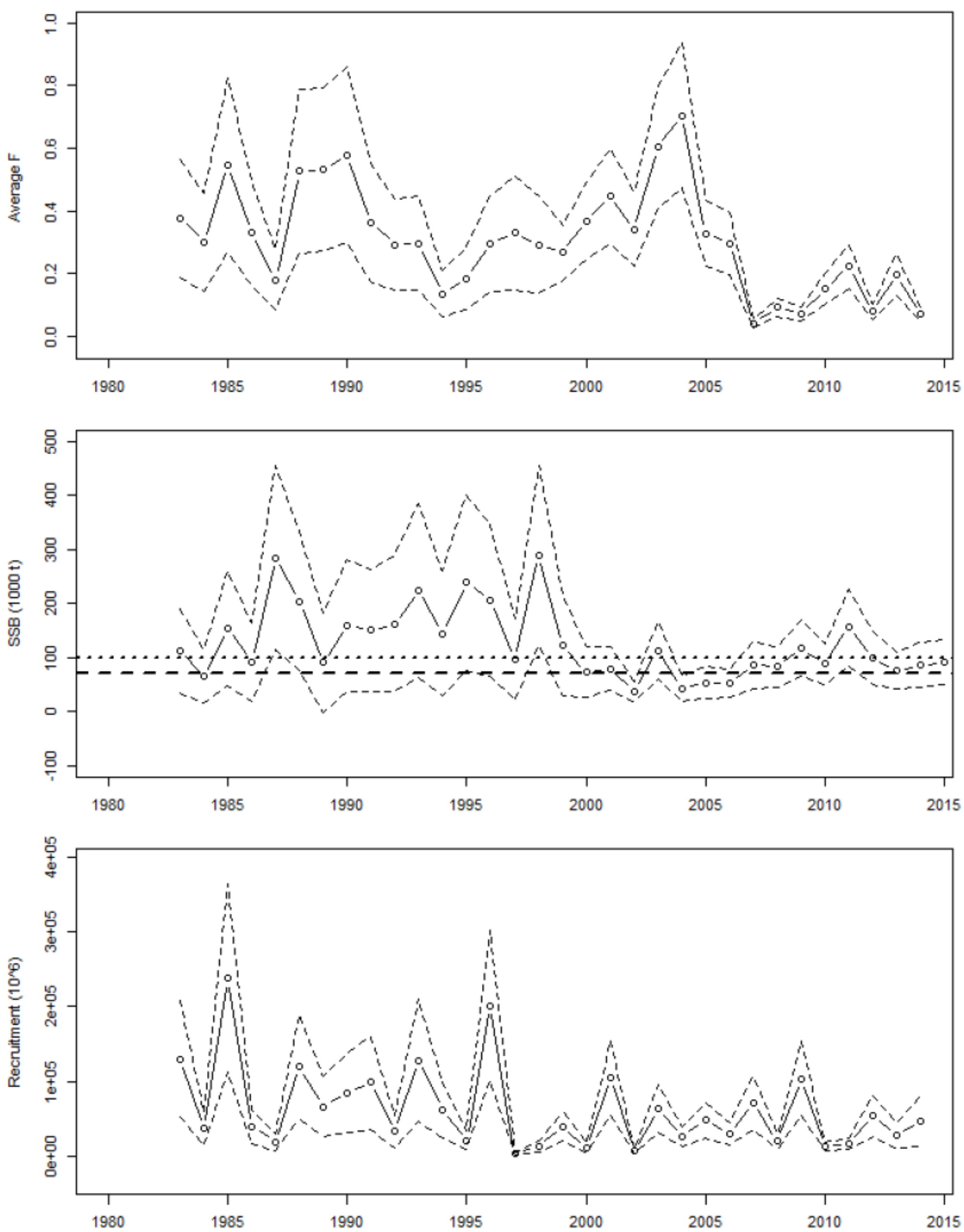


Figure 11.Time series of average fishing mortality ages 1 and 2 (top panel), spawning stock biomass (middle panel) and year class strength (lower panel) for sandeel in management unit 2. Dark lines are means, and dotted lines are 2 standard deviations from the mean). Table from ICES 2015a-s, figure 11.3.10).

Table 5 and Figure 11 illustrate the impact of recruitment variation on SSB, with the stock below B_{pa} (and $Be_{scapement}$) for most years since the late 1990s, and in the mid-2000s, even below $B_{lim.}$ These were the years with exceptionally poor incoming recruitment (bottom panel of figure 9). The high values for in fishing mortality in the early and mid-2000s came after the stock had declined. However the second period of poor recruitment around 2010 was not accompanied by an increase in fishing mortality, which remained at some of the lowest levels in the time series. Since 2000 the two minor improvements in recruitment produced subsequent increases in SSB, indicating that survivorship from fishing was high enough to recruitment signals to be passed on to the population reproductive potential. From figure 12 the uncertainty in estimates of spawning biomass has been declining since the 2000s, suggesting that the CPUE data are becoming more informative, possibly due to more effective effort standardization. The decrease in uncertainty in estimates of fishing mortality occurred in the last 1990s, and may be a response to improvements in catch documentation, and has shown very consistent performance thereafter. Recent recruitment estimates are highly uncertain, which is almost always true for short-lived stocks where cohorts enter the fishery just a year or two after they were spawned. SSB has already increased almost to $B_{escapement.}$ Future SSB is expected to continue to depend on strength of the recruiting year classes, since fishing mortality is low enough that recruitment variation will be transferred into fishing and spawning biomass.

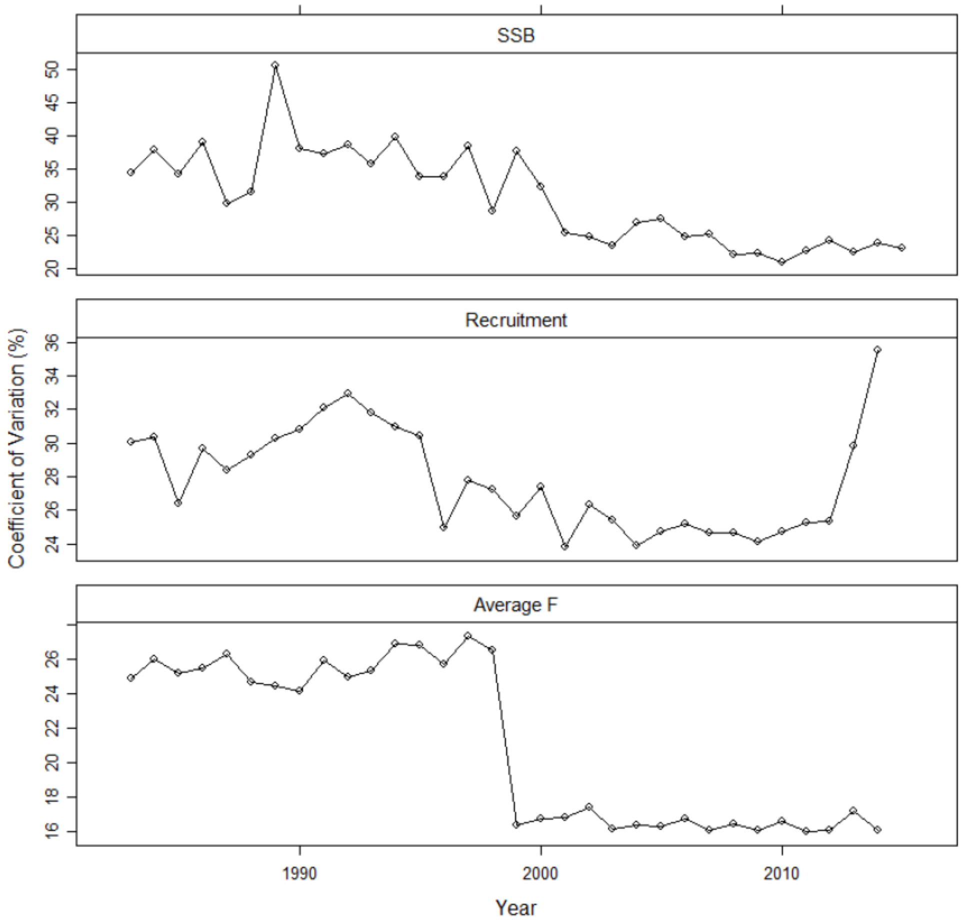


Figure 12. Coefficients of variation of the population parameters in figure 11. Coefficients of variation for SSB (top panel), recruitment (middle panel) and fishing mortality (Bottom panel), taken from ICES 2015a-s, figure 11.3.9).

Management Unit 3

In estimating the goodness of fit, equal weighting were given to fitting the catch at age and dredge survey data. The resultant coefficients of variation suggest a moderate fit to age 0 sandeels (CV = 0.45) and even more lack of fit to older ages (CV= 0.83 for age 1). For the catch-at-age data, CVs were moderate for age 1 in the first half of the hear (CV = 0,57) and much higher for age 1 in the second half of the year and all older ages (all CVs > 0.9), As with the other management units, fitting the presumptive stock-recruitment relationship was given a much lower weight and was poorly fit (CV = 0.92), which is not worse than the fits to some of the catch-age-age data. Goodness of fit was overall considered to be within acceptable bounds, but room for improvement in model formulation clearly remains (ICES 2015a-s, Section 11.4.5; their table 11.4.5). Retrospective performance was considered

moderate, indicating some improvement in assessment structure but not yet full convergence on a robest formulation (ICES 2015a-s, their Figure 11.4.8).
Key results of trends in spawning biomass, year-class strength, and fishing mortality are shown in Table 6 and Figure 13, with their variances in Figure 14.

Table 6.: Estimates of recruits, total stock biomass (TSB), spawning stock biomass (SSB), maximum yield consistent with the harvest strategy, and fishing mortality for management area 3 (table from ICES 2015a-s, Table 11.4.9).

	Recruits (million)	TSB (tonnes)	SSB (tonnes)	Yield (tonnes)	Mean F1–2
1983	92568	207400	73091	105946	0.469
1984	44414	299202	95454	123635	0.502
1985	302008	257981	141974	59083	0.276
1986	363681	790656	164638	420341	1.006
1987	84853	1065910	285808	403908	0.915
1988	296648	645779	386598	391081	1.378
1989	99705	788449	129312	481893	1.163
1990	203957	416721	190842	219183	0.600
1991	92749	706559	196051	368105	0.769
1992	237392	377034	176535	195700	0.492
1993	216216	735776	197964	263954	0.676
1994	164432	678634	246387	444119	0.753
1995	135386	545567	190400	218922	0.509
1996	930757	740538	318834	247397	0.417
1997	59256	1697540	250820	604159	0.991
1998	90345	571347	384086	499333	0.993
1999	107430	368878	169768	223160	1.399
2000	73916	333530	72249	242732	1.572
2001	79980	242633	60960	245290	1.184
2002	15960	241217	47523	209302	1.230
2003	38593	99609	56968	58942	0.619
2004	17286	116249	26839	79234	0.814
2005	30937	102838	57322	29677	0.268
2006	86299	124240	45486	18863	0.161
2007	53888	302190	70118	113232	0.617
2008	98104	273113	108243	94491	0.545
2009	113609	309191	67557	33350	0.169
2010	13466	528750	254199	80576	0.607
2011	11783	249286	203338	94750	0.549
2012	99625	149131	111560	45111	0.235
2013	149542	267421	49103	39233	0.385
2014	383868	535153	58454	144393	0.515
2015			202124		
arith. mean	149645	461516	154261	212472	0.712
geo. mean	89426				

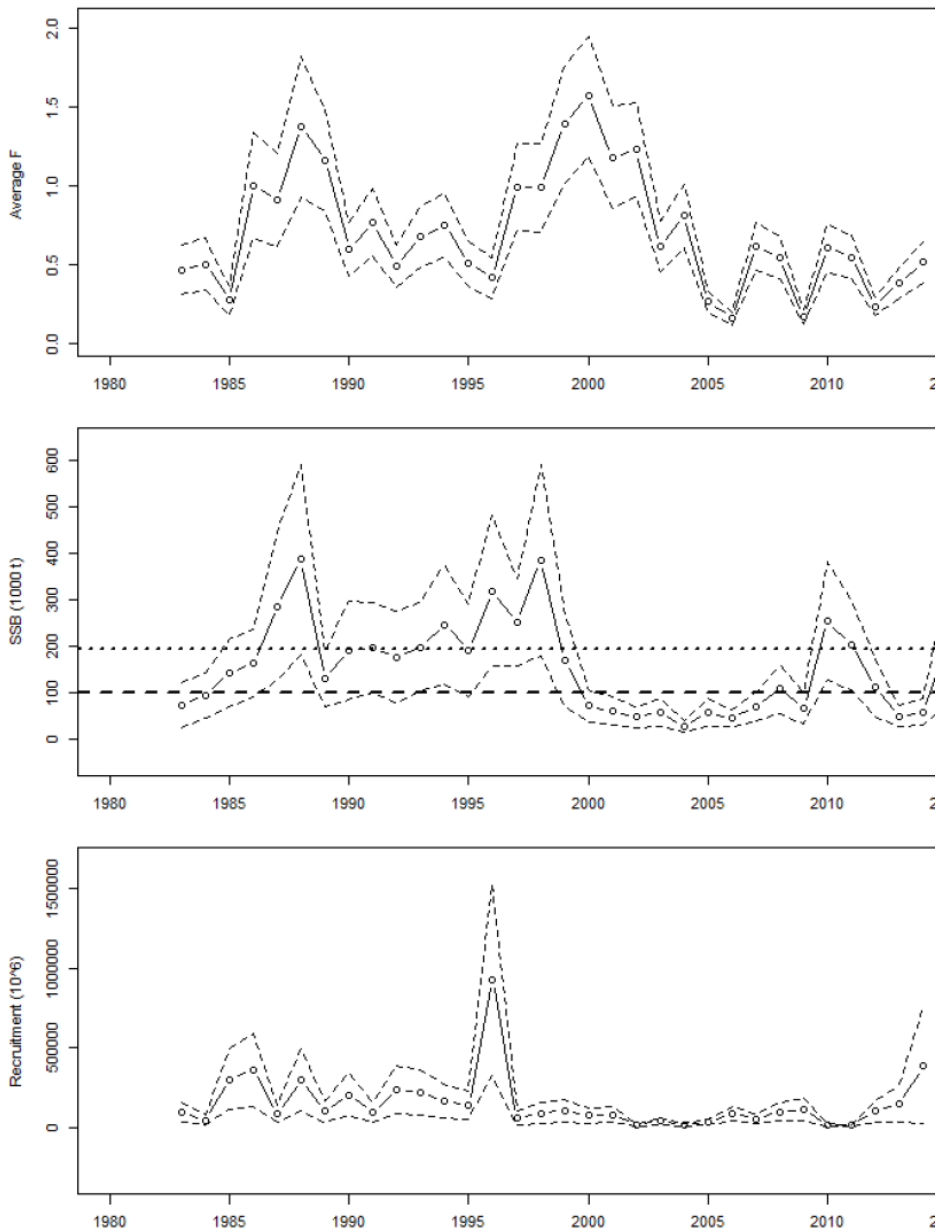


Figure 13. Time series of average fishing mortality ages 1 and 2 (top panel), spawning stock biomass (middle panel) and year class strength (lower panel) for sandeel in management unit 2. Dark lines are means, and dotted lines are 2 standard deviations from the mean). Table from ICES 2015a-s, figure 11.4.10).

Table 6 and Figure 13 illustrate the impact of recruitment variation on SSB. Between the exceptional but anomalous 1996 cohort, recruitment was consistently low until 2012, with a possible improving trends in the recent years. With poor incoming recruitment the stock fell below B_{pa} ($B_{escapement}$) by 200, and below B_{lim} soon afterwards. Fishing mortality was reduced in the early years of the 2000s, such that even modest improvements in recruitment were sufficient to allow the biomass to rise above both reference points for three years at the end of the 2000s. The improved SSB did not prevent more years of very low recruitment causing SSB to fall back below the escapement targets, even though fishing mortality remained below the longer term average F.

Comparing Figure 14 and Figure 10, overall uncertainty regarding all population parameters are higher for management unit 3 than for unit 1, with no evidence from Figure 14 that the inclusion of the dredge surveys are reducing the uncertainty in estimates of spawning biomass. Uncertainties are compatible for some years between management units 2 and 3 (Figure 12 and Figure 14), with each having lower CVs in a few years, and estimates of fishing mortality in management unit 3 less uncertain than in unit 2 for all recent years. However, it seems that improvements in catch documentation and effort standardization contributed more gradually and cumulatively to improving estimates of fishing mortality. Recent recruitment estimates are highly uncertain, which is almost always true for short-lived stocks where cohorts enter the fishery just a year or two after they were spawned. However, SSB has already increased above B_{lim} and is expected to be above $B_{escapement}$ when the large recruiting 2014 year class is fully mature.

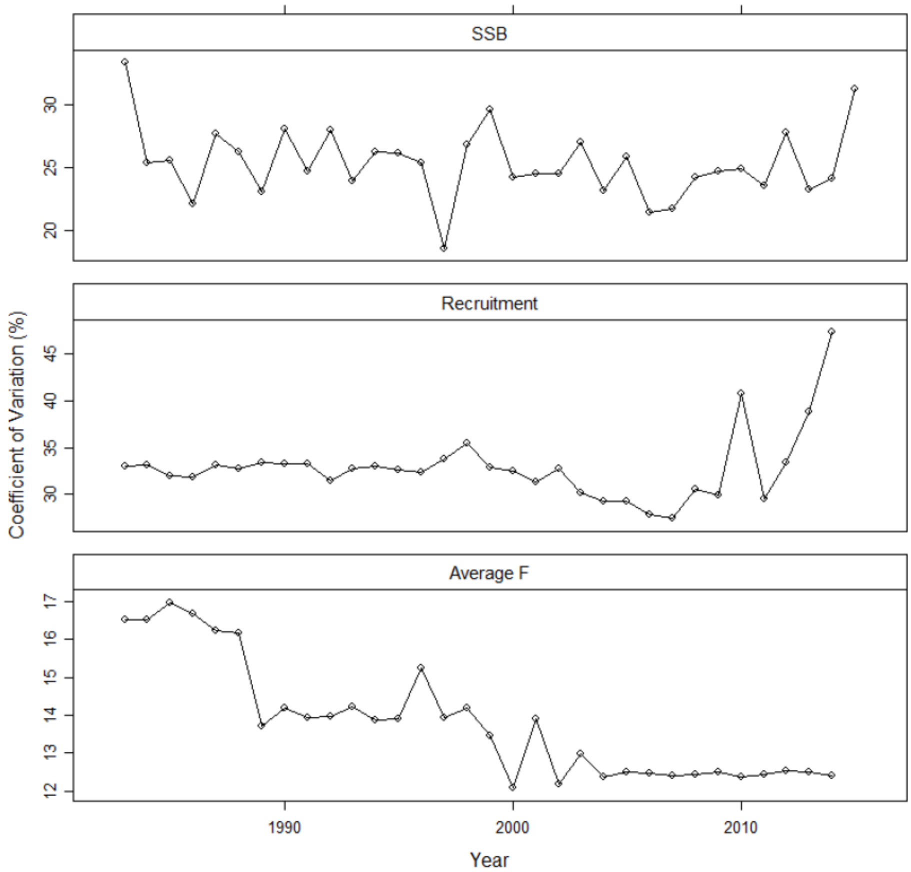


Figure 14. Coefficients of variation of the population parameters in Figure 13. Coefficients of variation for SSB (top panel), recruitment (middle panel) and fishing mortality (Bottom panel), taken from ICES 2015a-s, figure 11.4.9).

<u>Overall status</u>

Considering the final advice from ICES 2015a-s as a whole, the status of sandeel has improved in recent years, and is now within acceptable biological limits (Table 7). This s recent improvement though, and future status will depend on continued recruitment of year-classes stronger that those that were common in the 2000s.

Table 7. Summary of stock status in 2015 across all management units , taken from ICES 2015a-s Table 6.3.39.1.

Table 6.3.39.1 Sandeel in the North Sea (SA 3). State of the stock and fishery, relative to reference points.

	Fishing pressure				Stock size			
		2012	2013	2014		2013	2014	2015
Maximum Sustainable Yield	F_{MSY}	?	?	? Undefined	MSY $B_{escapement}$	✗	✗	✓ Above escapement
Precautionary approach	F_{pa}, F_{lim}	?	?	? Undefined	B_{pa}, B_{lim}	✗	✗	✓ Low risk
Management plan	F_{MGT}	?	?	? Undefined	SSB_{MGT}	?	?	? Undefined

With no specific harvest strategy adopted by the management authority, ICES has provided a range of catch options. All but the zero catch option and a 75% reduction in F from F2014, allow increases in catches in 2015, and only the full escapement with no cap on fishing mortality result in further improvements in SSB (Table 8).

Table 8. Catch options presented by ICES in 2015 advice, taken from ICES 2015a-s, table 6.3.39.3.

Table 6.3.39.3 Sandeel in the North Sea (SA 3). Annual catch options. All weights are in thousand tonnes.

Rationale	Catches (2015)	Basis	F (2015)	SSB (2016)	%SSB change*	%TAC change**
MSY approach with F_{cap} = 0.5	370	SSB_{2016} ≥ MSY $B_{escapement}$ and F_{cap}	0.5	356	76%	61%
MSY approach without F_{cap}	666	SSB_{2016} = MSY $B_{escapement}$	1.16	195	−4%	190%
Zero catch	0	F = 0	0.00	569	181%	−100%
Other options	93	F_{2014} × 0.25	0.11	515	155%	−60%
	177	F_{2014} × 0.5	0.21	466	131%	−23%
	254	F_{2014} × 0.75	0.32	422	109%	10%
	324	F_{2014} × 1	0.42	382	89%	41%
	388	F_{2014} × 1.25	0.53	346	71%	69%
	446	F_{2014} × 1.5	0.64	314	55%	94%

Sandeel in Areas 4 and 6

Sandeel area 4 is not currently commercially fished. There is a small research quota for this area only which is much smaller than the historic commercial fishery allowed here. Sandeel area 6 is a very small bank in the Skagerrak fished only by smaller scale vessels delivering to processors in northern Denmark. Sandeel fishing areas are managed as individual substocks for the purposes of stock assessment and quota allocations, but there is no scientific basis indicating that these are actually separate stocks from a biological standpoint across the North Sea and Skagerrak.

ICES has quantitative stock assessments for areas 1-3 and manages these with escapement targets. For Area 4, there is no stock assessment and no management since this is not a commercially fished area. One condition of it becoming a commercially fished area again is that there would have to be a stock assessment and commensurate management targets. Area 6 is extremely small relative to areas 1-3, with a very small catch of sandeel relative to the other areas as well. However, this area is important for the smaller scale fishermen in the Skagerrak.

On the basis of the above information, the MSC's Risk Based Framework was used to assess the sandeel fishery in areas 4 and 6, the results of which are given in Appendix 1.2.

Area 4

No analytical assessment or short-term forecast is available for this stock. The ICES framework for category 3 stocks was applied based on a combined abundance index for the ages 0 and 1 from the dredge survey of the Firth of Forth (ICES(s) 2012). This index is estimated to have increased by more than 20% between 2010–2013 (four-year average) and 2014. The exploitation on the stock is considered to be very low; therefore, no additional precautionary buffer was applied (ICES 2015a-s). There is no commercial TAC for sandeel in Area 4—only a monitoring TAC for the purposes of establishing a sufficient data set for an analytical assessment in the future. In addition, the entire UK coastal zone is closed to sandeel fishing in Area 4. In 2012 and 2014, monitoring TACs of 5000 t were implemented for this stock. Since the monitoring TAC was established, sandeel catches in Area 4 have been below the catch corresponding to ICES advice. ICES emphasizes the importance of obtaining sufficient sampling from the monitoring fishery. Historically, the sandeel catch in area 4 has been as high as 170 thousand t (in 1997), and routinely in the range of 30-60 thousand t per year, which is well above the current monitoring TAC of 5,000t.

Area 6

Only catch history is known for this substock of sandeel in the Kattegat. In the absence of more information, ICES bases its advice on the average catch of the three previous years, and applies a precautionary buffer of 20% (ICES 2015b-s). ICES has been providing TAC advice on this basis since 2013, and the catch each year since then has always been below the TAC advice of ICES. This sandeel bank is fished only by smaller Danish trawlers who report no detectible changes in population size or density during fishing activities in recent years. An experienced Danish sandeel fisherman reported the following (Dan Harding Pedersen pers. comm.)

- The sandeel caught in the Kattegat are on average large/old (compared to the other areas), except in very few extraordinary years (1986, 1993) where there seemed to be a temporary massive influx of lots of small/young sandeel (presumably from the North Sea) on every single bank in the Kattegat. The 'normal' Kattegat sandeel occur in high abundance on certain banks (two north of Læsø, one west of Anholt etc.) every year, and more erratically on other banks.

- For these 'safe' banks, the catch rates have been stable throughout the 40-year period that he has been fishing. There will always be sandeel on the other banks as well – but only some of them, so you have to search. This was possible in former times when the quotas and number of vessels were higher. But with the current low quota (last year fished by just two vessels), there are enough fish on the safe banks – so no one will waste time looking for fish on the others.

- He also explained that the shallow water depth and the fact that it was older/larger fish, meant that no matter how many fish you would see on the sonar when you arrived at a bank, once you had fished on them for a day, the rest would have dispersed so widely that it would take several days for them to come back in large enough densities to make fishing worthwhile – a behavior he felt offered them a kind of natural protection against overfishing.

If the fishery at its current scale were depleting the stock some decline in CPUE might be experienced, and this has not generally been the case. Decreases in catches since the 1990s have been due to additional regulations applied to the fisheries both inside UK jurisdiction and in EU jurisdiction. An analysis of actual sandeel fishing in Area 6 versus the sandeel habitat area in this area (see Availability rationale in the PSA tables) shows that there is very little overlap of the fishery with the sandeel habitat in the area.

Norway Pout

General Considerations

The North Sea Norway pout stock subject to certification assessment is widespread in the central and northern North Sea. To the east its range extends into the Kattegat, to the north to the Barents Sea, and to the west species extends to the Labrador Sea and Newfoundland shelf of the Northwest Atlantic, at suitable depths. Analysis of survey data provided no evidence of stock separation within the North Sea (Larsen et al 2001, Lambert et al et al. 2009)), and the stock is managed as a unit stock. Affinities with Norway pout stocks to the north and west have not been established. Depth of occurrence is primarily between 50 and 250 m (Raitt 1968; Sparholt, Larsen and Nielsen 2002b).

The fishery is uses small-mesh bottom trawls primarily in the north-western North Sea and along the edge of the Norwegian Trench in the north-eastern part of the North Sea. Since 2000 the fishery has been prosecuted almost exclusively by Danish and Norwegian vessels, with Norway pout used in a reduction process for fish meal and fish oil. It is commonly taken in a mixed fishery with blue whiting, especially during the period of high blue whiting catches in the late 1990s and 2000s. Main fishing seasons are second half of the year, although prior to the 2000s in some years there were high catches in 1st quarter of the year as well. Landings have been relatively low since 2001, and were the lowest on record in the middle of the 2000s, with the directly fishery closed in 2005-2007 (except Quarter 1 and Q2 of 2006) and in the first half of 2011 and 2012 (Table 9, Figure 15). In the periods of closures but high abundance of blue whiting, by-catch quotas for Norway pout in the Norwegian mixed blue whiting fishery around 5 kt, as well as small experimental fisheries to test abundance estimated from the assessments. In the years of directed fisheries with Norway pout higher catches (2010, 2012, 2013) the fishery primarily harvested the 2008, 2009, and 2012 year classes which were average or above average. Between 2008 and 2013, the quota was only fully taken in 2011, due to the combination of high fuel costs and restrictive blue whiting bycatch regulations in 2009 and 2010.

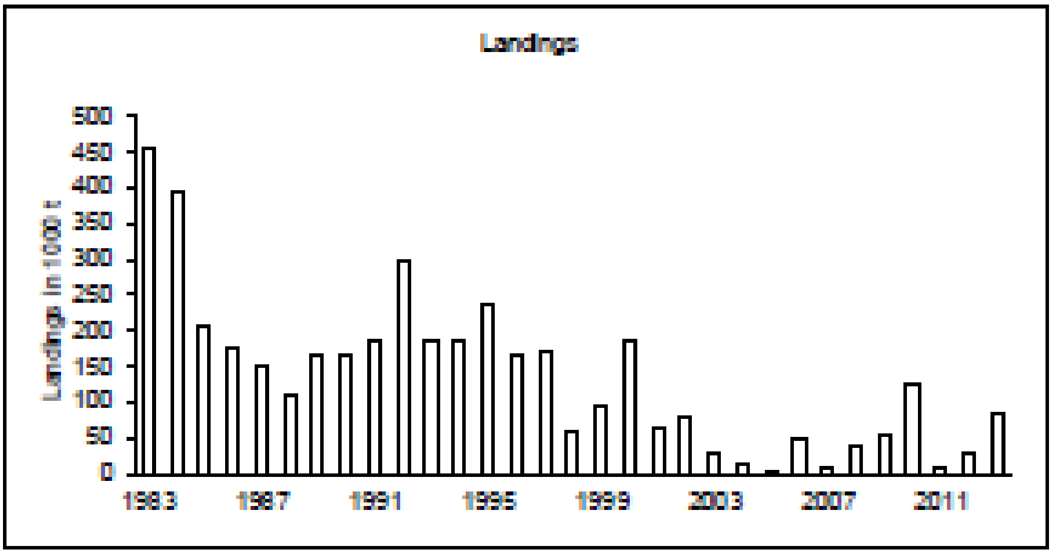


Figure 15. Reported landings of Norway pout from 1983-2014. (from ICES 2014a-p Figure 5.3.2 Panel a).

Table 9. Landings of North Sea Norway pout from 1961 to 2013, by country. Taken from ICES 2014a-p Table 5.2.2).

Year	Denmark		Faroes	Norway	Sweden	UK (Scotland)	Others	Total
	North Sea	Skagerrak						
1961	20,5	-	-	8,1	-	-	-	28,6
1962	121,8	-	-	27,9	-	-	-	149,7
1963	67,4	-	-	70,4	-	-	-	137,8
1964	10,4	-	-	51	-	-	-	61,4
1965	8,2	-	-	35	-	-	-	43,2
1966	35,2	-	-	17,8	-	-	+	53,0
1967	169,6	-	-	12,9	-	-	+	182,5
1968	410,8	-	-	40,9	-	-	+	451,7
1969	52,5	-	19,6	41,4	-	-	+	113,5
1970	142,1	-	32	63,5	-	0,2	0,2	238,0
1971	178,5	-	47,2	79,3	-	0,1	0,2	305,3
1972	259,6	-	56,8	120,5	6,8	0,9	0,2	444,8
1973	215,2	-	51,2	63	2,9	13	0,6	345,9
1974	464,5	-	85,0	154,2	2,1	26,7	3,3	735,8
1975	251,2	-	63,6	218,9	2,3	22,7	1	559,7
1976	244,9	-	64,6	108,9	+	17,3	1,7	437,4
1977	232,2	-	48,8	98,3	2,9	4,6	1	387,8
1978	163,4	-	18,5	80,8	0,7	5,5	-	268,9
1979	219,9	9	21,9	75,4	-	3	-	329,2
1980	366,2	11,6	34,1	70,2	-	0,6	-	482,7
1981	167,5	2,8	16,4	51,6	-	+	-	238,3
1982	256,3	35,6	12,3	88	-	-	-	392,2
1983	301,1	28,5	30,7	97,3	-	+	-	457,6
1984	251,9	38,1	19,11	83,8	-	0,1	-	393,01
1985	163,7	8,6	9,9	22,8	-	0,1	-	205,1
1986	146,3	4	2,5	21,5	-	-	-	174,3
1987	108,3	2,1	4,8	34,1	-	-	-	149,3
1988	79	7,9	1,3	21,1	-	-	-	109,3
1989	95,7	4,2	0,8	65,3	+	0,1	0,3	166,4
1990	61,5	23,8	0,9	77,1	+	-	-	163,3
1991	85	32	1,3	68,3	+	-	+	186,6
1992	146,9	41,7	2,6	105,5	+	-	0,1	296,8
1993	97,3	6,7	2,4	76,7	-	-	+	183,1
1994	97,9	6,3	3,6	74,2	-	-	+	182
1995	138,1	46,4	8,9	43,1	0,1	+	0,2	236,8
1996	74,3	33,8	7,6	47,8	0,2	0,1	+	163,8
1997	94,2	29,3	7,0	39,1	+	+	0,1	169,7
1998	39,8	13,2	4,7	22,1	-	-	+	57,7
1999	41	6,8	2,5	44,2	+	-	-	94,5
2000	127	9,3	-	48	0,1	-	+	184,4
2001	40,6	7,5	-	16,8	0,7	+	+	65,6
2002	50,2	2,8	3,4	23,6	-	-	-	80,0
2003	9,9	3,4	2,4	11,4	-	-	-	27,1
2004	8,1	0,3	-	5	-	-	0,1	13,5
2005	0.9*	-	-	1	-	-	-	1,9
2006	35,1	0,1	-	11,4	-	-	-	46,6
2007	2.0**	-	-	3,7	-	-	-	5,7
2008	30,4	-	-	5,7	+	-	+	36,1
2009	17,5	-	-	37,0	+	-	+	54,5
2010	64,9	0,2	-	60,9	+	+	+	126,0
2011	3,3	-	-	3,2	+	+	+	6,5
2012	22,3	0,1	-	4,6	+	+	+	27,0
2013	29,0	6,2	-	46,9	+	+	+	82,1

* 781 t taken in a trial fishery; 160 t in by-catches in other (small meshed) fisheries.

** 681 t taken in trial fishery; 1300 t in by-catches in other (small meshed) fisheries.

The variation in year-class strength is large, with the strongest year-classes prior to the benchmark recruitment more than 15 times larger than the weakest (**Table 29**, column 2). The 2014 recruitment estimate of more than 240 million recruits is more than 50% larger than the next largest year-class (1994) and is highly uncertain. Although the estimate is accepted by ICES for advice on this stock (ICES(p) 2015) the advice also stresses the uncertainty of the estimate, and recommends caution in management.

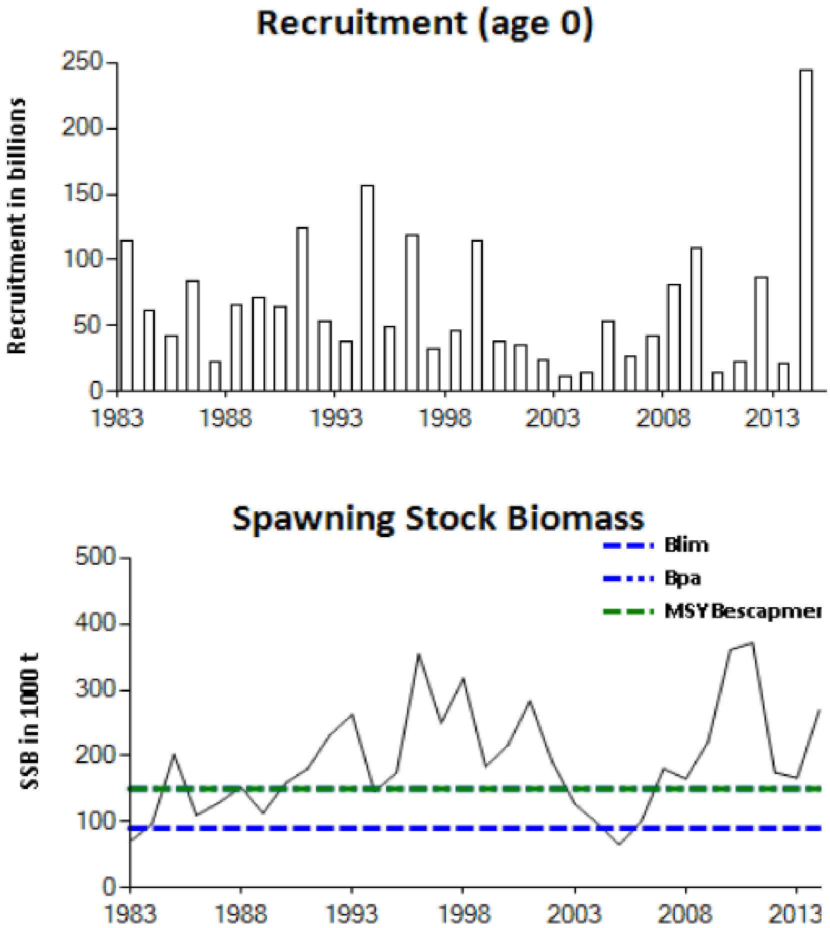


Figure 16. Time series of year class sizes (top panel) and spawning biomass (lower panel) for North Sea Norway pout, from ICES(p) 2015 (Table 6.3.16b.1 panels b and d).

Table 10. Recruits (in millions) and biomasses and yields (in thousands of tonnes) for North Sea Norway pout (Taken from ICES(p) 2015 Table 5.3.6).

Year	Recruitment at age 0	SSB	Total catch	Mean F at ages 1–2
	thousands	tonnes	tonnes	
1983	113 834 000	69 791	457 600	0.9
1984	62 003 000	96 168	393 010	1.28
1985	41 936 000	202 280	205 100	1.325
1986	84 198 000	109 784	174 300	1.092
1987	22 249 000	128 800	149 300	0.897
1988	66 160 000	152 308	109 300	0.637
1989	71 266 000	113 089	166 400	0.828
1990	64 027 000	158 523	163 300	0.758
1991	123 682 000	180 670	186 600	0.882
1992	53 383 000	231 879	296 800	0.912
1993	38 276 000	262 547	183 100	0.831
1994	156 918 000	145 742	182 000	1.051
1995	49 341 000	174 592	236 800	0.577
1996	119 297 000	354 213	163 800	0.44
1997	32 596 000	250 143	169 700	0.575
1998	46 397 000	317 525	57 700	0.291
1999	113 813 000	183 345	94 500	0.642
2000	37 840 000	215 803	184 400	0.567
2001	34 674 000	283 241	65 600	0.258
2002	23 603 000	189 941	80 000	0.51
2003	10 752 000	127 409	27 100	0.245
2004	13 578 000	97 858	13 500	0.154
2005	53 172 000	65 152	1 900	0
2006	26 079 000	100 205	46 600	0.252
2007	42 419 000	180 344	5 700	0.022
2008	81 366 000	164 974	36 100	0.132
2009	108 547 000	221 242	54 500	0.243
2010	14 027 000	360 891	126 000	0.402
2011	22 891 000	371 610	6 500	0.031
2012	87 249 000	174 667	27 000	0.315
2013	20 814 000	166 532	82 100	0.383
2014	243 669 000	269 574		
Average	65 001 750	191 276	133 752	0.562

This variation in year-class strength is also apparent in the stock biomass, with nearly a with a nearly 10-fold difference between the largest and smallest total stock biomass (ICES 2014a-p, table 5.3.2) and a six-fold difference in SSB (Table 10). Such variation of biomass responding to recruitment variation is expected. Norway pout are relatively short-lived with few fish aged 5 or older in the population and there multi-year runs of weak or strong year-classes are common. Consequently biomass can build up or decline quickly from natural processes (Nielsen et al., 2012, Sparholt et al., 2002a, 2002b; Figure 16, Table 10, column 4).

The benchmark assessment in 2012 was not asked to consider the causes of the runs in strong or weak recruit, beyond considering multiple scenarios that explicitly or implicitly made different assumptions about stock productivity. The annual assessments also do not consider causes of this recruitment variation, beyond observing that little information is available but environmental factors such as temperature are likely involved (ICES 2014a-p, Section 5.1.1). Top-down predation mortality is variable over time, but again is considered more likely to follow the variation on year class-strength than lead it, with predators increasing the biomass of Norway pout that is consumed when the stock is abundant and decreasing it when Norway pout experience weak recruitment (ICES 2014a-p, section 5.1.1), However, neither the increases nor biomasses consumed are fully in proportion to the variation in stock biomass, so the magnitude of variation in estimates of natural mortality is not as great as the variation in year-class strengths (ICES(p)-WGSAM 2011, 2012c-p, 2014c-p).

Whether driven directly by physical oceanographic conditions or mediated by bottom up and even top-down predator-driven processes, these environmental influences on year-class strength mean that the stock-recruit plots have large scatter (Figure 17). Year classes more than twice the geometric mean (44 million recruits) have been produced by some of the smallest SSBs ever observed, and year-classes well below the geometric mean have been produced across the full range of observed SSBs, including the two largest SSBs in the time series.

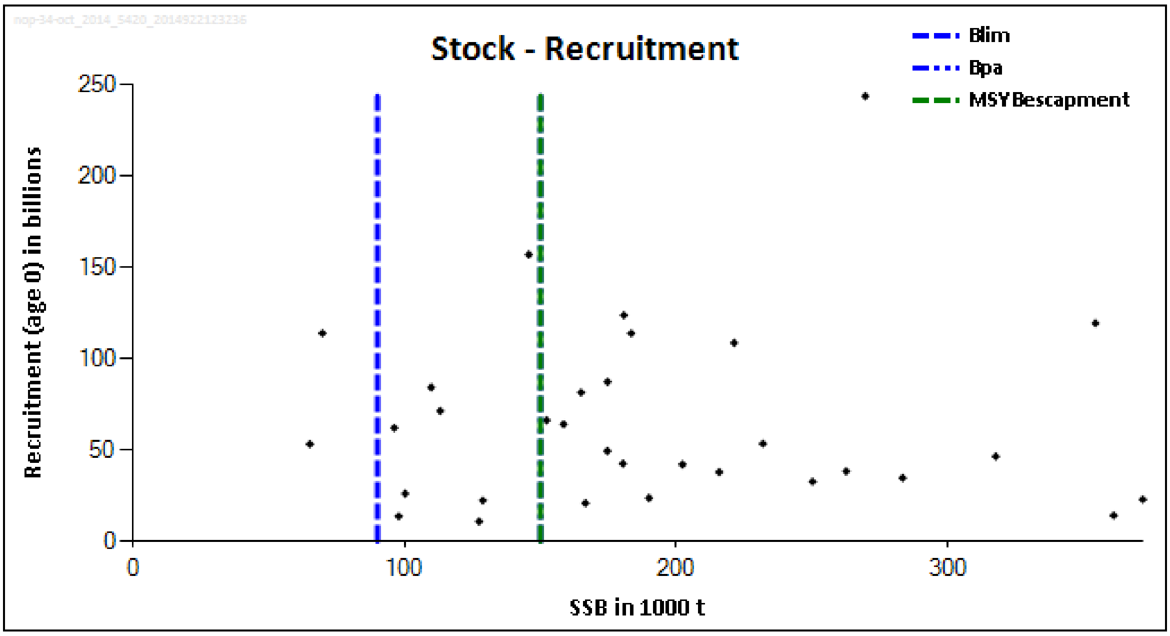


Figure 17. Plot of recruitment as a function of SSB; taken form ICES(p) 2015, Figure 6.3.16b.3. This scatter the stock recruit relationship affects the ability to resolve the degree of dependence of recruitment on spawning biomass, and to fit a stock recruit curve.

With the stock-recruit curve poorly constrained by the data, the ability to anchor biologically-based reference points for the stock is also weak. Rather, the limit reference point of 90,000t for this stock is based on a 1997 estimate of B_{loss}. In turn B_{loss} was based largely on simple computations from visual inspection of historical stock-recruit data available at the time, and identifying SSBs associated with year-classes considered at the time to be particularly weak (ICES(p) 2009, ICES 2012a-p, Section 5.7, ICES 2014a-p, Section 5.7). The corresponding quasi-target reference point of B_{pa} was then based solely on uncertainty in the assessment at that time to manage risk of falling below the B_{lim}, and not to otherwise optimize biological outcomes for the stock (ICES 2012a-p, Section 5.7, ICES 2014a-p Section 5.7). The Inter-benchmark review of the stock in 2012 reviewed a variety of alternative approaches, including segmented regressions in an attempt to better estimated an inflection point in the stock-recruit relationship. However, after considering a variety of scenarios, it concluded that there was no biological justification to change the reference values, and that it could perform as a surrogate for an MSY-based strategy (ICES 2012a Section 5.7, table 3). The ICES 2014 review of the stock reconsidered that conclusion in the context of the review of MSY reference points in 2013 (ICES 2014b-p). Although that workshop concluded that in general harvest strategies based on minimum escapement goals would only be precautionary if accompanied by a cap on fishing mortality when SSB was high, the 2014 review of Norway pout concluded that the $B_{esapement}$ strategy could be used without an accompanying control on fishing mortality (ICES 2014a-p, Section 5.7).

Table 11. Conclusions of a review of biologically based reference points for North Sea Norway pout, taken from ICES 2012a-p, text table in Section 5.7).

	Type	*Value*	*Technical basis*
MSY	MSY $B_{escapement}$	150 000 t	$= B_{pa}$
Approach	F_{MSY}	Undefined	None advised
	B_{lim}	90 000 t	$B_{lim} = B_{loss}$, the lowest observed biomass in the 1980s
Precautionary	B_{pa}	150 000 t	$= B_{lim}\, e^{0.3*1.65}$
Approach	F_{lim}	Undefined	None advised
	F_{pa}	Undefined	None advised

Growth rate as demonstrated by mean weight at age has been variable over the time series. Because of the short life span of Norway pout, the quarterly values from commercial catches are used in the assessment, rather than the IBTS Q1 weights at age that provide only annual data of size and growth. Again runs of years with lower and higher weights at age are apparent (Figure 18). In addition females are larger than males for most years.

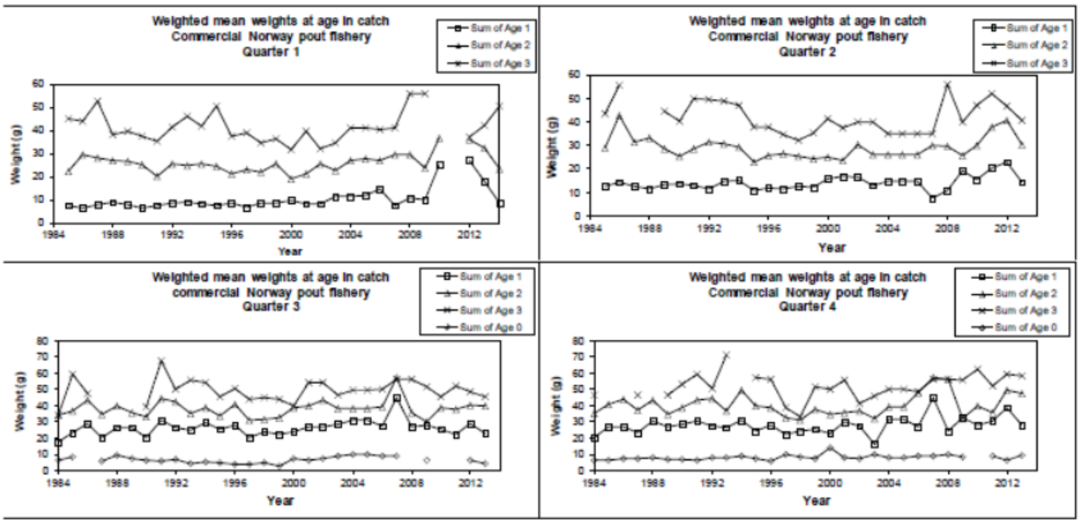


Figure 18. Weighted mean weights at age in catch of the Danish and Norwegian commercial fishery for Norway pout by quarter of year during the period 1983-2013. Taken form ICES 2014a-p, figure 5.2.1.

Lambert et al. (2009) examined the weight at age data and found evidence of weak density dependence in growth. This is illustrated by both a significant negative correlation of mean weight of age 2 Norway pout in Q1 and estimated size of the cohort at the end of Quarter 4 of the preceding year (Figure 19, panel a) and significant negative correlations of overall mean length at age 1 and 2 with estimates of the year class at age 0 (Figure 19 panels b and c). The relationships are complex, however, as there are also geographic differences in growth, with more southerly samples generally larger at al than Northerly samples, and correlations both positive (whiting) and negative (cod, haddock) with SSB of key predators of Norway pout (Lambert et al. 2009)

Overall, the reduction in mean length at age (Figure 19, panels b and c) was primarily an absence of high mean weight at age for large cohorts, with a large scatter of mean length age ages for weak or average cohorts. This relationship implies the density dependence due in part to higher survival of slower growing Norway pout in large cohorts rather than just food limitation of growth. These patterns have not been examined relative to oceanographic drivers and the size selectivity of major predators, but are consistent with the results of Neilson et al (2012).

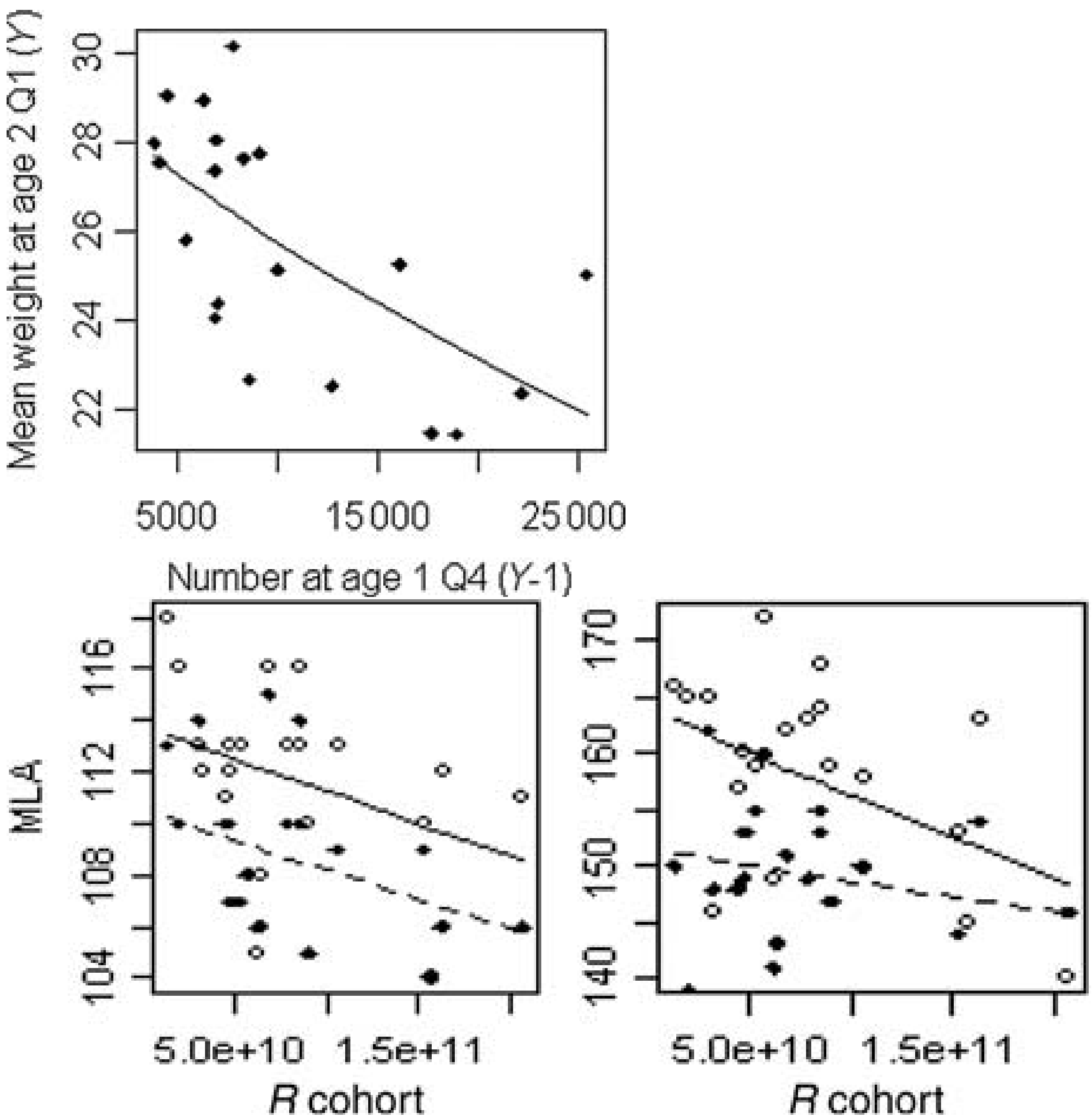


Figure 19. Weight at age 2 quarter 1 (panel a) and length at ages 1 and 2 (quarter 1) as functions of cohort size at the end of Quarter 4 of the preceding year (panel a) and cohort size at ago) (panels b and c). Table from Lambert et al, 2009 figures 10 and 11).

The patterns in growth and size at age interact with maturation to provide complex patterns of maturation at age as well. Although almost all Norway pout are mature by age 2, there is evidence that maturation is more strongly size dependent for females and slightly more strongly age dependent for males and for both sexes has weak negative correlation with year-class strength (Figure 20, Lambert et al. 2009). Because of the extended spawning time of Norway pout, and the high natural mortality at age 1, this implies an extended maturation period for age 1 with estimates of SSB changing through the year (Figure 20).

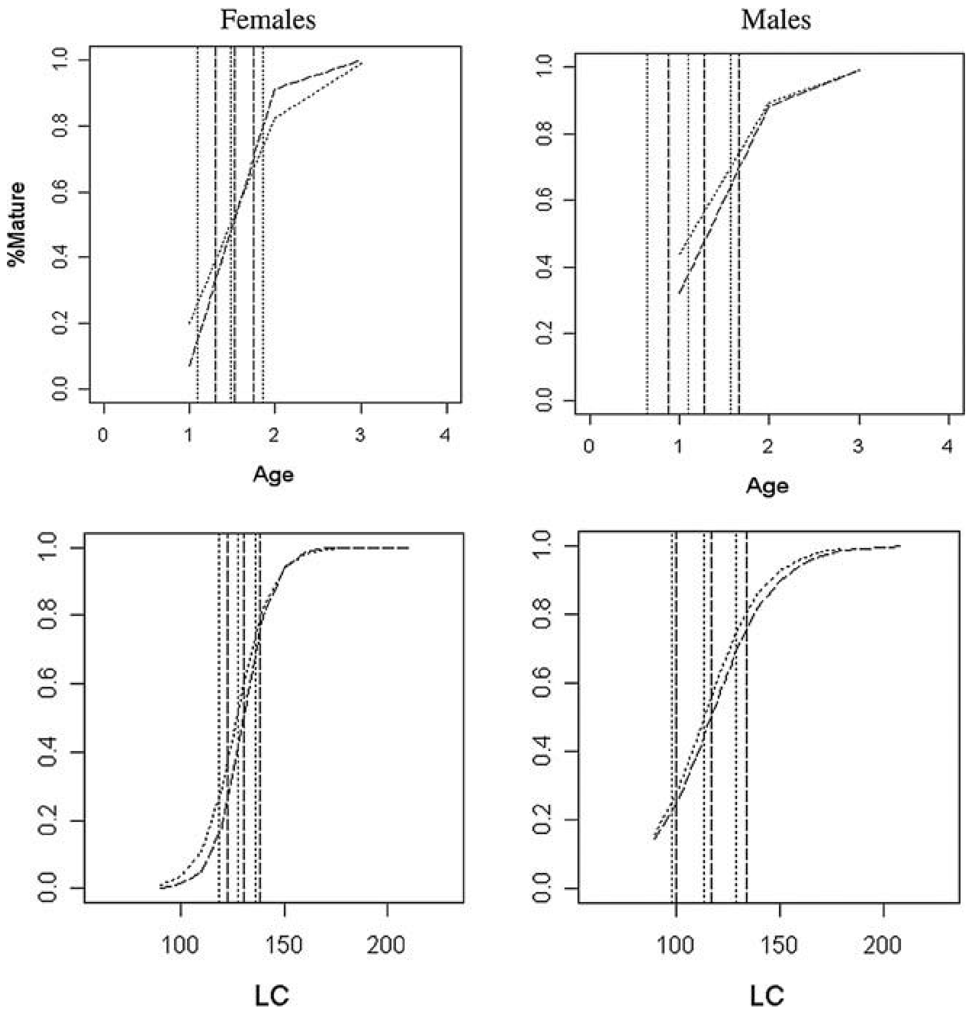


Figure 20. Maturity ogives by age (top) and length (bottom) as a function of length category (LC), and comparison between weak and strong year classes for each sex. Dotted lines are for the weaker year classes; long-dashed lines, strong year classes; taken from Lambert et al, 2009, Figure 15).

Including all of the interacting factors in calculation of annual SSB and total biomass would be extremely complex, and require detailed in-year monitoring of Norway pout abundance and in-season data on abundance of key predators. Fortunately, the factors interact in ways that provide small multi-year trends in key productivity parameters including annual growth increments, and annual age and length of 50% maturity (Figure 21). These small annual increases or decreases in productivity parameters support the use of recent average values for these parameters in assessments and management of the stock. The inter-benchmark assessment in 2012 considered multiple approaches to treatment of growth and maturation and settled on a set of values that provided most robust performance in the simulation tests (Table 12 and ICES 2012a-p). These values have been examined and retained in recent assessments (ICES 2012a-p, 2014a-p).

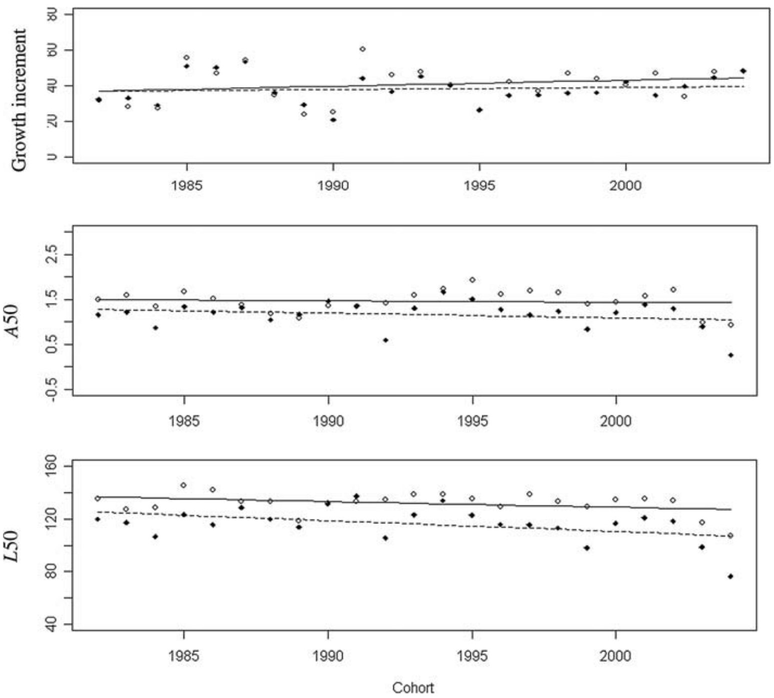


Figure 21. Temporal trends in the growth increment for each cohort from age to age+1 (cm-per-year, panel 1), and age and length of 50% maturity (panels b and c) by sex. Black dots and dashed lines, males; white circles and continuous line, females. Table from Lambert et al. 2009, Figure 15)

Table 12. Growth and maturation values considered in the 2012 benchmark assessment of Norway pout.

Age	Weight (g)				Proportion mature	M
	Q1	Q2	Q3	Q4		Quarterly
0	-	-	4	6	0	0.29
1	9	14	28	28	0.2	0.29
2	26	25	38	40	1	0.39
3	43	38	51	58	1	0.44

Natural mortality estimates on all ages of Norway pout are larger than the corresponding estimates of age-specific fishing mortality, and strongly influence assessment results. The large values reflect high pressure from predators of all ages, especially on post-0-group pout, and post-spawning mortality that also is estimated to be high (Neilsen et al 2012).

The 2012 benchmark assessment considered four alterative scenarios for treatment of natural mortality in the assessments, with the scenarios differing in how natural mortality levels by age and season were estimated. Different scenarios estimated natural mortality from survey data during years of low or no fishing under alternative growth and maturation assumptions, from survey data in all recent years, and from a multispecies model (SMS, ICES 2011, 2012c-p). The Benchmark review concluded that the scenario using the total mortality estimates in years of low fishing and most recent available data on maturation and weights at age provided estimates that were most consistent with the data sources and were ecologically most plausible (ICES 2012a,-p Section 5.2.5.1).

Spawning sites of Norway pout are incompletely known. IBTS survey results in Q1 show that maturity stage 3 (fully mature) Norway pout are widespread in the central and northern

North Sea, but with greatest representation around Viking Bank and the east coast of Scotland (Lambert et al. 2009, Figure 1). The majority of maturity stage 3 samples were taken in quarter 1, but that is also when survey sampling is most intense. Mature Norway pout were taken in all quarters, however.

Diets of Norway pout have not been intensively studied. However two different studies of 0-group Norway pout found them to feed primarily on copepods and the rest on small crustaceans. Particularly decapods and hyperiids. Limited evidence suggests that larger Norway pout continued to feed almost entirely on copepods (Bromley et al 1997, Albert 1993, 1995).

Assessment methods

The information on the Norway pout assessment methods and stock status is taken from ICES 2012a-p, 2012b-p, 2014a-p, and (p)2015, with some reference to prior ICES assessments. Consistent with ICES practice, the intersessional benchmark assessment meeting investigated many aspects of the assessment data and methods in depth, agreeing on treatments of data and analytical methods that become the standard practice for annual assessments until the next benchmark meeting. New information can be considered and assimilated as appropriate into assessments at any time. However the entire framework is only reviewed at the benchmark assessments held at typical intervals of five years, although that interval depends on the rate at which new information comes available (ICES 2012a-p, Section 2)

<u>Key Data Sets</u>
The main sources of data used in the assessment are the annual multispecies IBTS trawl surveys of the North Sea in quarters 1 and 3 and quantification and sampling of commercial catches. The surveys cover depth the full depth range of Norway pout in the North Sea and its geographic extent in the North Sea, although the affinity of the stock with Norway pout in the Barents Sea, which is not covered by the IBTS surveys, is unclear. The primary data used from the surveys are standardized CPUE estimates of annual relative abundance (Figure 22 and ICES 2012a-p, Section 5.2.6.1.5). The commercial catch monitoring and sampling tries to cover the full extent of the fishery geographically and seasonally, and provides data on landings plus catch weight, length and maturity at age (ICES 2012a-p, Sections 5.2.1-5.2.3).

The key indices of stock status from both the commercial and survey fishing fleets were the time series of catch at age per unit of effort. These CPUE series are presented in Figure 22 with the commercial fleet in the left column of panels by age (0, 1, 2 and aggregate, top to bottom) and for the survey fleets in the right panels. Note that the IBTS survey has the most complete coverage and was in the 1st quarter. The other surveys were all in quarter 3. All CPUE indices, but particularly those from the surveys show declines in the mid-2000s and again 2010-2011, but higher values, particularly for the 0-group pout, in the most recent years.

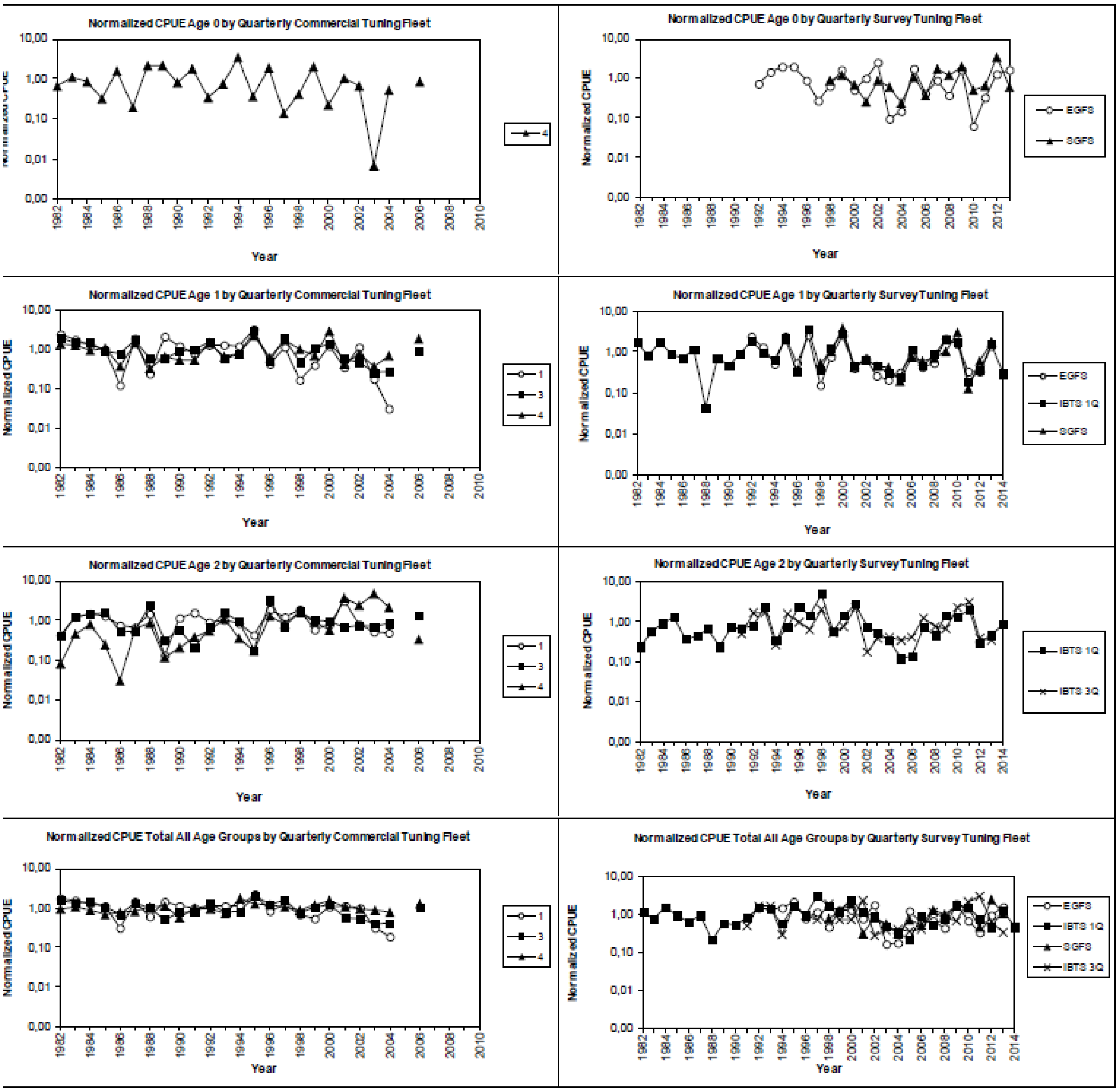


Figure 22. Trends in Catch per unit effort from the commercial fleets (left panels) and surveys (right panels for 0-group, age, age 2, and aggregate Norway pout in the North Sea. Taken from ICES 2012a-p Table 5.2.2. All lines standardized to a unit mean, to allow comparison of trends across ages of greatly differing abundance and vessels with different catchabilities.

Assessment Model

The SXSA (Seasonal Extended Survivors Analysis) has been the standard assessment method to estimate quarterly stock numbers (and fishing mortalities) for Norway pout in the North Sea since 2009. In-depth reviews of its performance relative to a multispecies model that would account for predation in the annual computations were conducted in a benchmark meeting in 2006 and reviewed again in 2009. The conclusion was that the quarterly estimates of population dynamics from SXSA were more appropriate as a basis for management advice on this largely seasonal fishery on a rapidly-growth species with high natural mortality than the annual dynamics of SMS. However, the natural mortality estimates input to SXSA come from the multispecies model to ensure that predation is accounted for the assessment. Aside from adjustments to the timing of when recruitment estimates are included in the population (end of Q2 or start of Q3, to accommodate the change in assessment year from January-December to July-June), most other aspects and settings in the assessment have been standard since the either the 2009 assessments, aside from input parameters in the assessment on natural mortality, maturity and mean weight (growth) at age, which were undated in the Inter-benchmark assessment in spring 2012 (ICES, 2012a-p Table 5.2.6).

The SXSA (Seasonal Extended Survivors Analysis, developed by Skagen (1993) is an analytical catch-at-age analysis based on quarterly catch and CPUE data. The assessment is considered appropriate to indicate trends in the stock and immediate changes in the stock because it computationally addresses the seasonality of all information sources: in the fishery catches, fishing effort, and the age specific commercial catchability of Norway pout, which changes enough during a year that it is more effectively treated with quarterly estimates; and in the fishery independent data sources, including survey-based information about recruitment strength. The assessment provides stock status and year class strengths of all year classes in the stock up to the first quarter of the assessment year (spring assessment) and second quarter of the assessment year (autumn assessment that updates the spring results and is the basis for management during the main months of fishing).

Tuning is performed over the period 1983 to present producing log residual ($\log(N_{hat}/N)$) stock numbers and survivor estimates by year, quarter, age and tuning fleet. The contributions from the various age groups to the survivor estimates by year and quarter and fleet are in the SXSA combined to an overall survivors estimate, s_{hat}, estimated as the geometric mean over years of $\log(s_{hat})$ weighted by the exponential of the inverse cumulated fishing mortality as described in Skagen (1993). Minimizing these seasonal log residuals by year, quarter, age, and fleet is comparable to the standard approach of minimizing the annual log residuals by year, age and fleet in the standard catch at age XSA analyses used widely in the ICES assessment community (ICES 2012a-p,b-p)

For each annual assessment the following parameters are specified:

Year range:	1983 – current year
Seasons per year:	4
The last season in the last year is season:	3
Youngest age:	0
Oldest true age:	3
Plus group:	4+ group in SXSA, none in the SMS
Recruitment occurs in season:	3
Spawning occurs in season:	1
Single species mode:	Yes, number of species = 1

These were accepted as an adequate basis for subsequent assessments after a thorough exploration of the performance of the modelling framework in the 2006 benchmark assessment and a full review in the 2012 inter-benchmark review (ICES 2012a-p).

The data sets used annually in the assessment include:

- Catch in numbers from monitoring the commercial fleet;
- Weight in catch from monitoring the commercial fleet;
- Weight in stock from the surveys augmented by commercial data in seasons without surveys;
- Natural mortalities from SMS runs;
- Maturity ogive from the benchmark assessment, updated by data from the commercial fleet;
- Tuning constraints from the benchmark assessment guidance;
- Weighting for r_{hats} (deviations of past recruitment estimates) from benchmark assessment.

Assessment Results

Results of the SXSA analysis are presented in Table 13 for population numbers at age 0 (recruitment), SSB TSB and fishing mortalities by year). The main summary statistics are also displayed graphically in Figure 22.

Fishing mortality has generally been lower than natural mortality and or the last decade has varied below the long term yearly average (0.6). This decline is observed in all quarters of the year. The effects of fishery closures or very low TACs are reflected in the correspondingly low fishing mortality in 2005, 2006, 2007, 2011 and in first part of 2012. Even in the years of higher fishing mortality the TACs have not been taken since the mid-1990s (Table 10). The low TAC of 6kt in 2011 was taken in second half year resulting in a very low F in 2011.

Spawning stock biomass (SSB) showed a multiyear decline from 2001 to 2005 (Figure 23, top panel) due to recruitment of a series of below average to poor year-classes (Figure 23, third panel), rebuilt to well above the long term average biomass by 2011 as recruitment returned to average or above average. Two very weak year-classes in 2010 and 2011 produced a second more rapid drop in SSB, but before the B_{pa} benchmark was passed recruitment improved somewhat, and the stock increased again. Although the stock was below the escapement minimum of 90,000 t in 2005, it recovered to well above the escapement target by 2007 and has been above B_{pa} since that time (i.e. the stock show full reproductive capacity). Throughout this period fishing mortality has followed a long term decline since the mid-1990s, with variations following rather than leading (and possibly contributing to) declines in recruitment and stock biomass (Figure 23, second panel).

Table 13. Standard ICES summary table of recruitment at age 0, Spawning stock biomass in Quarter 1, Total stock biomass in Quarter 3 (after recruitment is counted in the population estimate), and mean fishing mortality for ages 1 and 2. Taken from ICES 2014a-p Table 5.3.6.

Year	Recruits (age 0 3rd qrt)	SSB (Q1)	TSB (Q3)	Landings ('000 t)	Fbar(1-2)
1983	85174	69790	1457400	457,6	0,900
1984	46391	96167	899941	393,0	1,280
1985	31374	202261	479543	205,1	1,325
1986	62990	109759	504655	174,3	1,092
1987	16651	128758	467805	149,3	0,897
1988	49502	152249	399209	109,3	0,637
1989	53328	113080	555478	166,4	0,828
1990	47908	158509	527237	163,3	0,758
1991	92584	180673	744951	186,6	0,881
1992	39962	231914	812737	296,8	0,911
1993	28645	262727	488122	183,1	0,830
1994	117457	145877	697466	182,0	1,050
1995	36917	174692	933894	236,8	0,577
1996	89204	354405	805622	163,8	0,440
1997	24361	250131	840788	169,7	0,575
1998	34769	317234	496695	57,7	0,292
1999	85098	183176	680896	94,5	0,644
2000	28258	215901	823210	184,4	0,567
2001	26035	282965	465208	65,6	0,259
2002	17643	189702	362388	80,0	0,511
2003	7958	127679	227478	27,1	0,245
2004	10066	97796	161318	13,5	0,155
2005	39511	64674	270824	1,9	0,000
2006	19283	99382	419703	46,6	0,255
2007	31400	178732	383303	5,7	0,022
2008	60470	163172	574134	36,1	0,134
2009	80871	218885	885542	54,5	0,246
2010	10394	358122	821416	126,0	0,406
2011	16964	369220	402643	6,5	0,031
2012	64979	173367	487978	27,0	0,318
2013	25110	165199	646367	82,1	0,406
2014		273915			
Arit mean	**44.557**	**190.941**	**603.998**		**0,564**
Geomean	**35.960**				

Table 14. Annual ICES Advice on North Sea Norway pout, TAC set by management, and reported and estimated landings. Table from ICES(p) 2015 table 6.3.16.b1.

Year	ICES advice	Predicted catch corresp. to advice	TAC Norway	TAC EU[a)]	Official catch	ICES catch
1987	No advice	-	No TAC	200	215	147
1988	No advice	-	No TAC	200	187	102
1989	No advice	-	No TAC	200	276	167
1990	No advice	-	No TAC	200	212	140
1991	No advice	-	No TAC	200	223	155
1992	No advice	-	No TAC	200	335	255
1993	No advice	-	No TAC	220	241	176
1994	No advice	-	No TAC	220	214	176
1995	Can sustain current F	-	No TAC	180	289	181
1996	Can sustain current F; take bycatches into consid.	-	No TAC	220	197	122
1997	Can sustain current F; take bycatches into consid.	-	No TAC	220	155	133
1998	Can sustain current F; take bycatches into consid.	-	No TAC	220	72	62
1999	Can sustain current F; take bycatches into consid.	-	No TAC	220	93	85
2000	Can sustain current F; take bycatches into consid.	-	No TAC	220	182	175
2001	Can sustain current F; take bycatches into consid.	-	No TAC	211.2	63	57
2002	Can sustain current F; take bycatches into consid.	-	No TAC	198	93	74
2003	Can sustain current F; take bycatches into consid.	-	No TAC	198	24	21
2004	The stock is in risk of decreasing below B_{lim}	-	No TAC	198	16	14
2005	Fishery should be closed		Only bycatch	5	1	2
2006	Fishery closed until 4th August where a TAC of 95 000 t was set.		No TAC	95	54	47
2007	Fishery closed because SSB < B_{pa} in 2008.	0	Only bycatch	5	6	6
2008	F = 0.35 or 50 000 t for first half of 2008	<50 in 1st 6 months		41		
In-year[b)]	Maintain SSB > B_{pa}	< 148	80	114.616	39	36
2009	Reduce F to increase SSB > B_{pa}	< 35		28.3		
In-year[b)]	Maintain SSB > B_{pa}	< 157	128	116.279	55	56
2010	Maintain SSB > B_{pa}	< 307	86	76		
In-year[b)]	Maintain SSB > MSY $B_{escapement}$	< 434		162.95	137	126
2011	No directed fisheries	0				
In-year[b)]	Maintain SSB > MSY $B_{escapement}$	< 6	3	4.5	7	7
2012	No fisheries	0		0		
In-year[b)]	No fisheries	0			30	27
In-year[c)]	Maintain SSB > MSY $B_{escapement}$	< 101	25	70.683		
2013	Maintain SSB > MSY $B_{escapement}$	< 458($Catch_{12}$ = 0) < 393($Catch_{12}$ =101)	157	165.7	82	82
In-year[b)]	Maintain SSB > MSY $B_{escapement}$	< 457				
2014	Maintain SSB > MSY $B_{escapement}$	< 216	108	128.25		
In-year[b)]	Maintain SSB > MSY $B_{escapement}$	< 108	123			
2015	Precautionary considerations (F = 0.6)	< 326				

Weights in thousand tonnes.
a) Divisions IIa(EU) and IIIa, and Subarea IV(EU).
b) For Norway pout preliminary advice is given in autumn, while the in-year advice is given in June on the basis of the first surveys and catches in the TAC year.
c) Update of in-year advice in October 2012.

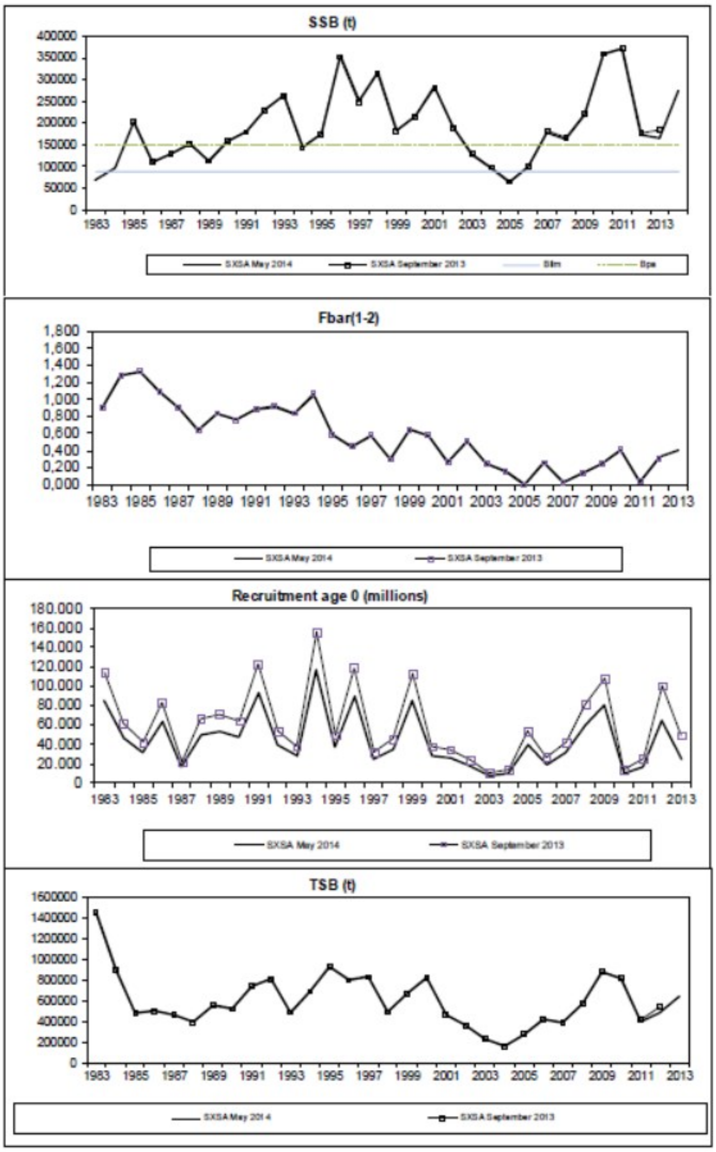


Figure 5.3.5 Norway pout IV and IIIaN (Skagerrak). Comparison of May 2014 SXSA with the September 2013 assessment based on the new benchmark baseline assessment SXSA May 2012 Scenario 2.

Figure 23. Data from Table 14, displayed graphically as time trends. Taken from ICES 2014a-p, Figure 5.3.5.

<u>Harvest advice</u>

Prior to an ICES review of MSY-based reference points and harvest control rules in 2014 (ICES 2014b-p), scientific advice on all small pelagic stocks in the North Sea had been provided using a minimum escapement limit and a target reference point estimated in a variety of ways since the early 1990s. The intent of the biomass escapement limit was to maintain the stock SSB at a level where recruitment would not be impaired. The 2012 intersessional benchmark assessment considered the performance of this strategy along with several alternative strategies including fixed F strategies, fixed effort strategies, combinations of minimum and maximum fixed TACs, and various mixed strategies. The review concluded that the escapement strategy would provide as high likelihood of maintaining the full productivity of the stock as any of the other strategies, and perform better than the fixed F strategies. Advice continues to report on harvests consistent with multiple strategies (Table 15), but the $B_{escapement}$ target continues to be the primary basis for management of the harvest (ICES 2012a-p, Section 5.5 and 5.10.1, ICES 2014a-p, Annex, Section E.1). Note if the $B_{escapement}$ strategy were applied without additional precautionary measures, the resultant F would be more than three time the size of any F in more than two decades.

Table 15. ICES(p) (2015) advice on 2015 fishery, based on 2014 fall assessment, and seven alternative possible harvest strategies.

Rationale	Catch 2015	Basis	F 2015	SSB 2016	%SSB change[1)]
Precautionary considerations	326	F = 0.6 (F ceiling in MSE 2013)	0.60	646	132
Escapement strategy	1071	MSY $B_{escapement}$ in 2016	3.83	150	−46
Zero catch	0	No fishery	0.00	872	214
Other options	100	Catch = 100 kt (TAC ceiling in MSE 2013)	0.16	802	188
	200	Catch = 200 kt (TAC ceiling in MSE 2013)	0.34	733	164
	219	F (2013)	0.38	720	159
	234	~Max F last decade	0.41	709	155
	412	F = 0.8 (F ceiling in MSE 2013)	0.80	587	111

Weights in thousand tonnes.
1) SSB 2016 relative to SSB 2015.

The numerical value of the escapement limit was originally set at 90,000 t based on examination of the scatter in the stock recruit data available in the early 1990s, and although periodic reconsiderations of the escapement limit have changed and strengthened the rational for the value, the limit itself had not changed. Likewise the target reference point was set at 150,000 based on the uncertainty in the assessment, and that value has been retained since it was set (ICES 2014a-p, Annex Section E.1)

During the MSY benchmark assessment review, the experts concluded that for at least North Sea sprat likely more generally for small pelagic species, only strategies applying an F limit control rule as well as a $B_{escapement}$ rule were found to be sustainable. These results were considered for North Sea Norway pout, but at this point no F_{cap} has been adopted.

The 2014 full assessment of the stock indicated SSB well above $B_{escapement}$ and increasing, and the 2015 estimate of the 2014 year-class being the largest in the entire series indicate that both SSB and Total stock biomass will continue to increase. Hence, although the medium and long term sustainability of the stock and fishery cannot be assured without a management plan and objectives, as well as control measures to deliver the specified outcome, the short term significant improvement in year class strengths means that the stock has full reproductive capacity. Although technically the summary concluded that fishing pressure is undefined for the stock, the estimates of average F remain low and are likely to further decrease with strong recruitment to the stock. Hence exploitation rate is likely to be appropriate and sustainable (Table 16), as 2015 TAC adopted by both Norway and the EU are only slightly over 150,000 t and not the catch of over a million t consistent with the $B_{escapement}$ strategy (Table 6).

Table 16. ICES summary of status and stock and harvests in 2015. Table form ICES(p) 2015, Text table at start of 6.3.16b.1

Stock status

Fishing pressure				
	2011	2012	2013	
MSY (F_{MSY})	?	?	?	Undefined
Precautionary approach (F_{pa}, F_{lim})	?	?	?	Undefined
Qualitative evaluation	↘	↗	↗	Below average
Stock size				
	2012	2013	2014	
MSY ($B_{escapement}$)	✓	✓	✓	Above trigger
Precautionary approach (B_{pa}, B_{lim})	✓	✓	✓	Full reproductive capacity

Sprat

General Considerations

The North Sea sprat (hence “sprat”) stock complex subject to certification assessment comprises a large suite of possible population units. A review in 2009 (ICES(sp) 2009) concluded that although not fully panmictic throughout the North Sea, there is insufficient evidence to justify differentiating the sprat into specific substocks at this time. It is, however, differentiated from stocks of sprat in the English Channel, Baltic Sea, Celtic Sea and more southerly stocks. Management advice for the sprat in the Skagerrak and Kattegat (IIIa) is provided separately from advice on the North Sea sprat because of differences in catch composition of the fishery (ICES(sp) 2009, 2014a-sp), and sprat in those fisheries is not considered in this certification assessment.

Sprat are harvested primarily with pelagic trawls, typically with a mixture of juvenile herring bycatch. In years of strong year-classes of North Sea herring, the herring bycatch caps may limit the harvest of sprat before the sprat TAC is taken (ICES 2015a-sp). A Norwegian fishery using purse seines also harvests sprat in the North Sea, and is regulated by the Norwegian government.

Sprat are broadly distributed throughout the North Sea with the largest concentrations found in the southern and central portions. To the west and south the range extends along the coast of Europe, and to the east the IIIA stock component abuts with a separate stock in the Baltic sea. Commercial catches are concentrated in the southern half of the North Sea. There is inter-annual variation in how the catch is distributed in the southern and central North Sea, but with greater harvests in the eastern than western portion of this area in most years over the past two decades. Figure 24 shows the geographic pattern of catches between 1999 and 2014. Catches in earlier years have a similar geographic distribution and are presented in ICES 2015a-sp Figure 4.7.1.

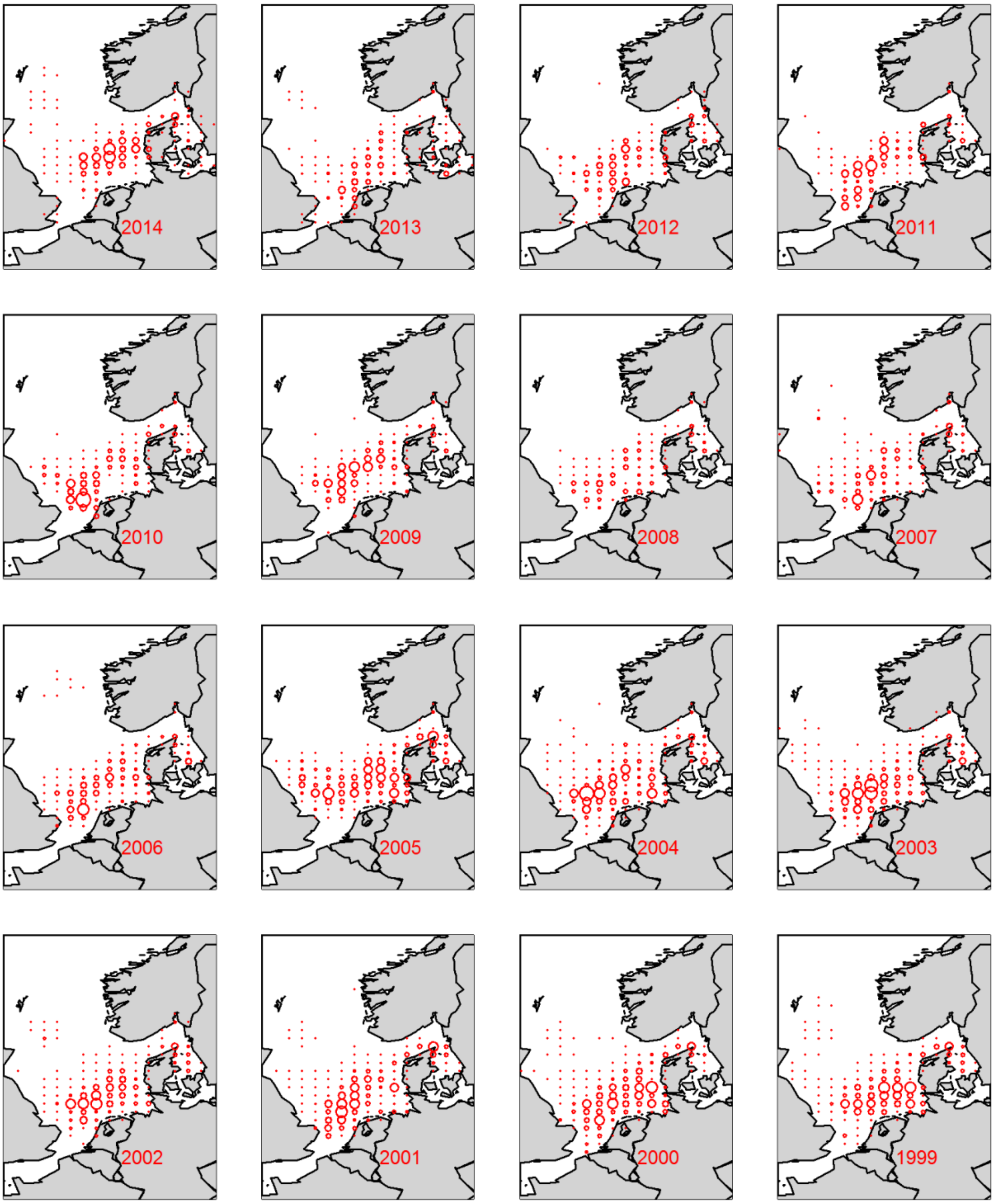


Figure 24. Distribution of annual commercial catches by statistical rectangle in Division IV and IIIa. Period from 1999 to 2014. Diameter of bubbles scales with the square root of the catch. (calendar year). Taken from Figure 8.1.3 in ICES 2015a-sp.

Sprat show large variations in year-class strength, with the strongest year-classes since 1990 approximately 12-fold larger than the weakest (Table 17). Even weaker year-classes are reported from before 1990, but commercial data from the earlier periods are considered unreliable and assessment estimates for those years may not be directly comparable to more recent estimates. With sprat having a relatively short life span, the variation in year-class strengths is carried over into total and spawning biomass, again with more than 12-fold difference between the largest and smaller biomasses over the past 25 year (Table 17).

Particularly in years of high sprat biomass, however, they may represent an important portion of the prey base for piscivorous predators in the North Sea (see section 3.2).

The variation in year-class strength may be amplified to some extent in the population biomass, because there have been several cases of multi-year runs of weak or strong year-classes. The benchmark assessment in 2013 examined these runs in detail, to see if environmental signals could be informative for science advice and management. The benchmark assessment did not report evidence of direct effects of physical oceanography on sprat recruitment. However, such evidence is available for at least Baltic Sea sprat, from GLOBEC studies there (Margonski et al 2010, Peck et al 2012, Voss et al 2012), and the general processes are thought to influence North Sea Sprat as well (Peck et al. 2012). Rather, both the above-cited papers and the Benchmark assessment focused on evidence of strong bottom-up trophodynamic drivers of productivity, that indirectly transferred oceanographic conditions into recruitment variation. In particular, as sprat is a planktivorous fish, the expert group concluded there was a likely decrease in carrying capacity for species that selectively feed on large copepods, and a possible increase in carrying capacity for species that feed preferentially on small plankton. Sprat were concluded to fall into this latter category, seeming to prefer the smaller *Temora* to *Calanus* (Pliru et al., 2012; Pinnegar, 2011; Kleinertz et al., 2012, ICES 2014a-sp). Consequently an increase in productivity may be possible, and may continue under most climate change scenarios, given the well-documented changes in zooplankton communities in the North Sea, as smaller zooplankton replace large copepods which prefer cooler water (Beaugrand et al., 2002; Drinkwater et al., 2003; Reid et al., 1998, 2001). This explanation would make detailed accounting of variability in historical recruitment of North Sea sprat require extensive data on the plankton community, and require detailed new analyses. However, it implies that variation in year-class strength in future will continue to be large, but on average some strengthening of recruitment may be expected (ICES 2014a-sp).

Whether driven directly by physical oceanographic conditions or mediated by bottom up and even top-down processes, these environmental influences on year-class strength mean that the stock-recruit plots have large scatter (Figure 25). This scatter, in turn, affects the ability to resolve the degree of dependence of recruitment on spawning biomass, and to fit a stock recruit curve. With the stock-recruit curve poorly constrained by the data, the ability to anchor biologically based reference points for the stock is also weak (ICES 2014a-sp, Section 4.7).

Table 17. Estimated recruitment, total stock biomass (TBS), spawning stock biomass (SSB), landings weight (Yield) and average fishing mortality. All estimates are for July – June. For example 2012 refers to the model year 2012/2013. Taken from Table 8.6.5 ICES 2015a-sp).

Year	Recruits	TSB	SSB	Yield	Mean F
	(million)	(tonnes)	(tonnes)	(tonnes)	ages 1-2
1974	277672	3043580	493675	379747	0.834
1975	462121	4100360	473609	637282	2.027
1976	206206	1334300	300856	557359	1.045
1977	255411	2162540	293821	318769	1.544
1978	239834	1480490	153745	378632	1.636
1979	206574	1814630	161617	368667	1.322
1980	269770	2211270	153510	300239	1.285
1981	98745	1013130	154754	203897	1.326
1982	67207	597237	69179	123379	0.670
1983	78053	791359	73648	85168	1.337
1984	43968	469030	64943	85617	0.884
1985	28772	270026	36475	40922	1.275
1986	167353	1212910	13955	15687	0.478
1987	138381	1173980	83078	37551	0.264
1988	247341	1909550	81594	95972	0.239
1989	112010	852110	109308	51943	0.083
1990	136817	1119690	88114	67386	1.714
1991	209840	2917290	112610	114872	0.681
1992	231657	2234490	144104	148236	0.743
1993	228422	2086690	220851	209193	1.499
1994	112258	1133630	56683	313687	1.098
1995	71099	518420	165482	387626	1.283
1996	108094	975471	129996	84573	0.561
1997	142098	1583470	253825	104797	0.545
1998	161010	1455410	256582	172063	1.143
1999	115649	1215170	197045	215412	0.658
2000	105839	1374690	227366	195170	0.836
2001	102773	1072300	107056	131538	1.330
2002	122101	1143940	155833	157248	1.432
2003	119246	1174680	71115	159515	1.032
2004	231829	2318620	173429	207779	1.803
2005	78553	1012100	143612	232048	0.929
2006	114414	1111740	133207	74648	0.998
2007	79439	947283	255703	85080	1.412
2008	164387	1604520	128603	63623	0.847
2009	115021	1203960	173037	162714	0.826
2010	169134	1448800	215236	126077	0.590

2011	179800	1258060	206881	119083	0.627
2012	136757	1404750	93658	86196	0.623
2013	313422	2163210	142489	81268	0.259
2014	839739	7582100	360294	167812	0.646
2015			662653		

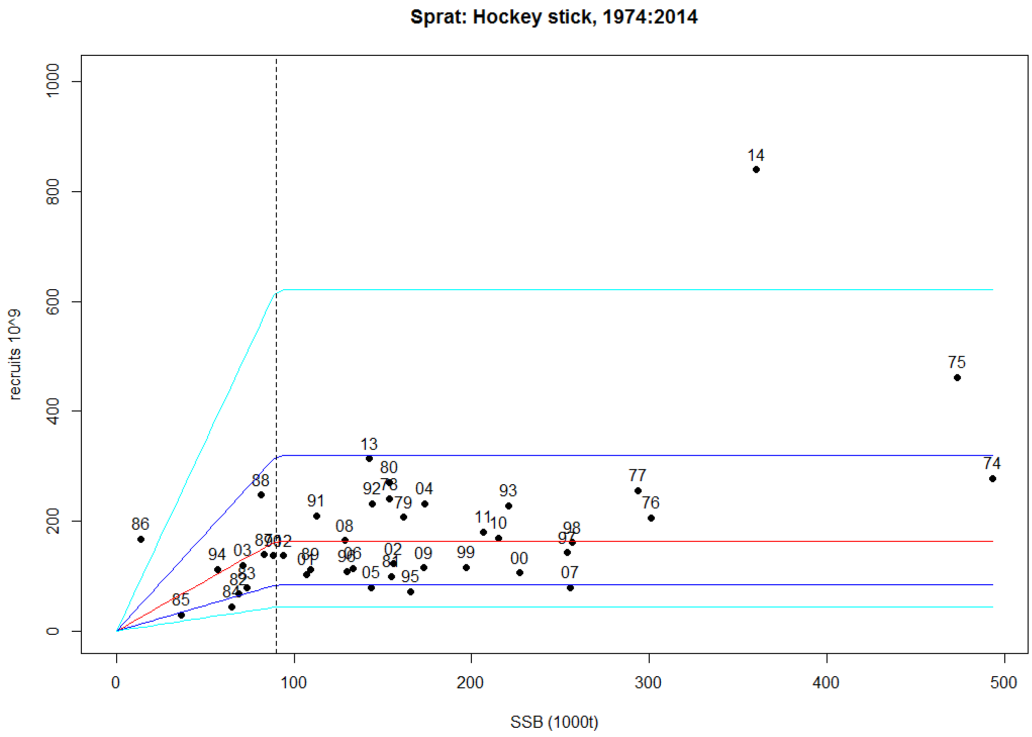


Figure 25. Stock-recruitment relationship (years and age refer to the model year. For example 2012 refers to the model year July 2012 to June 2013). Taken from figure 8.6.1 of ICES 2015a-sp.

Growth rates are variable over time (Figure 26). Although models indicate that environmental factors are expected to affect growth of sprat (Frisk 2015), efforts to disentangle contribution of direct oceanographic and more indirect trophodynamic factors on variation in length or weight at age have made limited progress (Daewal et al. 2008). Not only are the drivers confounded to varying degrees with each other, but sampling is hard to standardize to the biological year (i.e., relative to events like timing of spring bloom rather than just calendar date). Although there is a long term trend slightly downward for weights at age 1 and to a lesser extent age 2, these trends are not seen in ages 3 and older (Figure 26, ICES 2015a-sp). Nor has there been a systematic attempt to link details of inter-annual variation in growth parameters to specific oceanographic or trophic drivers.

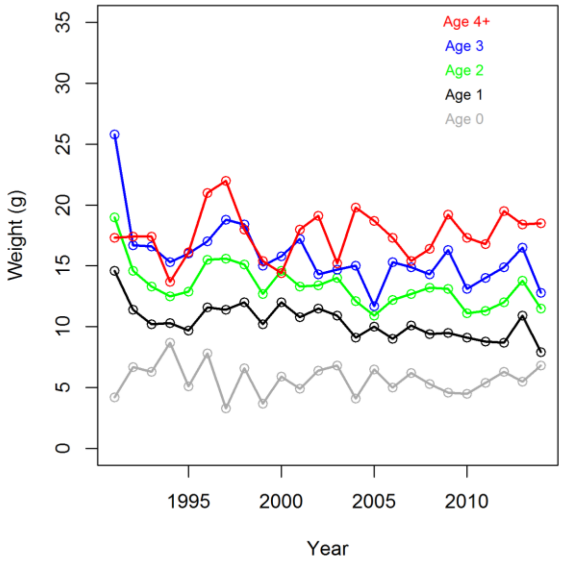


Figure 26. Mean weight at age since 1990, in quarter 4 of each calendar year. From Figure 8.6.2 of ICES 2015a-sp.

Maturation of sprat begins at age 1 and by age 2 over 80% of sprat were mature (Figure 27). As a short-lived species, maturation proceeds through the year, and intermediate stages of maturity are hard to discriminate (ICES 2014a-sp). Consequently the maturation at age values are approximate, with the percentage mature at age typically lower early in the calendar year and higher later in the year. Pattern of maturation was examined in an expert workshop (ICES 2014a-sp), and it was concluded that maturity of 0.9 for age 2 sprat was the most appropriate value for use in assessments. .

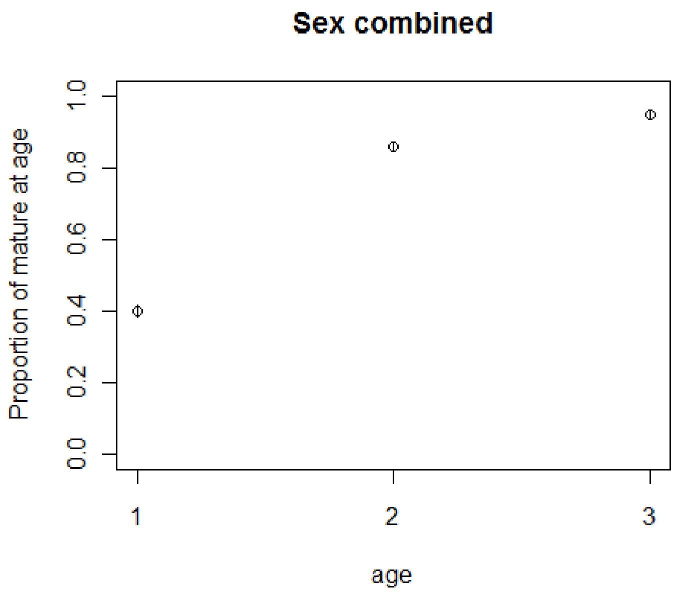


Figure 27. Percent mature at age from the Quarter 1 IBTS survey data. Figure from figure 4.6.4 of ICES 2014a-sp.

Sprat in the North Sea has a prolonged spawning season ranging from early spring to late autumn, with the main season in April–June (ICES 2015a-sp). Spawning is widespread through the southern and central North Sea and occurs across a broad range of depths, but with eggs released largely in the water column at depths less than 100 m from the surface. From there transport processes play a role in dispersion of eggs and larvae (deSilva 1973, Baumann et al. 2006).

Natural mortality is high, with predation playing a large role at all ages. Estimates of natural mortality at age by quarter and year are available from multispecies assessment models (ICES(sp) 2011, 2012, 2014b-sp). They are never lower than 0.1 even on the oldest ages, and exceed 0.8 for some years on 0-group sprat (Table 18)

Table 18. Frequency of occurrence of estimates of natural mortality (m) by age frm 1990-2014. Summarized from table 8.6.2. in ICES 2015a-sp.

Range of m	Age 0	Age 1	Age 2	Age 3
0.0-0.2	5	30	43	71
0.2-0.4	46	52	53	27
0.4-0.6	24	16	3	0
0.6-0.8+	20	0	0	0
0.8+	3	0	0	0

.

The diet of sprat has been studied in several research projects. A few of these were form the North Sea (DaSilva 1973b, Last 1987; Heath 2005, Kleinertz et al. 2012, Raab et al. 2012) and results from the adjacent Baltic, Celtic and Irish Sea provide similar results (Coombs et al. 1992, Casini et al. 2004, ICES 2014a-sp). Its diet is exclusively planktivorous at all ages. It eats a variety of zooplankton, selecting for the smaller zooplankton in community, with the lipid-rich larger *Calanus* and related species not well represented in the diet. In addition, in some places and years sprat can feed heavily on eggs of other species of fish (Pliru et al. 2012).

Assessment methods

The information on the sprat assessment methods and stock status is taken from ICES 2014a-sp, 2014b-sp, and 2015a-sp and 2015b-sp, with some reference to prior ICES assessments. Consistent with ICES practice, the sprat benchmark assessment meeting investigated many aspects of the assessment data and methods in depth, agreeing treatments of data and analytical methods that become the standard practice for annual assessments until the next benchmark meeting. New information can be considered and assimilated as appropriate into assessments at any time, but the entire framework is only reviewed at the benchmark assessments usually held every five years (ICES 2014a-sp, Section 2)

<u>Key Data Sets</u>

The main sources of data used in the assessment are the annual multispecies IBTS trawl surveys of the North Sea in quarters 1 and 3, the annual hydroacoustic survey in July for herring but also quantifying sprat (ICES 2014a-sp, Section 4.5.2) and quantification and sampling of commercial catches (ICES 2014a, Section 4,4) These surveys cover depth the full depth range of sprat in the North Sea, as well as the full distribution of the stock.

The estimated quarterly landings at age in numbers are available for the Danish fishery for the period 1974—2014, and form both Danish and Norwegian fisheries since 2002 (Table 19 for data since 2002). As there are very few 5+-year olds in the catches, ages 4 and 5+ were joined in a 4+ group and mean weight at age of this group estimated as the weighted average of mean weights of the two groups. In 2014 the one-year old sprat contributed 73% of the total landings, which is similar to 2013 (70%) and above the average contribution (60% since 1996, range: 27—94%). Sampling of commercial catches is stratified by month and statistical rectangle, and generally proportionate to catch levels (ICES 2014a-sp Section 4.5.1.4).

Table 19. Quarterly catch at age of North Sea sprat, from ICES 2015a-sp, Table 8.2.2).

Year	Quarter	Age-0	Age-1	Age-2	Age-3	Age-4
2002	Q1	0	323,605	70,070	13,307	791
	Q2	0	23,206	5,025	954	57
	Q3	72,234	6,240,286	393,859	40,131	3,446
	Q4	480,139	4,192,059	902,086	193,376	10,170
2003	Q1	0	1,595,254	1,150,283	106,446	3,660
	Q2	0	67,395	38,384	3,408	121
	Q3	0	3,773,602	536,016	39,557	13,331
	Q4	411,438	7,597,795	1,040,850	47,583	30,233
2004	Q1	0	132,197	22,821	1,347	76
	Q2	0	29,872	5,157	304	17
	Q3	330,650	3,616,036	790,575	46,831	3,599
	Q4	21,362,903	4,845,166	372,609	33,761	1,849
2005	Q1	0	3,214,471	218,695	9,249	305
	Q2	0	690,733	41,135	1,703	54
	Q3	0	12,371,678	222,757	34,807	1,169
	Q4	905,687	7,636,106	193,874	15,025	595
2006	Q1	0	675,765	5,164,658	136,240	5,908
	Q2	0	11,341	59,145	1,469	65
	Q3	0	2,354,139	1,164,248	196,933	3,705
	Q4	0	1,589,716	922,747	98,174	2,439
2007	Q1	0	188,409	112,126	21,465	1,057
	Q2	0	12,611	7,505	1,437	71
	Q3	0	791,996	370,110	83,329	3,360
	Q4	570,769	3,607,022	1,587,098	207,134	16,190
2008	Q1	0	275,013	212,650	8,983	1,280
	Q2	0	4,661	3,355	217	36
	Q3	11,226	374,967	1,350,863	273,722	23,195
	Q4	471,069	1,457,841	1,154,410	243,032	40,973

2009	Q1	0	274,316	32,208	1,962	129
	Q2	0	302,545	35,522	2,163	143
	Q3	0	4,428,777	185,438	18,651	853
	Q4	221,908	7,851,426	562,588	93,691	4,255
2010	Q1	0	43,328	3,230,747	475,426	71,299
	Q2	0	6,548	342,686	39,999	8,396
	Q3	12,808	1,429,681	433,709	7,880	1,438
	Q4	344,087	3,395,699	3,034,682	825,848	970,833
2011	Q1	0	190,971	1,981,930	704,501	91,150
	Q2	0	90,971	174,916	55,063	6,773
	Q3	2,669	1,410,307	959,871	206,730	28,765
	Q4	366,915	4,094,960	2,652,433	752,025	214,962
2012	Q1	0	101,747	41,459	5,929	697
	Q2	0	191,599	78,071	11,165	1,313
	Q3	16,927	2,207,305	609,219	68,208	16,287
	Q4	111,565	3,503,253	1,603,395	239,132	17,808
2013	Q1	0	118,913	500,345	54,490	4,178
	Q2	0	902	3,798	474	40
	Q3	25,538	2,263,365	330,826	58,469	9,576
	Q4	401,216	2,382,055	507,642	154,932	59,316
2014	Q1	0	7,600	516	66	64
	Q2	0	1,497,692	101,690	13,015	12,598
	Q3	2,123,129	8,292,983	608,778	56,122	50,202
	Q4	1,523,128	3,754,357	323,800	73,041	22,923

Sprat abundance in the Quarter 1 IBTS surveys are available from 1974 to 2014, and from Quarter 3 since 1991. Abundance indices in both surveys are stratified means of catches by set within each ICES statistical rectangle. The time series show substantial variation over time, with the age 1 in the 2015 Q1 survey being the highest on record. However, there are no consistent multiyear trends in the abundance indices from either survey time series. The large variation but lack of strong multi-year trends suggest the dominant signals in the survey are passage of strong or weak year classes through the population, and not depletions or rebuilding of the stock due to fishing mortality (Table 20 and Table 21).

The annual July herring hydroacoustic survey estimated of sprat abundance and biomass are presented in Table 22. In the early years of this survey, coverage of the total range of sprat in the North Sea was incomplete, with coverage expanding from 2000 to 2004, after which it has stabilized. This the assessment model only uses data since 2004 in estimating the development of the population over time.

Table 20. Abundance indices by age from IBTS Q1 from 1972-2015 as calculated by the stratified method Taken from table 8.3.1 ICES 2015a-sp.

Year	Age				
	1	2	3	4+	Total
1972	467.25	531.95	53.80	6.81	1,059.81
1973	255.91	206.75	26.07	0.16	488.90
1974	1,178.64	2,008.10	257.81	76.02	3,520.56
1975	96.65	1,567.44	747.15	22.84	2,434.08
1976	863.93	433.09	192.26	3.09	1,492.38
1977	141.86	2,559.19	230.25	19.74	2,951.04
1978	987.54	486.59	227.12	6.96	1,708.21
1979	429.51	212.18	150.98	5.49	798.15
1980	336.85	849.58	31.61	2.85	1,220.89
1981	624.72	817.55	144.51	9.31	1,596.08
1982	119.84	311.95	80.45	3.69	515.94
1983	143.00	453.27	127.60	7.89	731.75
1984	233.76	329.00	39.61	6.49	608.86
1985	376.10	195.48	26.76	4.16	602.49
1986	44.19	73.54	22.01	1.48	141.21
1987	542.24	66.28	19.14	2.16	629.82
1988	98.61	884.07	61.80	6.99	1,051.46
1989	2,314.22	476.29	271.85	7.12	3,069.48
1990	234.94	451.98	102.16	30.28	819.37
1991	676.78	93.38	23.33	2.75	796.24
1992	1,060.78	297.69	43.25	7.77	1,409.48
1993	1,066.83	568.53	118.42	6.41	1,760.19
1994	2,428.36	938.16	92.16	4.10	3,462.77
1995	1,224.89	1,036.40	87.33	3.28	2,351.90
1996	186.13	383.53	146.84	19.03	735.53
1997	591.86	411.96	179.54	17.77	1,201.13
1998	1,171.05	1,456.51	305.91	19.13	2,952.60
1999	2,534.53	562.10	80.35	5.27	3,182.25
2000	1,058.01	860.09	278.32	45.18	2,241.61
2001	883.06	1,057.04	185.54	17.90	2,143.53
2002	896.13	642.52	69.76	8.26	1,616.66
2003	1,818.25	344.39	33.60	2.68	2,198.92
2004	1,593.78	495.63	78.23	5.03	2,172.67
2005	3,059.03	269.39	36.47	0.87	3,365.77
2006	426.01	1,174.00	93.78	5.08	1,698.86
2007	1,053.59	1,341.38	275.18	11.19	2,681.33
2008	1,427.99	766.97	96.68	6.85	2,298.49
2009	3,140.10	451.31	25.53	2.77	3,619.72
2010	2,101.85	1,736.00	156.14	25.48	4,019.48
2011	646.57	966.59	734.01	132.34	2,479.50
2012	2,481.94	1,995.87	429.47	30.58	4,937.86
2013	709.56	1,303.67	453.65	59.46	2,526.34
2014	2,963.62	1,029.25	230.15	29.67	4,252.70
2015*	3,218.27	2,912.03	479.29	32.44	6,642.03

Table 21. Abundance indices by age from IBTS Q3 from 1972-2015 as calculated by the stratified method Taken from table 8.3.3, ICES 2015a-sp.

Year	Age					
	0	1	2	3	4+	Total
1991	0.00	196.33	78.74	32.50	0.45	308.02
1992	20.36	2,430.01	2,024.16	120.25	21.31	4,616.09
1993	7.46	1,423.79	1,540.57	317.35	13.41	3,302.58
1994	3.49	2,441.07	333.21	80.24	7.05	2,865.05
1995	0.00	729.86	2,067.47	1,064.51	12.82	3,874.66
1996	1.51	310.54	734.58	315.55	44.04	1,406.23
1997	15.70	4,527.79	1,278.58	237.42	28.24	6,087.72
1998	193.63	2,020.65	1,122.15	146.22	4.82	3,487.46
1999	1,754.76	7,982.21	918.38	61.66	0.12	10,717.12
2000	27.96	2,535.90	1,561.27	42.31	3.29	4,170.73
2001	51.83	2,310.04	1,495.48	116.37	0.75	3,974.47
2002	103.68	4,248.45	1,153.75	112.07	11.60	5,629.54
2003	11.07	1,619.47	303.27	13.41	0.54	1,947.76
2004	4,279.64	3,061.32	840.65	106.76	2.16	8,290.54
2005	0.64	8,273.86	438.34	64.28	25.89	8,803.00
2006	0.05	1,446.66	1,913.58	85.74	2.41	3,448.43
2007	42.73	1,435.51	1,122.14	223.09	4.55	2,828.01
2008	95.18	1,806.34	977.72	123.95	2.89	3,006.09
2009	496.67	9,424.91	2,186.34	262.98	8.74	12,379.64
2010	19.32	3,967.83	3,076.58	179.98	3.67	7,247.38
2011	3.44	10,660.13	3,788.89	1,052.66	63.67	15,568.79
2012	0.06	2,761.31	2,896.50	416.86	31.88	6,106.61
2013	0.04	3,508.33	3,143.59	359.82	46.85	7,058.64
2014	870.06	10,316.05	1,741.91	72.06	1.12	13,001.20

Table 22. Time-series of sprat abundance and biomass (biomass obtained from summer North Sea acoustic survey. The surveyed area has increased over the years. Only figures from 2004 and onwards are broadly comparable. Table from table 8.3.2, ICES 2015a-sp.

Abundance (million)						Biomass (1000 tonnes)				
Year/Age	0	1	2	3+	sum	0	1	2	3+	sum
2000	0	11,569	6,407	180	18,156	0	100	92	3	196
2001	0	12,639	1,812	110	14,561	0	97	24	2	122
2002	0	15,769	3,687	207	19,664	0	167	55	4	226
2003*	0	25,294	3,983	338	29,615	0	198	61	6	266
2004*	17,401	28,940	5,312	367	52,019	19	267	73	6	366
2005*	0	69,798	2,526	350	72,674	0	475	33	6	513
2006*	0	21,862	19,916	760	42,537	0	159	265	12	436
2007	0	37,250	5,513	1,869	44,631	0	258	66	29	353
2008	0	17,165	7,410	549	25,125	0	161	101	9	271
2009	0	47,520	16,488	1,183	65,191	0	346	189	21	556
2010	1,991	19,492	13,743	798	36,023	22	163	177	14	376
2011	0	26,536	13,660	2,430	42,625	0	212	188	44	444
2012	7,807	21,912	12,541	3,205	45,466	27	177	150	55	409
2013	454	9,332	6,273	1,600	17,660	2	71	74	25	172
2014	5,828	58,405	20,164	3,823	88,219	9	429	228	62	728

Variances associated with the survey estimates are not presented in the annual assessments. However the very course consistency among the three fishery-independent surveys can be seen in Figure 28. Full consistency is not expected since these surveys occur in difference quarters, and the variance among them contributes to the overall uncertainty in the assessment estimates of population parameters.

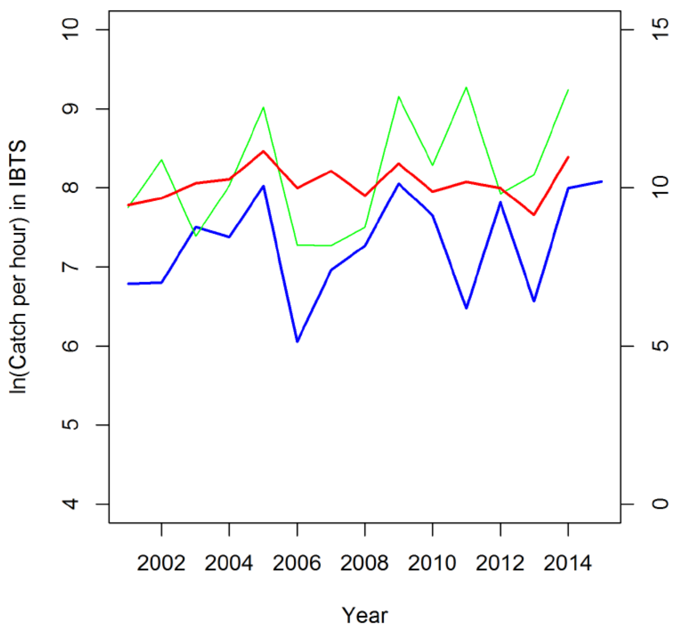


Figure 28. Estimates of numbers of age 1 sprat in the North Sea from the IBTS Q1 survey (blue), IBTS Q3 survey (green) and the July hydroacoustic survey (red). Taken from ICES 2015a-sp, Figure 8.3.3.

During the 2014 benchmark assessment, all these sources of data were evaluated for quality and consistency across their respective time series, and for appropriateness for inclusion in the analytic assessments. Factors related to identification of species and length composition of sprat in the commercial and survey catches were evaluated as being unbiased. However, age reading was consider to have no bias in coverage, but potential bias in the actual otolith reading due to a lack of calibration exercises among different laboratories since the early 2000s. Estimates of age-specific maturation rated were also considered unbiased with regard to sampling methods and evaluation protocols, but the extended maturation and spawning period of sprat was considered to introduce a potential bias in estimates due to difficulty in covering the full range of spawning times and places simultaneously. These potential biases are taken into account in the assessment methodologies used (see next section), but are not considered serious enough to degrade the quality of an assessment of an inherently short-lived species (ICES 2014a-sp, Section 4.3 and scorecard therein).

Assessment Model

The assessment was made using SMS (Lewy and Vinther 2004) with quarterly time steps. Details of the computations in SMS are discussed under Principle 2, where their treatment of multispecies interactions is explained, as well as the fitting methods to the data. Three surveys were included, IBTS Q1 ages 1-4+, IBTS Q3 ages 1-3 and HERAS (Q3) ages 1-3. 0-group sprat is unlikely to be fully recruited to the GOV (IBTS) or HE-RAS in Q3 and this age group was excluded from runs. SMS was reviewed at the Benchmark assessment meeting, and it was found to provide the best performance of the alternative assessment methods considers. The comparison among methods considered both appropriateness of the assumptions of the model to the life history and fisheries of sprat, goodness of fit to the available data sets, and robustness to a range of scenarios based on alternative assumptions about the population dynamics of North Sea sprat and the data sets used in the assessment.

The variable settings and assumptions considered in the benchmark review included:

- Seasonal time steps
- Age range to be fit in the various data sets
- Coefficients of variation of input data from the surveys and catches
- Weighting of th various data sets in estimation of goodness of fit
- Relative coefficients of variation of model estimates relative to catch data, survey data and stock-recruit function
- Year and ages for estimating seasonal pattern of exploitation

These were considered to be a thorough exploration of the performance of the modelling framework, and an adequate basis for accepting SMS settings for subsequent assessments. Details of these tests of the model are reported in ICES 2014a-sp, Section 4.

The model assessment year goes from 1 July to 30 June, to better reflect the sprat life history, particularly recruitment and maturation, and the temporal pattern of fishery operations.. Hence, 2000 season 1 refers to 2000 quarter 3, 2000 season 2 refers to 2000 quarter 4, 2000 season 3 refers to 2001 quarter 1 and 2000 season 4 refers to 2001 quarter 2. SSB and recruitment was estimated at July 1st. In the tables in this certification assessment, “quarter” always refers to the calendar year quarter (i.e. Q1 is January to March), and if the SMS assessment season is referenced, it is called “season” and not “quarter”.

Assessment Results

In the 2015 assessment, performance of the analytical model was considered acceptable, even though the estimate of incoming recruitment was far outside any recent reference data. Statistical convergence in model fit was found and catches of the main ages/months caught in the fishery were fit reasonably well (ages 1-2, seasons 1 and 2). The CVs of fits to the

survey data were generally low, with the CV of fit to IBTS Q3 somewhat higher. There were no obvious patterns in the residuals, apart from a series of strong negative residuals of the youngest age in IBTS Q1 in the years 1974 to 1982 . All the details of model fit are presented in section 8.6 for ICES 2015a-sp, and associated figures and tables).
The trends in the key population indicators – Spawning biomass, fishing mortality and recruitment, are presented in Figure 29.

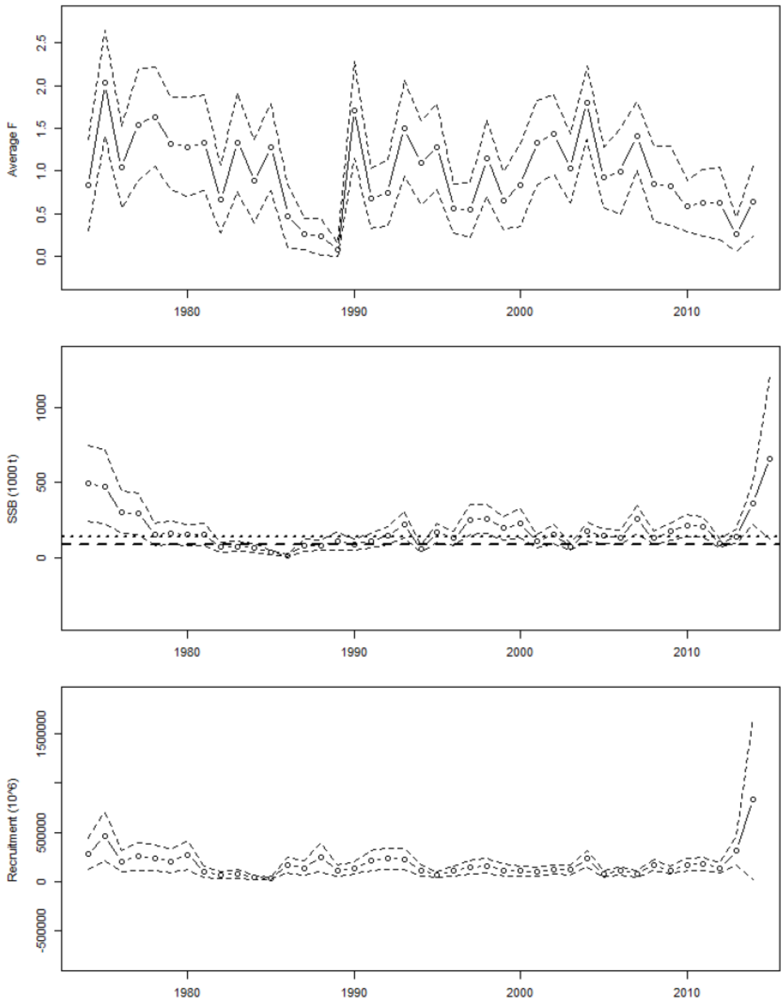


Figure 29. Assessment estimates of fishing mortality (panel a), spawning biomass (b) and recruitment (c) from the 2015 assessment of North Sea sprat, with 95% confidence intervals (From ICES 2015a-sp, Figure 8.6.7).

The striking pattern from this figure is the unprecedented strength of the 2014 year-class of sprat, and its effect on SSB as it begins to mature in 2015. Until 2014 the stock SSB had been varying around or even below its biological target reference point (panel b) with increases in SSB following each increase in recruitment, and subsequently declining as the strong year classes quickly passed through the population. There is no basis to judge if the exceptional recent recruitment will move the stock to a new and higher productivity, or if this year-class, too, will pass through the population and SSB will return to historical levels. However, for the next few years SSB is expected to be well above levels seen in recent decades, although the uncertainty in SSB is also larger than in the historical series (Figure 30).

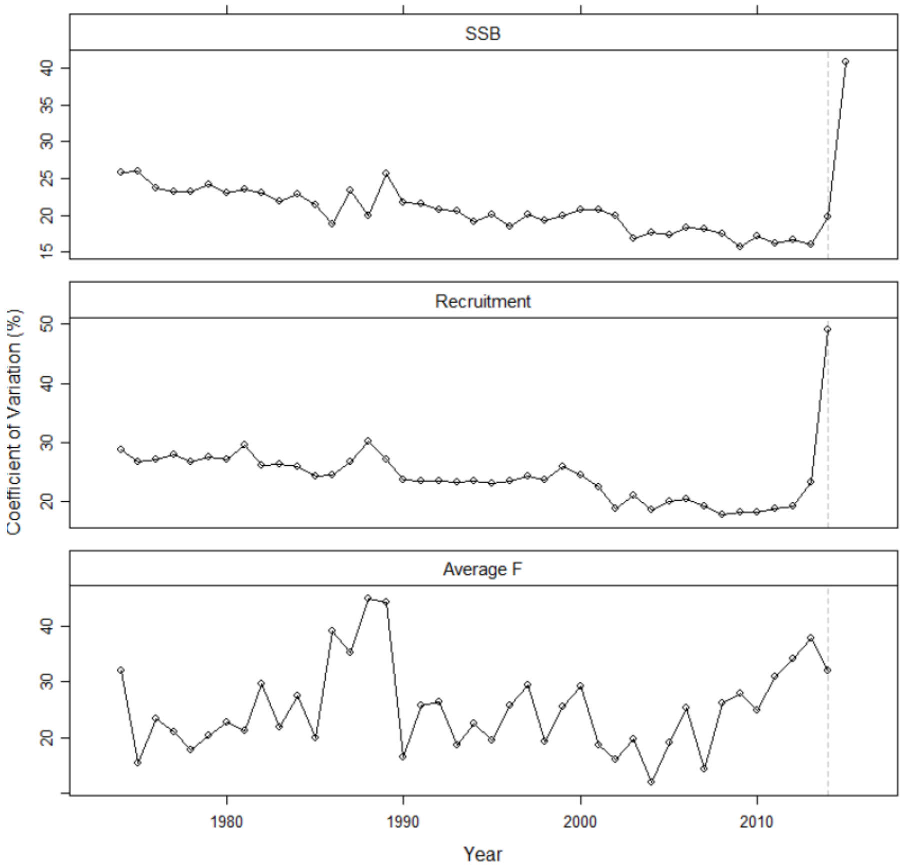


Figure 30. Coefficients of Variation in key population parameters of North Sea sprat. From ICES 2015a-sp, Figure 8.6.3.

Harvest advice

Prior to an ICES review of MSY-based reference points and harvest control rules in 2014 (ICES 2014c-sp), scientific advice on North Sea sprat had been provided using a minimum escapement limit and a target reference point estimated in a variety of ways since the early 1990s. The intent of the biomass escapement limit was to maintain the stock SSB at a level where recruitment would not be impaired. The numerical value of this limit was originally set at 90,000 t based on examination of the scatter in the stock recruit data available in the early 1990s, and although periodic reconsiderations of the escapement limit have changed and strengthened the rational for the value, the limit itself had not changed. Likewise the target reference point was set at 142,000 based on the uncertainty in the assessment, and that value has been retained since it was set (ICES 2014c-sp, Annex I)

During the MSY benchmark assessment review, six different management strategies were evaluated for North Sea sprat. The strategies used only a biomass limit control, only an F control, and various combinations of both controls, using both relative and absolute levels of SSB and/or F limits and targets.

Using simulations accounting for a wide range of uncertainties in data quality, stock dynamics, and fishing patterns, strategies and triggers for application of the controls were sought that had at least a 95% probability of maintaining the stock above B_{lim}, which was taken to be the minimum escapement goal. The review concluded that for North Sea Sprat, and likely more generally for small pelagic species, only strategies applying an F limit control rule were found to be sustainable. Neither the Fixed Escapement-strategy, where the spawning stock is fished down to B_{pa} every year, nor the constant F_{MSY} were sustainable.

Consequently, in order to make the Escapement-strategy sustainable, it must be applied with an upper limit on the fishing mortality. The simulations indicated that optimal control rules for this strategy was an F_{cap} of around 1.2, combined with the existing escapement goal to ensure exploitation progressively decreased as SSBs approached their biomass reference points. Details of these simulations are presented in Annex 1 of ICES 2014c-sp, but take into account a wide range of uncertainties, including about the dependence of recruitment on SSB, and the level of natural mortality on the stock (Table 23).

Table 23. Range of uncertainties considered in the evaluation of robustness of the harvest strategies for North Sea sprat. Table from Table 4 in ICES 2014c-sp.

Description	Change implemented
Variable natural mortality	0.16 (standard deviation)
High natural mortality	20% higher
Higher inflexion point	20% higher
Later maturation	20% fewer are mature at age 1 and 2
Earlier maturation	20% more are mature at age 1 and 2
Shifted from a Hockey stick to a Ricker	see Eq. 7
Shifted from a Beverton & Holt	see Eq. 8
Elevated exploitation of age 0	Same exploitation level as for age 1
Elevated exploitation of age 1	Same exploitation level as for age 2

Based on these results, ICES adopted the combined $B_{escapement}$ and F_{cap} strategy for use in North Sea sprat. Applying that harvest strategy the ICES advice is for a catch less than 506,000 t, with the catch limited by the Fcap. The EU has set the 2015 TAC at 227,000 t, substantially below the advised upper limit on catches but still the largest TAC since 2005 and more than 40% above the 2014 TAC (ICES 2015b-sp, Table 6.3.49.7).

Such discrepancies between ICES advised maximum harvests and TAC set by the EU have occurred numerous times in the past two decades. In the early 2000s, TACs were often set above the advised maximum harvest, but after a period at the end of the previous decade, when no scientific advice on harvests was provided, TACs have been near, and usually below the advised maximum catch (Table 24). However the EU management authority has not adopted a medium term management plan for the stock, nor has it set stock-specific management objectives beyond the general requirements of the common fishery policy. Therefore the consistency of TACs with the scientific advice remains a practice that may or may not be followed in any given year, a factor relevant to medium-term sustainability of the fishery.

Table 24. ICES advised catch, basis for the advice, TAC set by the EU, and harvests by the fishery, from 1987 to 2015. Table taken from ICES 2015b-sp, Table 6.3.4.7).

in thousand tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	Official catches	ICES landings
1987	Catch at lowest practical level	0	57	78	32
1988	TAC < recent catches, preferably zero	0	57	93	87
1989	No advice	-	59	50	63
1990	No advice	-	59	49	73
1991	No advice	-	55	92	112
1992	No advice	-	55	72	124
1993	No advice	-	114	127	200
1994	No advice for sprat; maintain bycatch regulations	-	114	184	320
1995	No advice	-	175	190	357
1996	No advice	-	200	141	136
1997	Enforce bycatch regulations	-	150	123	103
1998	Limited by restrictions on juvenile herring	-	150	175	163
1999	Limited by restrictions on juvenile herring	-	225	167	188
2000	Limited by restrictions on juvenile herring	-	225	208	196
2001	Catch prediction	225	225	180	170
2002	Catch prediction	160	232	167	144
2003	Catch prediction	175	257	201	177
2004	Catch prediction	171	257	208	194
2005	Catch prediction	244	257	242	206
2006	Catch predictions	< 250	175	135	114
2007	Catch prediction	< 195	175	99	84
2008	Catch prediction	< 170	170	75	61
2009	No advice	-	170	140	133
2010	No advice	-	170	155	143
2011	Reduce catches	-	170	143	134
2012	Reduce catches		162	95	86
In year	No increase in catches (2011)	< 134			
2013**	MSY approach, F_{cap} (catches)	< 144	162	70.6	66
2014**	MSY approach, F_{cap} (wanted catch#)	< 227	144	157	140
2015**	MSY approach, F_{cap} (wanted catch#)	$\leq$ 506	227		

Hence although the medium and long term sustainability of the stock and fishery cannot be assured without a management plan and objectives, as well as control measures to deliver the specified outcome, the short term significant improvement in year class strengths means that the stock has full reproductive capacity, and the exploitation rate is appropriate and sustainable (Table 25).

Table 25. ICES summary of status and stock and harvests in 2015. Table from ICES 2015b-sp, Table 6.3.49.1.

Table 6.3.49.1 Sprat in Subarea IV. State of the stock and fishery relative to reference points.

	Fishing pressure					Stock size				
		2012	2013	2014			2013	2014	2015	
Maximum Sustainable Yield	F_{MSY}	?	?	?	Undefined	MSY $B_{escapement}$	✓	✓	✓	Above escapement
	F_{cap}	✓	✓	✓	Appropriate					
Precautionary approach	F_{pa}, F_{lim}	-	-	-	Not applicable	B_{pa}, B_{lim}	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	-	-	-	Not applicable	SSB_{MGT}	-	-	-	Not applicable

3.4 Principle Two: Ecosystem Background

3.4.1 The North Sea ecosystem

The North Sea is a shallow continental shelf ecosystem. Water depths in the areas fished by the reduction fishery ranges from about 30 meters on the Dogger Bank in the south to 200 meters on the Fladen mud flats in the north (Figure 31). The ecosystem is temperate hosting typical cooler-water species such as cod, herring and sandeel.

Figure 31 Bathymetric map of the North Sea indicating names of fishing grounds. The most referred areas here are the Fladen Ground (north west) and the Dogger Bank (center) (from Wikipedia).

3.4.2 North Sea fish community

The fish community in the North Sea forms a complex food web. Lower trophic level fish species (such as sandeel, sprat and Norway pout) rely on copepods for food, while they themselves provide food for higher trophic level species such as adult predatory fish, marine mammals, and birds (Figure 32). In this context, the species targeted by the reduction fishery, together with juvenile herring, form a complex where the function of each species is partly substitutable by the other species (Table 26).

Table 26. Fraction of the targeted species in the diet of predators, only showing predators with one diet larger than 10%. Data from ICES (2013) and Mackinson and Daskalov (2007).

Predator species	Prey species		
	Sandeel	Sprat	Norway pout
Whiting	30%	16%	
Haddock	29%		
Gurnards	27%		
Mackerel	26%		
Halibut	20%		
Turbot	16%	15%	
Monkfish	13%		
Megrim		33%	24%
Horse mackerel			32%
Saithe			32%
Baleen whales	66%	1%	0.5%
Toothed whales	22%	8%	17%
Seals	29%		
Rays	47%		

Even though many species eat the forage fish, no single predator rely fully on one forage fish species. Therefore, none of the forage fish can be considered keystone species, but the forage fish community as a whole can be considered a *key trophic level*. The North Sea is therefore not a “wasp-waist” system as there is no single keystone species. Despite these general features of the trophic system, specific note has been made for some ETPs, which likely depend on one species (sandeel), but no fish species do (see 2.3).

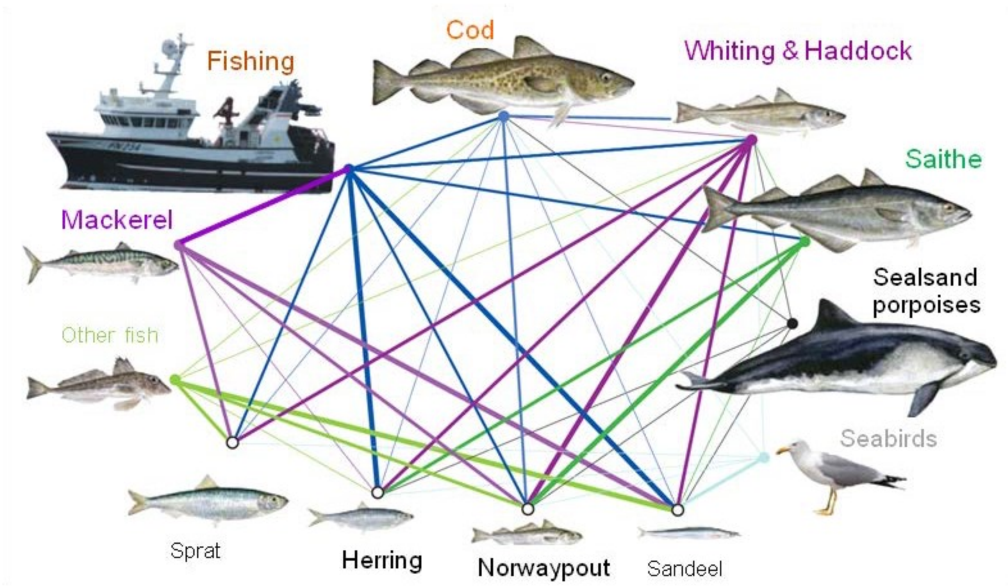


Figure 32. Overview of the important predators and prey in the North Sea SMS model food web. Other fish include grey gurnard, North Sea and western horse mackerel, and starry ray. Seabirds include fulmar, gannet, great black-backed gull, guillemot, herring gull, kittiwake, puffin, and razorbill. Seals and porpoises include grey seal and harbour porpoise. The colour of the line indicates which predator the species is eaten by, the thickness of the line indicates the biomass removed in this interaction (average from 1963 to 2010) (ICES, 2013).

3.4.3 Impacts of fishing on the fish community

The entire fish community in the North Sea is strongly influenced by fishing (e.g., Daan et al. 2005; ICES 2016). The most conspicuous effect is the depletion of top predator species. The depletion of top predators has lowered predation mortalities on lower trophic level species and this release of the top-down control has likely facilitated todays large stocks of forage fish species, to the degree that the biomass of the forage fish complex has increased the last 30 years despite the development of the reduction fishery.

There is some evidence of an incipient recovery of the important large piscivorous species in the North Sea (cod, haddock and saithe) facilitated by reductions in fishing mortality (ICES 2013). This highlights the need for an adaptive management system that is continuously able to account for the changing needs of dependent predators based on their stock sizes. This realization has spurred the development of multi-species models, which, over the last 30 years have become an integral part of the management of the ecosystem aspect of fisheries (see section 3.4.4).

Management of ecosystem effects of the fishery is mandated by the Common Fisheries Policy (CFP). The CFP recognizes the need to manage fisheries collectively on a multispecies basis as well as the need to increasingly account for ecosystem aspects in formulating future fishery management policy and in developing management plans. This is expressed though the Marine Strategy Framework Directive (EU, 2008). A partial strategy of implementing ecosystem effects of fishing on other components of the food web is the use of multi-species models to derive M2s. These M2s forms an explicit link between higher trophic level species (larger fish, birds and marine mammals) to lower trophic level species. The M2s are used in the single species stock assessment and in calculation of reference points. There is no specific plan for the entire North Sea ecosystem with a clearly formulated objective; an implementation of the Marine Strategy Framework Directive is expected to be a key element of a future plan.

Direct evidence for the effect of the ecosystem management measures could be recovery of higher trophic level species and the absence of changes in somatic growth or other effects related to food limitation. The incipient recovery of predatory fish stock indicates that forage fishing is not hindering recovery of those species. There are no systematic studies linking growth changes (or the absence of growth changes) to lower trophic levels in the North Sea. Further, the current model used in the assessment of M2s (“SMS”) does not allow the estimation or simulation of food limitation on higher trophic levels. Some efforts have been made to solve this problems, by setting up an EcoSim model and including food-dependent growth; however, conclusive evidence has yet to emerge.

3.4.4 Ecosystem modelling to support management of North Sea fish stocks and other dependent species

Several ecosystem models have been developed for the North Sea (ICES, 2014d). The most important models supporting ecosystem based management are the Stochastic Multispecies Model (SMS; Lewy and Vinther, 2004) and the EcoPath model (Mackinson and Daskalov, 2007).

The SMS model is statistical model based on maximum likelihood optimization. It is a development of the earlier “MSVPA” models (Gislason and Helgason, 1985) and it can be viewed as a simplified version of the “Gadget” model system (Begley and Howell, 2004). In the present SMS analysis (ICES, 2014d) the following predator and prey stocks were available: predators and prey (cod, whiting, haddock), prey only (herring, sprat, sandeel, Norway pout), predator only (saithe), no predator prey interactions (sole and plaice) and ‘external predators’ (8 seabirds, starry ray, grey gurnard, western mackerel, North Sea mackerel, North Sea horse-mackerel, western horse-mackerel, grey seals and harbour porpoise. For inputs the SMS model relies on observations of catch-at-age, survey indices, and stomach contents. The latter are crucial for estimating the predator-prey interactions between species, formalized as “suitabilities”. The output is estimations of biomasses, fishing mortalities, and predation mortalities. It is particularly the predation mortalities, the "M2s" that are used in many single species stock assessments in the North Sea (Figure 33). They are further used to calculate the biomass of prey species removed by dependent predators (Figure 34).

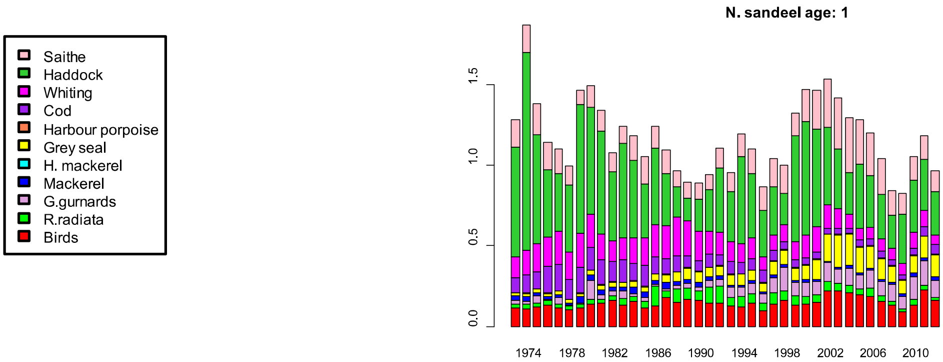
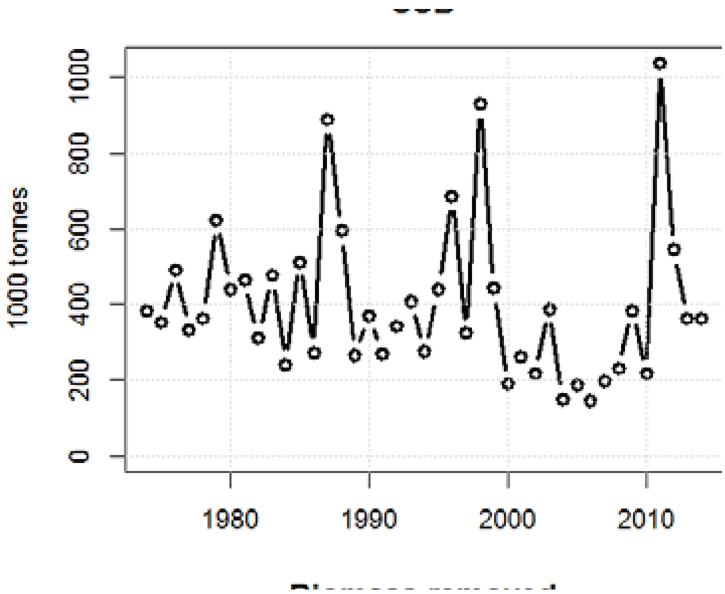
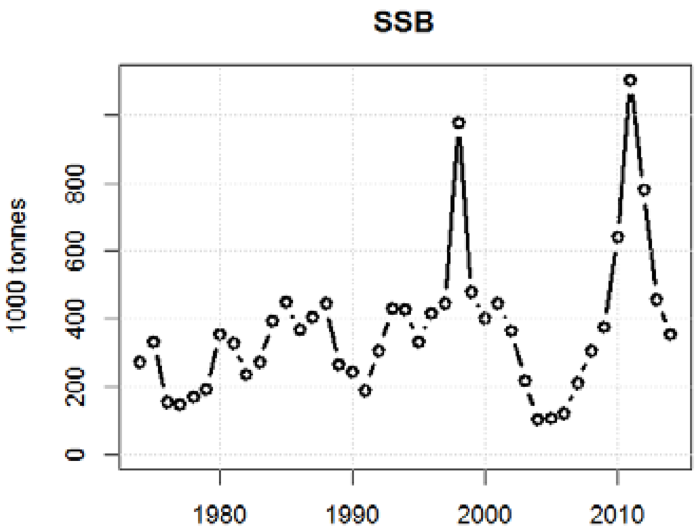
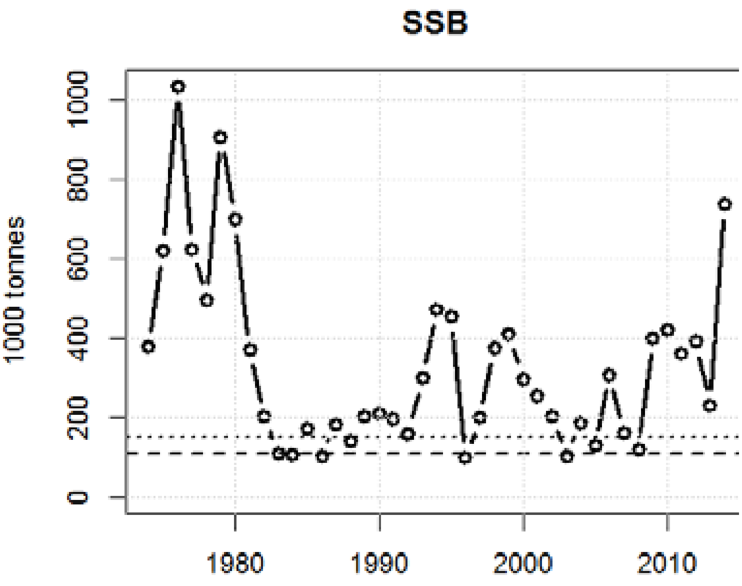


Figure 33. Example of predation mortalities (M2s) on sandeel age 1 calculated by the SMS model (ICES, 2014d).







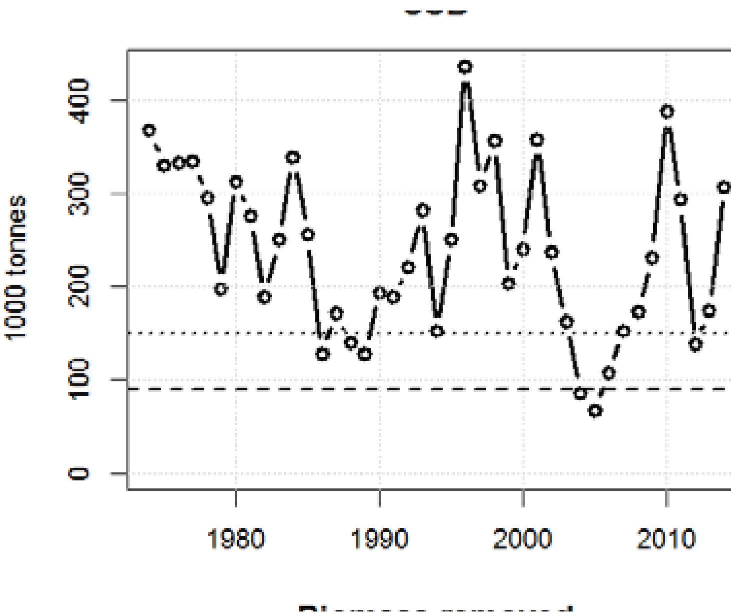


Figure 34. Biomass of sandeel removed by fishing (black), background mortality (M1, grey) and by dependent predators (M2; white) for areas 1-4 as calculated by the SMS model (ICES, 2014d).

The M2s are updated on a tri-annual schedule. This means that a possible future recovery of top predators, and resulting increases in M2s and decreases in the catch of forage fish that can be taken, will be accounted for. This ensures that fishing does not impede productivity or recovery of predatory species.

The North Sea EcoPath model (Mackinson and Daskalov, 2007) is a more comprehensive model in terms of species than the SMS model. The model represents 68 functional groups including mammals (3), bird (1), fish (45), invertebrates (13), microbial (2), autotrophic (1), discards (1) and detritus groups (2). The model is parameterized with estimates of biomass, production and consumption rates and diet composition compiled from survey data, stock assessments and literature sources. The EcoPath model is not, as the SMS, a statistical model, and it relies on process information, on biomass estimates from other models (North Sea MSVPA runs) and on hand-tuning for calibration. Once set up the model can be used with EcoSim to simulate management options, such as forage fishing (Brown and Mackinson, 2013).

The integration of multi-species modeling in the advice of fish stock management in the North Sea, including the assessment of indirect effects on ETPs, represent current state-of-the-art ecosystem management. There two issues that should that should be kept in mind: 1) The modelling procedure and incorporation of M2s into single-species fish stock assessments is likely to ensure that depleted dependent fish predators are allowed sufficient food to not impede recovery. For other dependent species, such as birds and mammals, the assessment team has additionally examined the population status and the likelihood of fishery impeding the recovery of depleted species. The assessment team has dealt with this by also examining the population status of dependent predator species and the likelihood of fishery impeding recovery of threatened species. More details and references related to specific species and ecosystem impacts are given in the sections on ETP and Ecosystem. 2) There is always a considerable inherent uncertainty in multi-species modeling and assessments. This uncertainty originates from a yet incomplete understanding of species encounters in predator-prey interactions in ecology in general. A specific uncertainty related to the SMS model is the reliance on stomach data to estimate the predator-prey interactions. The stomach data used to calculate the preferences of fish species on their prey are old (from 1991) and made at the trailing edge of the gadoid outburst. Update of the preferences will therefore improve the reliability of the M2 estimates. Addition of new stomach data may be particularly important with the incipient recovery of predatory gadoid stocks, which may lead to fundamental changes in the food web. The assessment team therefore recommends the addition of new stomach data into the SMS assessments. Despite this uncertainty, the procedures employed are likely to provide a good description of the trophic interactions in the system.

3.4.5 Retained, bycatch and endangered, threatened or protected species impacted by the reduction fishery

3.4.5.1 Retained species

The fishery is generally quite clean with limited catch of non-target species. The main non-target species landed are other sandeel species in the sandeel fishery, and catch of herring in the sprat and Norway pout fisheries. There is one issue of some concern: the lack of reliable information about other sandeel species in the sandeel fishery.

This assessment of non-target catch is done in two ways: by self-reporting in electronic logbooks and by official sampling. The self-reporting is done by visually assessing the catch as it rolls by on its way to the hold. There is no common procedure so each vessel develops its own. The official sampling is performed at sea or dockside by taking buckets from the holds. The number of samples taken is very low. The logbook reporting is controlled to be within 10% of the findings from the control’s sampling. Both procedures are fairly uncertain, but generally report low catches of non-target species.

There is a systematic discrepancy between the numbers from the logbooks and official landings: the logbooks report much smaller catch of non-target species than the official landings. This discrepancy is a concern that the fishery is urged to solve and the assessment team has included it as a recommendation in this report. The officially catches report the highest landings of non-target species, and these values are used in the assessments performed here, as an upper bound on the landings of non-target species.

The main non-target species is herring. Herring has an $F < Fmsy$, with $B > Bmsy$ and increasing SSB. Both SSB and the fishing mortality are reliably estimated by the stock assessment (ICES 2013). A bycatch quota is set aside in the herring assessment for landings of herring as non-target catch.

All three fisheries catch several minor species in small amounts. We have operated with a *de minimus* threshold of 0.2% to consider the retained species as a "minor" species in the assessment.

Sandeel

There are no officially reported main non-target species in the sandeel fishery (Table 27). Minor species (catch less than 5% and larger than 0.2%) are: sprat, herring and blue whiting. Sprat is covered by Principle 1 of this assessment.

Table 27 Reported catch in the sandeel fishery from official landings and from logbooks.

	Official registered landings					Logbook recordings (2014)	
Species	**2010**	**2011**	**2012**	**2013**	**2014**	**Catch**	**%**
Sandeel	97.82%	98.54%	99.29%	98.73%	98.17%	152,932,375	99.94
Sprat	1.62%	0.60%	0.10%	0.02%	0.24%	55,000	0.04
Herring	0.17%	0.13%	0.31%	0.35%	0.37%	9,700	0.01
Blue Whiting	0.12%	0.29%	0.04%	0.35%	0.14%	9,000	0.01
Mackerel	0.12%	0.37%	0.09%	0.24%	0.14%	4,000	0.00
Cod	0.00%	0.00%	0.00%	0.02%	0.00%	3,676	0.00
Edible crab	0.00%	0.00%	0.00%	0.00%	0.00%	3,000	0.00
Whiting	0.12%	0.29%	0.04%	0.35%	0.14%	1,500	0.00
Unspecified species						155	0.00
Greater weaver	0.01%	0.00%	0.00%	0.00%	0.03%	145	0.00
Sole	0.00%	0.00%	0.00%	0.00%	0.00%	25	0.00
Sculpin	0.00%	0.00%	0.00%	0.00%	0.00%	15	0.00
Gurnard	0.11%	0.03%	0.08%	0.20%	0.68%	0	0.00
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**153,018,591**	**100.00**

Sprat

Sprat in Subarea IV is landed with juvenile herring as a main non-target catch (Table 28). This is recognized by management and a bycatch quota is set aside for the sprat fishery in the herring assessments. Herring acts as a choke species and the fishery will be closed if the bycatch quota is used, though this has not happened.

Minor species are: dab, sandeel, whiting and flounder.

Table 28. Reported catch in the sprat fishery from official landings and from logbooks

	Official registered landings					Logbook recordings (2014)	
Species	**2010**	**2011**	**2012**	**2013**	**2014**	**Catch**	**%**
Sprat	94.63%	91.13%	87.42%	89.83%	89.73%	134,998,664	98.34
Herring	3.71%	6.73%	11.14%	8.33%	8.31%	1,805,810	1.32
Dab	0.38%	0.12%	0.19%	0.40%	0.09%	122,500	0.09
Sandeel	1.04%	1.57%	0.12%	0.00%	0.01%	88,000	0.06

Species	Official registered landings 2010	2011	2012	2013	2014	Logbook recordings (2014) Catch	%
Gurnard	0.01%	0.14%	0.19%	0.04%	0.13%	75,305	0.05
Mackerel	0.02%	0.11%	0.32%	0.45%	0.05%	65,323	0.05
Plaice	0.00%	0.00%	0.00%	0.04%	0.00%	50,740	0.04
Anchovies	0.03%	0.00%	0.03%	0.00%	0.80%	48,145	0.04
Whiting	0.10%	0.16%	0.46%	0.72%	0.65%	13,436	0.01
Greater weaver	0.02%	0.00%	0.00%	0.00%	0.00%	5,000	0.00
Norway pout	0.02%	0.00%	0.00%	0.00%	0.00%	1,850	0.00
Sardine						1,320	0.00
Flounder	0.38%	0.12%	0.19%	0.40%	0.09%	900	0.00
Garfish	0.00%	0.00%	0.00%	0.00%	0.00%	70	0.00
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**137,277,063**	**100.00**

Norway Pout

The fishery for Norway Pout has historically resulted in high catch of non-target species, particularly whiting, blue whiting, haddock, saithe, and herring (Table 29). Catches of the gadoid species has been low in the recent decade, while there is still significant catch of herring (ICES 2013).

Catch of gadoids can be avoided with sorting grids in the trawl. Sorting grids are mandatory by legislation since 2012 (ICES 2013). Additionally, there is little incentive to catch gadoids because they have little value when processed. However, the fishers report that it is difficult to use the sorting grids while achieving a good catch of Norway Pout. This, combined with increasing fuel costs, is part of the reason why the quota is rarely fished. Modification of the selective devices is ongoing (ICES, 2015d). Another measure to avoid gadoid catches is the “Norway Pout Box” (ICES, 2015d, annex). The “Norway pout box” is an area where there were historically high gadoid catches in the Norway pout fishery, and it has been closed for industrial fishery for Norway pout since 1977 onwards (EC Regulation No. 3094/86).

Currently, the main non-target species is herring that can act as a choke species and close the fishery during the season. A bycatch quota is set aside in the herring assessment. . Minor species are: haddock, whiting, and blue whiting.

Table 29 Reported catch in the Norway pout fishery from official landings and from logbooks

Species	Official registered landings 2010	2011	2012	2013	2014	Logbook recordings (2014) Catch (t)	Percentage
Norway pout	90.82%	82.95%	87.65%	91.53%	89.22%	27,702,000	99.57
Herring	6.15%	12.80%	7.55%	4.83%	5.90%	120,000	0.43
Haddock	0.60%	0.22%	0.04%	0.22%	0.23%	300	0.00
Whiting	1.85%	2.05%	2.90%	1.45%	1.99%		
Blue whiting	0.02%	0.69%	0.23%	0.41%	0.81%	88,000	0.06
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	27,822,300	**100.00**

3.4.5.2 Bycatch (slipping)

Discarding of bycatch in the fishery may occur by sorting the catch at sea or though slipping of the entire catch.

The catch is sucked up directly from the nets into the hull. Sorting devices are not allowed on board, and non-compliance is easy to spot. The operations are typically large, so hand-sorting is not an option. Consequently, discarding of a partial catch is not an issue.

Slipping an entire catch is the only way to discard an unwanted catch. There is no monitoring by observers, neither now or in the past, so there is no direct information about slipping. The nature of the fishery, which targets the schools of the stocks directly by combining acoustics and habitats (sand banks for sandeel; deep mud for Norway pout), makes it unlikely that the entire schools of non-target species are caught and possibly slipped. These are general observations, but there are special potential issues with bycatch of herring (see below).

The fishery has operated under the landing obligation where all fish have to be landed since 1/1-2015. The landing obligation can be considered a strategy, as its explicit objective is to eliminate discard of bycatch. The landing obligation means that there is no direct penalty for landing non-target fish, which reduces the incentive to slip. Therefore, in principle, there will be no incentive to slip an entire catch at sea due to the risk of penalties. The Danish AgriFish agency provides some evidence as to a successful implementation: 'During inspections conducted in 2015, our inspectors have informed and guided fishermen on the ban on discard in the Baltic Sea as well as for pelagic and industrial species in other areas. There have been no sanctions for noncompliance to the ban on discard in 2015' (AgriFish, 2016).

Herring acts as a choke species in the sprat and Norway pout fisheries, which could create an incentive to slip. Earlier, there was a catch-composition rule that one landing could contain no more than 50% herring in the Norway pout fishery or 20% in the sprat fishery. Therefore, at least in the sprat fishery, discarding (slippage) occurred but was not quantified (ICES 2015b). Now, under the landing obligation, all will have to be landed. Quotas of herring bycatch are not allocated to individual fishers and, because of the landing obligation there is no punishment for landing herring. In the sprat fishery, up to 9% of a catch of herring can be written off on the sprat quota; this is to create a disincentive to slippage. However, the fishery is considering development of internal regulation of the fishery to avoid olympic fishing where the bycatch quota is quickly fished by single vessels (Claus Sparrevorn, DPPO, pers. comm.). Such future internal regulation within the fishery could create incentives to slip a catch at sea, in particular in the Norway pout fishery, and they need to be monitored.

There is a closely monitored experimental sprat fishery in the German Bight. The fishery is monitored with tests of catch composition for each haul, though there are no onboard observers. The experimental fishery started in 2013 and is still ongoing. Slippage has, however, not been explicitly evaluated in the area (Lotte Worsøe, DTU Aqua, pers. comm.).

The DFPO and DPPO have developed codes of conduct (CoC), including self-reporting of bycatch. The CoCs do not explicitly mention slipping, however the assessment team has included a recommendation to do so in this report.

3.4.5.3 Endangered, threatened or protected species

ETP species are those recognized by national legislation and/or binding international agreements to which the jurisdictions controlling the fishery under assessment are party. For the North Sea region OSPAR maintains the official list of endangered species. Implementation of the OSPAR convention is embodied in the EU habitats directive. The implementation is the EU habitats directive, which states that “Member States shall establish a system to monitor the incidental capture and killing of the animal species listed […] In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned”.

The relevant ETP species identified by the team that may be exposed to potential direct or indirect impact by the fishery are:

Species	Latin name	Reference
Harbour and grey seals	*Phoca vitulina* and *Halichoerus grypus*	EC Habitats Directive Annex IV
Harbour porpoise	*Phocoena phocoena*	EC Habitats Directive Annex II, and IV, OSPAR
Minke whale	*Balaenoptera acutorostrata*	EC Habitats Directive Annex IV
Black-legged kittiwake	*Rissa tridactyla*	OSPAR
Roseate tern	*Sterna dougallii*	OSPAR
Common skate	*Dipturus batis*	OSPAR
Spotted ray	*Raja montagui*	OSPAR
Thornback skate/ray	*Raja clavata*	OSPAR
Starry ray	*Amblyraja radiata*	EC Habitats Directive Annex

Direct effect on ETPs may occur through entanglement and drowning in fishing gear. The fishery is conducted with trawl and purse seines, that are generally known to have negligible bycatch of birds or marine mammals. This has been documented by the observer program in the North Sea herring fishery, whose results are likely to apply also to the reduction fishery (ICES 2014d). Purse seines, as used in the sprat fishery, have the potential for bycatch of mammals; however, a report for ASCOBANS gave no indication of any cetacean bycatch concerns in the North Sea, following a review of bycatch and mitigation measures being implemented in European fisheries (Northridge, 2011). The fishery has developed a CoC including logbook reporting of bycatch, with no reported bycatches in 2014. Thus, the nature of the fishery operations makes direct impact on marine mammals and birds negligible.

Indirect effect occurs through competition for fish between ETPs and the fishery (Figure **35**). Indirect effects are accounted for in the management through escapement to ensure sufficient food for relevant ETPs. In practice this is done by increasing the natural mortality in the assessment to account for the needs of higher trophic level species. This mortality is assessed through multi-species statistical models and updated tri-annual (see 3.4.4). This procedure is highly likely to detect and counteract indirect effects on ETP species. In cases where indirect effects have been substantial the fishery has been closed (kittiwakes at Firth of Forth).

All ETP populations are monitored through population estimates and, for seabirds, through monitoring of breeding success of birds. The monitoring and the updated escapements through calculations of natural mortality constitute a partial strategy for limiting indirect effects of fisheries on ETP species.

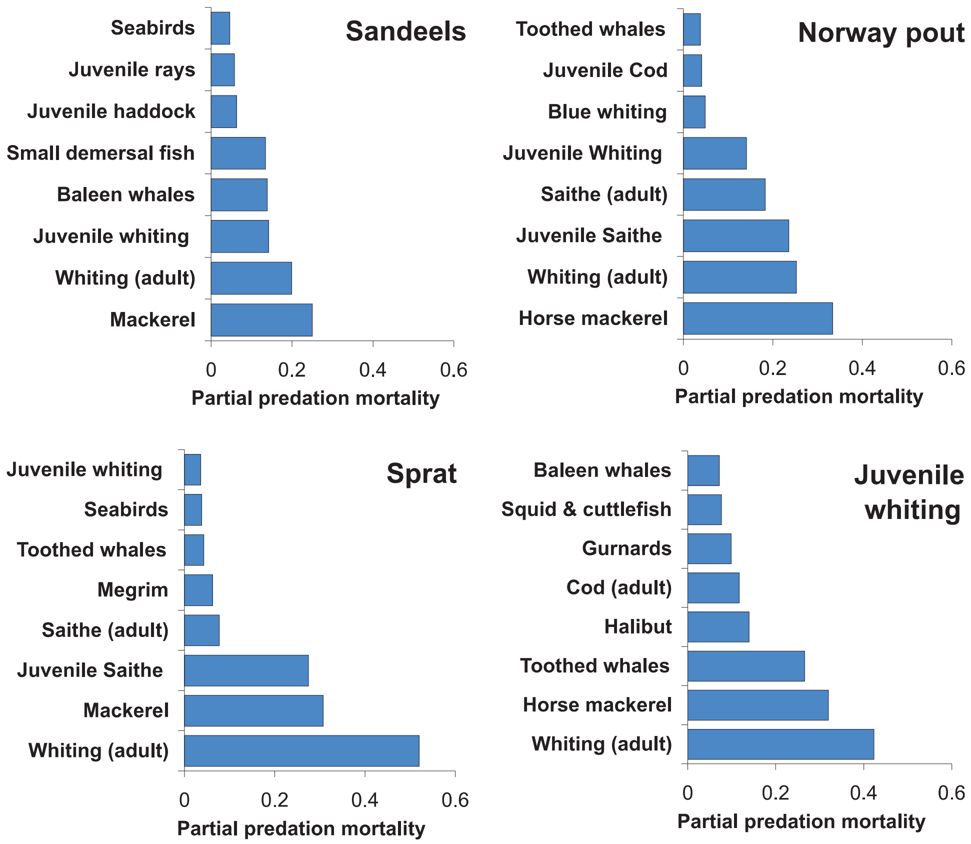


Figure 35: Predation mortalities imposed by ETPs on food species. “Toothed whales” are mainly habour porpoises; “baleen whales” are minke whales (Mackinson & Daskalov (2007) fig. 3.10).

Marine mammals

Seals

Harbour and grey seals are associated with coastal areas (Søgaard et al 2015), but they can forage far from the coast, for example tagging data show how harbour seals regularly use the Dogger Bank as a feeding area (Russell and MacConnell, 2014). However, populations of harbour seal and grey seal are improving (Søgaard et al, 2015). Negative effects on harbour seal abundances are mainly epidemics. Though sandeel are an important part of their diet (Table 26), the populations still increase. The direct and indirect effects of the fishery on seals has therefore not hindered a recovery of the seal populations.

Harbour porpoise

Harbour porpoise occur mainly in the eastern part of the North Sea where it is widespread and abundant (ASCOBANS) with a population on the order of 170.000 individuals (Hammond et al. 2013). It is therefore considered of “least concern” by IUCN.

The harbour porpoise is listed in Annex II and IV of the Habitats Directive (92/43/EEC), which obligates all EU Member States to protect porpoises in their entire range as well as to designate protected areas called Special Areas of Conservation (SACs) in areas of high porpoise density. Denmark, Germany and Sweden have designated 26 SACs (11, 11 and 4 SACs respectively) (
Figure **36**). Some limitations on activities apply within the SACs, however not for the reduction fishery.

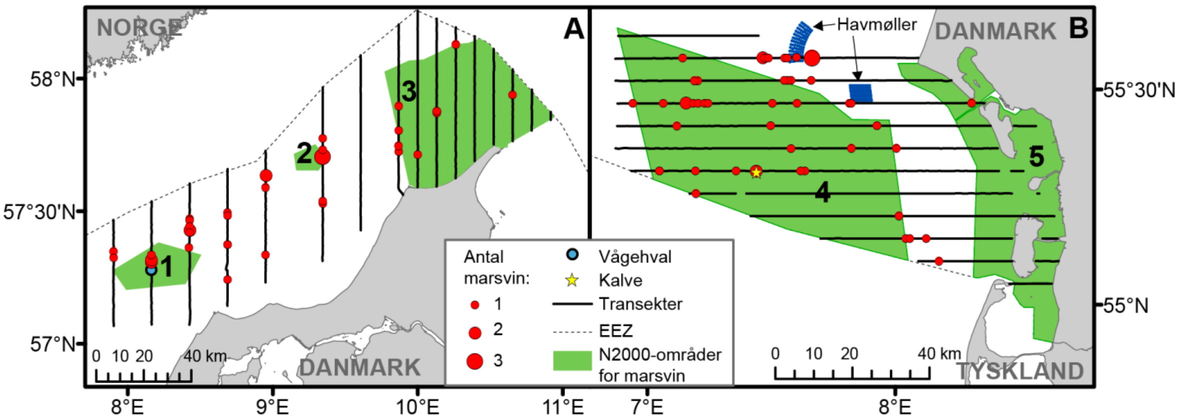


Figure 36 Special Areas of Conservation in the North Sea for harbor porpoises (green) with transects used for counting from aerial surveyes (black lines) and observations (red dots) (Søgaard et al, 2015)

The population is monitored in Denmark as part of the NOVANA monitoring program since 2011. The program uses acoustic listening stations, acoustic surveying from ships, and aerial surveying (
Figure **36**; Søgaard et al. 2015).

Indirect effects: The porpoises in the North Sea eat mainly juvenile demersal species. They eat small amounts of Norway pout and sprat (compared to other predators). Though their impact on the sandeel population is small, (ICES, 2014e; Mackinson and Daskalov fig. 3.10, 2007), sandeel is about 20% of their diet (Table 26).

Conclusion: The harbor porpoise population is in a healthy state. The direct effects of the fishery are negligible. Though they do eat sandeel, food limitation does not appear likely to limit the population of harbor porpoises.

Minke whale

Minke whales appear throughout the North Sea. They have a stable population around 10-20,000 individuals in the southern North Sea (IWC, 2014). The International Whaling Commission considers the population to be in a “healthy state”, despite a commercial catch of around 500 individuals per year by Norway.

Indirect effect: More than half of their diet in the North Sea is sandeel (ICES, 2014e; Table 26). This is a substantial consumption, though significantly smaller than the consumption by piscivorous fish (
Figure **35**). The consumption is accounted for through escapement rules in the stock assessment. As the population is healthy they do not appear limited by food.

Conclusion: the fishery does not negatively influence to population of minke whales, directly or indirectly.

Birds

The protection of birds is covered by the EU directive 2009/147/EC on the conservation of birds, which requires that “Member States shall take the requisite measures to maintain the population of the [ETP] species … at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level." (article 2). The directive is mostly concerned with limiting deliberate killing (hunting) and with habitat protection.

Birds are rarely caught directly in trawl or purse seine operations. The catch is pumped directly from the trawl/seine into the haul, leaving little potential for interactions with birds. Eventual bycatch is registered in logbooks as specified in the CoC; no bycatch was registered in 2014. The direct impact of the fishery on birds is therefore negligible. The main concern regarding birds is the potential for food-competition between birds and the fishery.

Black-legged kittiwake

Kittiwakes are well known to depend on forage fish, in particular sandeel, and their breeding success may be affected if sandeel populations are depleted (ICES 2013). Their foraging range is 50 km and they may therefore forage on offshore sandeel populations.

The breeding success of the Kittiwake population at the Isle of May is known to be directly linked to the nearby sandeel population. This effect prompted the closure of the fishery in Firth of Forth in 2000 (region IV), where there has since only been a monitoring fishery of 5000 t/yr to monitor the population (ICES, 2014d). Despite an initial increased breeding success of the closure (ICES, 2014d), the population of kittiwakes at the Firth of Forth islands continues to decline (by 63.1% between 2000 and 2013; http://jncc.defra.gov.uk/page-2889). This demonstrates that kittiwake population dynamics is influenced by other factors than the fishery.

Birdlife International has expressed concern that breeding success of kittiwake at Flamborough will be negative affected by the fishing on Dogger bank. Kittiwakes have the ability to forage far from their colony, with mean maximum foraging ranges reported between 60 (Thaxter et al. 2012) and 104 km (Soanes et al 2016). However, the average foraging range is much shorter, with a mean between 11 km (Soane et al 2016) and 25 km (Thaxter et al 2012). While the Dogger bank is inside the possible foraging range, they are mostly relying on the coastal sand eel banks closer to shore. Analysis of the correlation between fishing mortality on sandeel and kittiwake breeding success shows that fishing mortality in one year has a negative effect on breeding success two years later. The reason for the two-years lagged response is unclear, and indicates that breeding success is not directly affected by the impact of fishing on the biomass of sandeel on Dogger bank. The lagged response therefore points to an indirect effect, e.g., that the recruitment of sandeel closer to the coast is negatively affected by fishing on Dogger bank. This could be because the coastal population relies on recruitment from the Dogger bank. Alternatively, the effect could be a spurious correlation. The effect is particularly strong during the years where the fishing effort on Dogger Bank sandeels was very high (F was 1.0 per year from 1999 to 2002, peaking at 1.5 per year in 2001). In the last decade, following the regional management of sandeel stocks, sandeel fishing mortality on Dogger Bank has been below 0.66 year^{-1} (ICES, 2013). In the range of fishing mortality between 0 and 0.7 year^{-1} the analysis shows no correlation between kittiwake breeding success and sandeel fishing mortality. The effects of sandeel fishing is therefore highly unlikely to create an unacceptable impact, but it cannot be stated that there are no significant detrimental effects with a high confidence before the effect is fully documented.

Sprat may also be present in the diet of kittiwakes (*Lewis et al, 2001; Bull et al, 2004; Chivers et al 2012*). The sprat fishery is concentrated on the coast of Jutland, with only a minor effort on Dogger bank, so there is no conflict between the sprat fishery and kittiwake foraging

It should also be emphasized that the current decline in Kittiwake breeding success cannot solely be attributed to competition with fishing. The closure of the fishery in the Firth of Forth led to a short term improved breeding success of kittiwakes. However, the long term trend is more strongly influenced by major changes related to other factors rather than the local influence of the sandeel fishery in that area (pers. comm. Robert Furness). So, while food competition with the fishery obviously play a role when sandeel populations close to a kittiwake colony are depleted by the fishery, fishing cannot be used as the sole indicator for kittiwake breeding success and population recovery.

Roseate tern

Roseate tern is a migratory bird that spends the breeding season in Ireland and UK, among other places. Though the population has shown improvement, roseate terns still qualify as rare, sensitive, and with a localized distribution of regional importance, particular in the UK. Roseate tern need dense shoals of forage fish (sprat, herring or sandeel) within 15 km of the colony. Despite this, food limitation is not listed as a concern. The key known threats affecting roseate terns are those that limit the number and quality of suitable nesting sites available to the species, in particular predation and disturbance at the breeding colonies (OSPAR, 2009). Fishing does not occur within 15 km of the roseate tern colonies. Therefore, the fishery is not expected to compete with food for roseate terns and is therefore not affecting breeding success of Roseate terns. Roseate terns is therefore not considered a relevant ETP species.

Skates and rays

Three skate and ray species are included in the OSPAR list in the North Sea: Common skate (*Dipturus batis*), spotted ray (*Raja montagui*) and thornback skate/ray (*Raja clavata*). EU further lists Starry ray (*Amblyraja radiata*). The main threat to all species is fishing.

Common skate has been extirpated from most of the North Sea (except the northern part). The species is now assessed as “Critically Endangered” globally on the IUCN Red List of Threatened Species. EU Council Regulation 43/2009 prohibited all landings of *D. batis* in EU waters.

The overall status of *spotted ray* across the OSPAR Area is good, with stable or increasing populations in most areas (OSPAR 2010). The species is now assessed as “Critically Endangered” globally on the IUCN Red List of Threatened Species.

Thornback ray has been depleted by fisheries, where its area of distribution has contracted significantly. It remains abundant and its population stable (OSPAR 2010b) or increasing (ICES, 2015c). Thornback ray has a large proportion of sandeel in their diet (47%; Mackinson and Daskalov, 2007; Table 27). Food limitation, however, is not listed as threat.

The population of *Starry ray* is in decline. There should not be a targeted fishery for this stock and measures should be taken to reduce bycatch (ICES, 2015d).

There are no reports of bycatch of rays or skates in any of the fisheries considered here, neither from the official Danish catch reports or from the fishers own logging. Either the catches of rays and skates are so small that they escape registration, or they are being discarded (as mandated by law for some species). Due to the large scale of the fishing operation and the absence of sorting devices, discard is considered unlikely. The catches of skates and rays in the reduction fishery is therefore highly likely negligible, and bycatches are there not expected to hinder a recovery of the ray and skate populations.

3.4.6 Habitats

The low depth of the North Sea makes many habitats exposed to the action of waves and tides. The shallower areas are impacted by strong tidal currents which suspends finer sediments into the water column where it is washed away, e.g., the Dogger Bank. This leaves a habitat dominated by sand and gravel with a fauna of resilient organisms such as polychaete worms, amphipods and small clams within the sediment, and hermit crabs, starfish and brittle stars. Deeper areas, such as the Fladen grounds, experience only little wave and tide action. Here finer sediments are allowed to settle and form extensive mud flats. These areas are colonialized by more fragile organisms such as mud shrimps, nephrops and sea pens.

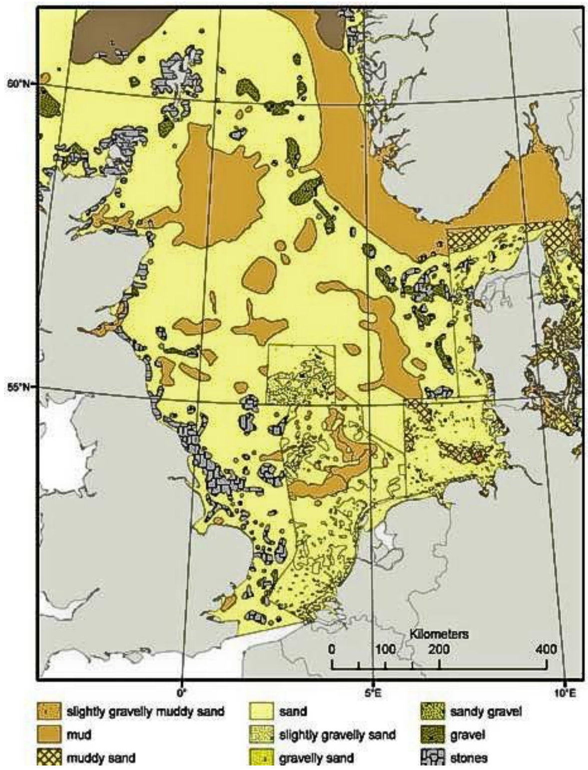


Figure 37. Habitat map of the North Sea (Source: North Sea Digital Atlas).

Information about the fished habitats in the North Sea and surrounding areas are mapped in detail based on information from bottom trawl surveys. Information is available from OSPAR; however, in most cases the information is dated and it is likely that specific sensitive habitats are not mapped.

The vessels are predominantly in excess of 12 m and therefore require a Vessel Monitoring System (VMS) to be fitted. Information about the spatial extent of the fishery from VMS data has been made available to the assessment team.

Protection of sensitive habitats is regulated through international convention of biodiversity (OSPAR 03/17/1, Annex 9), amended by OSPAR Recommendation 2010/2 (OSPAR 10/23/1, Annex 7) and corresponding national legislation (Marine and Coastal Access Act, 2009, in the UK; Natura2000 in Denmark). The measures for the implementation of legislation are a series of Marine Protected Areas (MPAs). The objective is to make MPAs "well-managed" by 2016. The management of the habitats through MPAs can be considered a partial strategy. The relevant MPAs for the reduction fishery, Central Fladen and Dogger, are not yet “well-managed”, but implementation is ongoing, e.g., with management for Central Fladen in review and an international proposal for a Dogger Bank MPA in the works. DPPO and DFPO are engaged in the process to implement MPA both at Central Fladen and Dogger bank.

3.4.6.1 Impact of the reduction fishery on sensitive habitats.

The fishery is conducted with various trawls: OTB (otter bottom trawl), OTM (otter midwater trawl), PTB (paired bottom trawl), PTM (paired midwater trawl), and purse seines in the sprat fishery. Depending on the targeted species, different habitats are fished:

Target species	Gear used	Habitat fished
Sandeel	Bottom trawls	Sand banks
Sprat	Midwater trawl and purse seines	Pelagic habitat
Norway Pout	Bottom trawls	Deep mud

Apart from the direct impact of the trawling the fishery might also have an impact due to lost gear. Though unlikely to be a major problem due to the cost of gear, this has yet to be documented. The CoC currently being implemented will provide this information in the future.

We divide the assessments of gear’s impact in two groups: 1) those which touch the bottom (bottom trawls) and 2) gears which do not touch the bottom (purse seines and midwater trawls).

Bottom trawls

The gears are bottom-touching trawl (though in some cases with modifications; see later). The impact of the trawl on the bottom comes from the doors, from the middle-weight (when used), and from the ground rope (Eigaard et al. 2015). The doors and the weight produce trawl tracks on the bottom, while the rope interacts with organisms on the bottom and possibly produce a cloud of mud. The targeted species are fish are living off (not on) the sea bed (sandeel are not targeted by the fishery while they are buried in the sand). The fishery therefore does not need to scrape the fish off the bottom (such as in nephrops fishery) so there is little incentive for the fishery to interact strongly with the bottom, as it will only result in increased fuel costs. Therefore, gear riggings do not use any kind of tickling chains or bobbins on the footrope of the trawl, as is used in e.g., the plaice fishery. Consequently the gear has a lower surface impact than the plaice and nephrops fisheries.

Pelagic gear

Purse seines and midwater trawls are used in the sprat fishery. The gears do not normally touch the bottom, however, they may touch the bottom in shallow areas or if the fishery is close to the bottom.

Sandeel fishery

Sandeel fishery with otter trawls is conducted on sandy bottoms on fairly shallow water. The sandeel fishery operates mainly on the sides of the sand banks. Such habitats have a high energy input from tides and therefore high natural disturbance. It is therefore not considered a particular sensitive habitat. In Sandeel Area 1 there is an overlap between the fishery and the proposed “Dogger Bank” MPA.

The Dogger Bank is a large continuous expanse of shallow sandbank. The southern area of the bank is covered by water seldom deeper than 20 m and extends down to greater than 50 m. Its location in open sea exposes the bank to substantial wave energy and prevents the colonization of the sand by vegetation on the shallower parts of the bank. Sediments range from fine sands containing many shell fragments between bed forms on top of the bank, to muddy sands at greater depths supporting invertebrate communities, characterized by polychaete worms, amphipods and small clams within the sediment, and hermit crabs, flatfish, starfish and brittle stars. The habitat is considered "moderately sensitive" with "low" exposure to trawling, and a "moderate" vulnerability (JNCC 2012, table 1), with a "high level of risk" (JNCC 2012, table 2). The UK, Dutch, German and Danish Governments have agreed to a joint management proposal through the Dogger Bank Steering Group, with the aim of submitting it to the European Commission. (JNCC http://jncc.defra.gov.uk/page-6508 "activities and management tab"). Stakeholders have been actively involved in this process via the North Sea Regional Advisory Council (RAC). Fisheries management measures will be implemented through the EU's Common Fisheries Policy (CFP).

In anticipation of future management measures related to a possible Dogger bank MPA, the sandeel fishery has developed new gear using trawl doors that can be fished mid-water instead of the doors with bottom contact (H. Mosegaard, DTU Aqua, pers. comm.). This trawl has a reduced bottom contact. As the new trawl is more fuel efficient it has already been partly adopted by the fleet.

Sprat fishery

The sprat fishery is conducted with pelagic gear. The fishery is concentrated close to the coast of Jutland in water depths down to about 10 m. Some bottom contact can therefore not be ruled out completely, and it can damage fragile habitats such as corals or sponges (Donaldson et al. 2010). The habitat where the fishery occurs is sand with a large natural tidal disturbance. The possible bottom impact from the gear is therefore highly likely to be less than the natural impact from tides.

Norway pout fishery

The Norway pout fishery occurs on the Fladen Ground (Figure 38). Fladen is a large plain of fine mud, at water depths ranging from 15–200 m or more, designated by OSPAR as "burrowed mud". This habitat is considered "sensitive" to mechanical disturbance (OSPAR 2010c), in particular from the nephrops fishery. The mud habitat is characterized by feather-like soft corals called sea pens, and the burrows made by crustaceans such as mud shrimp and nephrops. The entire Fladen area contains sea pens listed by OSPAR as a habitat "under threat/in decline". The dominant species (slender sea pen, *Virgularia mirabilis* and the phosphorescent sea pen, *Pennatula phosphorea*) are able to retract into the sediment upon disturbance. Tuck et al. (1998) in a study on a similar habitat found that the impact of trawl on these sea pens was small because the sea pens were able to retract before being hit by the ground rope of a trawl. Other studies, though, found a strong impact of trawling on similar species of sea pens (Hixon and Tissot, 2007), though it is unclear if those species are able to retract. The rarer tall sea pen *Funiculina* is unable to retract into the sediment. This species is known to exist in the northern part of Fladen ("Central Fladen"). This area has been proposed as an MPA.

The proposed Central Fladen MPA lies within the Fladen Grounds. The MPA has been proposed because there is a significant risk of not achieving the conservation objective for the burrowed mud feature for bottom-contact gears like otter trawls (DEFRA 2015) due to the presence of the tall sea pens. Management options are under review by the Scottish government, aiming for having fisheries management measures for the Central Fladen in place by 2016.

The main physical impact to the bottom from otter trawls is from the trawl doors (Sanchez et al. 2000). A secondary impact is from the ground rope, which will whirl up sediment and interact with larger bottom structures such as soft corals and sea pens. Norway pout is benthopelagic species often found just off the bottom on deep mud habitats. The footrope is made from “taifun” (http://vodbinderi.dk/taifun.html). This product is heavier than normal rope, and hence keeps the footrope close to the bottom without digging into the bottom sediment as a chain does. Generally, otter trawling is known to cause only causes subtle changes in the benthic community on mud habitats (Sanchez et al. 2000), with a short-term (2-5 days) negative effect but a longer-term positive effect (Kaiser et al. 2006). Impacts are clearly much smaller than beam trawling. Nevertheless, the fishery does not employ any special measures to limit the impact on the bottom.

Further, while the spatial extent of the Norway pout fishery is documented, there is no information about the cumulative intensity of bottom trawling on the Fladen ground, that can be used to estimate the recovery time for the habitat.

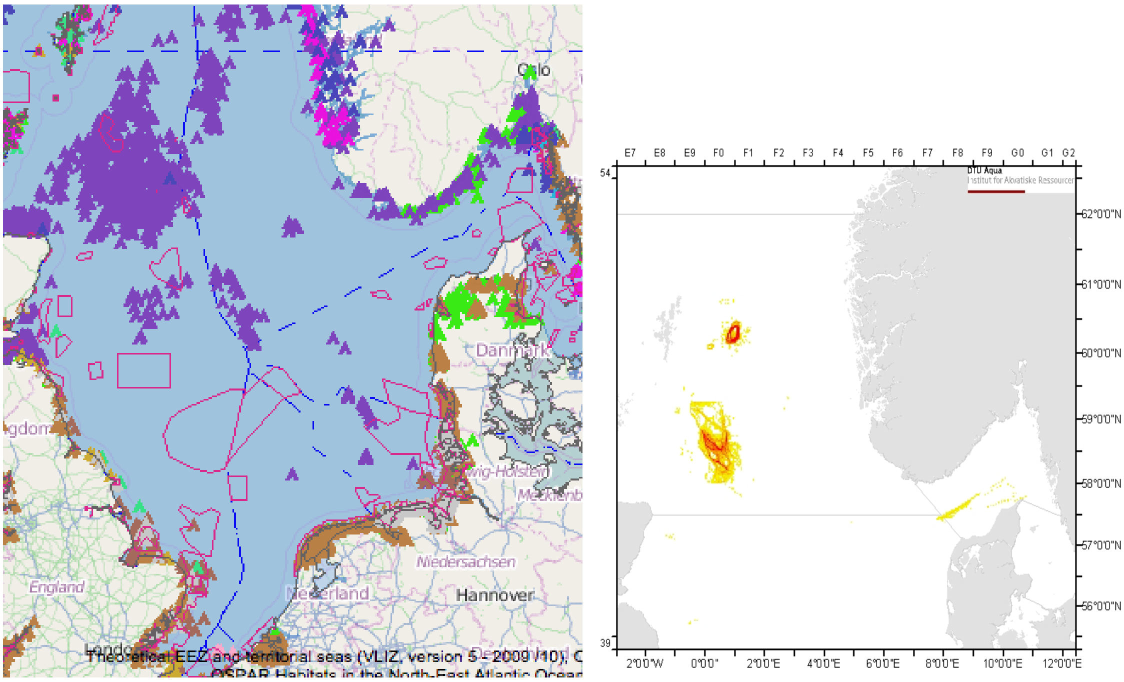


Figure 38. Maps of habitat (left) and trawling effort for Norway Pout from VMS data (right). Habitat maps shows planned or effective marine protected areas (magenta outlines), sea pen fields (magenta triangles) and lophelia reefs (blue triangles), and intertidal mud flats (brown triangles). Source: OSPAR. Trawling effort is based on 2014 VMS data; other years show similar spatial distribution.

Comparison with other MSC certified fisheries

Two recent MSC assessments have evaluated the impact of bottom trawling in the North Sea: the “DFPO Denmark North Sea Plaice Fishery” assessment and the “Danish and Swedish Nephrops Fisheries (Danish)”. Our evaluation of the habitat impact are generally consistent with these two assessment, though with some specific differences.

The plaice fishery put a condition on information of the different habitats, and active participation in MPA process. This was based on a score of SG75 in 2.4.1. The plaice fishery is performed with bottom trawls fitted with tickler chains designed to lure the plaice up from the bottom and into the trawl. The gear used in the plaice fishery therefore has a higher impact on the bottom than the gear used in the reduction fishery, where tickler chains are not employed. The reduction fishery on sandy habitats therefore has a somewhat smaller impact than the plaice fishery. On the other hand, the Norway pout fishery is taking place on a muddy bottom, which is more sensitive than the sand and gravel where the plaice fishery occurs. Taken together, the lighter gear but more sensitive habitat, makes our assessment and condition in 2.4.1 consistent with the plaice assessment.

The nephrops fishery is occurring on mud habitats similar to the Norway pout fishery. The nephrops fishery gear is, however, heavier than the Norway pout fishery as it need to catch a benthic species, and therefore employ brushes with a stronger impact on the habitat than the ground-rope used in the Norway pout fishery. The MSC assessment of the nephrops fishery awarded a partial SG80 in 2.4.1a, where we have given only a SG60. Our somewhat harsher judgment of a fishery with a lighter gear is based on the explicit knowledge of sea pens in the trawled area and by the absence of acknowledgement of potential issues and mitigating measures in the Norway pout fishery. Finally, the nephrops gave information (2.4.3) an SG85, where we have given a condition. Our condition was motivated by the absence of information of the combined impact of all trawl fisheries, in particular on the mud habitats.

General recommendations for forage fisheries: the Lenfest report

The increasing role of forage fisheries in the global oceans has motivated the “Lenfest forage fish task force” to develop recommendations for good management practice (Pikitch et al. 2012). The task force examined the impact of forage fishing on the forage fish and their dependent predators. Their work is summarized in recommendations on upper limits for the reduction in biomass and the level of fishing mortality that the stock can sustain without seriously affecting the population and the dependent predators. The recommendations are graduated with regards to the level of information present (low, intermediate and high). The North Sea would be considered a “high level” of information category. For this category the Lenfest report provides 5 recommendations:

1) “The harvest strategy must include an upper limit to F, a lower limit below which targeted fishing ceases (BLIM), and F should be reduced as BLIM is approached
2) The harvest strategy must include precautionary buffers that account for limits on the ability to predict fisheries and food web dynamics
3) In any case, lower biomass limits should not be less than 0.3 B0, and MAX F should not exceed 0.75 FMSY or 0.75M [B0 is unfished biomass and M is the total adult natural mortality].
4) The harvest strategy must—by independent, realistic, quantitative testing—be shown to achieve the Dependent Predator Performance Criterion, protect the forage fish stock from impaired reproduction, and allow it to recover through periods of natural fluctuations in productivity.
5) Apply spatial management to account for localized depletion effects on spatially constrained predators”

The assessment team has considered these recommendations for the reduction fishery. Recommendation 3, is difficult to evaluate, as ICES does not estimate the unfished biomass. Instead references biomasses, B_{lim} and B_{pa}, are estimated independently. Further, as described in P1, ICES does not operate with a Fmsy reference-point for sandeel. The natural mortalities are, however, available from the SMS run (Figure 34). It is clear, that the biomass fished in most cases are less than the biomass removed by natural causes (predation + “other” causes), and in most cases much less. Only for a few years for sandeel in areas 1-2 is the biomass fished of the same magnitude than natural causes. This means that fishing mortality is much less than 0.75 M, and recommendation #3 is therefore generously fulfilled for all three fisheries. The additional room in recommendation #3 accounts for the precautionary buffer in recommendation #2.

The “Dependent Predator Performance Criterion” (#4) means that management must: “…*adopt harvest strategies and management measures so that there is a greater than 95 percent chance that fishing on forage fish will not deplete any dependent predator population to levels that would meet the IUCN “vulnerable” criteria”.* This is addressed by P2.3 for birds and mammals and P2.5 for fish. As explained in the section on kittiwakes above, the sandeel fishery at Firth of Forth had previously depleted sandeel to a degree where it impacted kittiwake hatching success negatively. This led to a closure of the fishery. The Lenfest report explicitly note this as a “lesson learned” from the North Sea sandeel fishery.

Finally, the sandeel fishery has adopted a spatial management to account for local depletions of the stock. For sprat and Norway pout, spatial constrained predators is not an issue. Therefore recommendation #5 is also followed. Based on this the assessment team judges that the reduction fishery fulfils the Lenfest recommendations.

3.5 Principle Three: Management System Background

3.5.1 Legislative and Management Framework

European fisheries are managed through the European Union Common Fisheries Policy (CFP). The CFP started in 1983 and is reviewed every 10 years, with the most recent review coming into force in 1 January 2014 (Regulation (EU) No 1380/20143). This newly reviewed legislation aims to ensure that “fishing and aquaculture activities are environmentally sustainable in the long-term and are managed in a way that is consistent with the objectives of achieving economic, social and employment benefits, and of contributing to the availability of food supplies.”

Article 2 of the CFP specifies the new objectives: “the CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield (MSY). Furthermore, the CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavour to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment. In particular it shall, among other objectives, gradually eliminate discards; make the best use of unwanted catches; provide for measures to adjust the fishing capacity of the fleets to levels of fishing opportunities; take into account the interests of both consumers and producers; and be coherent with the Union environmental legislation.”

Under the CFP, specific legislation should be adopted for its implementation, and namely by multiannual management plans defining specific limits to set fishing opportunities and clear time-frames and safeguard mechanisms for unforeseen developments, discard plans with provisions and exemptions per fishery, and finally overarching technical measures regulation.

Other EU environmental legislation and international agreements that are applicable to habitats and species protection, but which are also relevant to fisheries activities are: the Marine Strategy Framework Directive (2008/56/EC) which obliges achieving a good environmental status by 2020; the Bird and Habitat Directives on the conservation of natural habitats providing the basis for the Natura 2000 networks; EC Regulation 812/2004 laying down measures concerning incidental catches of cetaceans; ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North

Seas); CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora); and finally the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).

At a national level, individual Member States are responsible for implementing the CFP and other EU legislation and agreements. EU fisheries legislation is transposed directly to national legislation, while environmental and other agreements are transposed by primary and secondary national legislation, enacted in accordance with the EU legislation.

Member States national fisheries administrations are responsible for a range of management and regulatory duties, including: fleet activity management; national quota management; the monitoring and control of all fisheries working within their national jurisdiction; the collection, collation, and communication of key fishery data; and finally undertaking a range of scientific monitoring and development work.

A Member State may take non-discriminatory measures to conserve and manage fish stocks, as well as maintain or improve the conservation status of marine ecosystems within 12 nautical miles of its baselines, as long as the EU has not adopted specific measures addressing conservation and management in that area or specifically addressing the problem identified by the Member State concerned. The Member State measures must be compatible with the objectives set out in CFP Article 2 and must be at least as stringent as the measures under Union law.

Denmark joined the EU in 1973 and has since accepted the provisions of the EU Common Fisheries Policy (CFP). The main fisheries law in Denmark is the 1999 Fisheries Act (Act No. 281 of 1999, consolidated as LBK No. 978 of 26 September 2008).

3.5.2 Consultation, Roles, Responsibilities, and Dispute Resolution

Extensive consultative processes are in place at national and European levels to debate policy, plans and management, and recent years have seen the introduction of more formal procedures to incorporate a wider stakeholder community within such consultations.

At a European level, key institutions are the Advisory Committee on Fisheries and Aquaculture (ACFA) which comprises a contact group at the European level for all stakeholders at national and regional levels - and Advisory Committees (ACs) - which comprise a contact group dealing with particular fisheries at the regional level.

At a national level in Denmark, administrations operate formal consultation procedures combining mailings on current issues and proposed changes to management systems and regular meetings are held with fishing industry and other key stakeholders covering a variety of issues such as fisheries, environment, engineering and others.

All member states have signed up to CFP, and are bound by European legislation. Disputes between Member States and the Commission are resolved in the Council of Ministers. Where appropriate, European legislation is enacted at the national level through relevant primary and secondary legislation. Formal procedures apply for the resolution of disputes through the national court systems. Ultimately, any European citizen or organization can take legal action against the Council of Ministers in the European Court of Justice. This is a system that is widely known and has been used when considered necessary.

The Ministry of Food, Agriculture and Fisheries (established by Royal Decree in December 1996) is responsible for fishing in Denmark. The aim of the Ministry of Food, Agriculture and Fisheries of Denmark is to provide the framework for: development and growth orientated food producing sector, responsible stewardship of natural resources; and food safety, consumers' choice and healthy eating habits. The ministry is divided in its political arm, which is in charge of policy development, minister related service and management; and the Danish Agrifish Agency that strives to create the best conditions for sustainable growth and green development in agriculture, horticulture and fisheries.

The Danish Agrifish Agency is responsible for regulating, monitoring, enforcement and inspection of fishing. It is also responsible for providing structural support from the European Maritime and Fisheries Fund (EMFF, Regulation (EU) No 508/2014). The agency also collects fisheries statistics and provides them to the EC. Finally, the agency includes three fisheries inspectorates and four fisheries inspection vessels, which are responsible for undertaking all control and enforcement activities in Danish waters and ports.

The main institutions involved in management of the sandeel, sprat, and Norway pout fisheries in the North Sea and Kattegat are:

- European Commission DG MARE – responsible for drafting European legislation on the management of European fisheries in accordance with the Common Fisheries Policy.
- Ministry of Food, Agriculture and Fisheries responsible for overall management of Danish fisheries.
- Danish Agrifish Agency, responsible for regulating, monitoring, enforcement and inspection of fishing, and providing structural support, e.g. from the European Maritime and Fisheries Fund.
- International Council for the Exploration of the Sea, ICES – provides the forum for consolidation of scientific work undertaken by scientists in participating national institutions (through relevant Expert Groups), and the delivery of advice on how best to manage fish stocks.
- European Commission's Scientific, Technical and Economic Committee for Fisheries, STECF – the fisheries scientific committee of the European Commission providing advice to the Commission on all aspects of fisheries science and economics.
- DTU-Aqua, national fisheries research institute, responsible for herring fisheries analysis and advice, including collaborating on stock assessment as part of the appropriate ICES working groups.
- The Danish and Fishermen's Association represent the interests of Danish fishermen national and internationally (ex. Advisory Councils).

All of these institutions have well established protocols covering their purpose, roles, operation, representation, consultation, and decision-making process, as well as for communicating policy, plans, decisions, and other information. Their roles are well understood and the interaction between them works effectively.

Regarding consultation, the Danish Fisheries Development Committee gives advice in matters related to the use of EMFF structural funds, priorities and mechanisms. Fishermen are represented on this Committee and have substantial input into its policy. The EU Committee (Paragraph 5 in the Danish Fisheries Law) is consulted in all matters related to the CFP and EU fisheries regulations. DFPO members are represented on this Committee. The ‘Paragraph 6’ Committee is also statutory and must be consulted in all matters related to regulation of Danish commercial fisheries. DFPO members are similarly represented here. Consultation with environmental NGOs appears to be more informal and they have no statutory role in the Committees mentioned above.

3.5.3 Long term and specific objectives for the fishery

As stated above, the newly reformed CFP has in its Article 2 specific precautionary and MSY objectives to reach sustainable fisheries, while it states that "in order to reach the objective of progressively restoring and maintaining populations of fish stocks above biomass levels capable of producing maximum sustainable yield, the maximum sustainable yield exploitation rate shall be achieved by 2015 where possible and, on a progressive, incremental basis at the latest by 2020 for all stocks".

The EU Marine Strategy Directive (Directive 2008/56/EC) also commits Members States to further foster the integration of environmental concerns into other relevant policies, such as the CFP, in order to achieve 'good environmental status' in the marine environment, through the development and implementation of national level policies based on an ecosystem approach, in order to meet the following targets by 2020[1]:

- populations of all commercially exploited fish and shellfish must be within safe biological limits, exhibiting an age and size distribution that is indicative of a healthy stock;
- all elements of the marine food web must occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity;
- biological diversity must be maintained and the quality and occurrence of habitats, and the distribution and abundance of species, are to be kept in line with prevailing conditions; and
- sea floor integrity is maintained at a level that ensures the safeguarding of structure and functions of the ecosystems.

Bird protection areas (with restriction/ban on fishing activities) have been designated under the auspices of the EU Birds Directive[2]. Natura 2000 areas in the North Sea and Skagerrak have been designated, and protection requirements include possible restrictions on fisheries.

For the three target species under assessment here, there are no Long Term Management Plans (LTMP), although TACs and quotas for the fishery has been set according to scientific advice from ICES from year to year, and there are implicit objectives within this framework for achieving the fisheries specific objectives laid out within the CFP and EU/Norway agreements.

3.5.4 Monitoring, Control and Surveillance

It is the responsibility of EU member states to enforce rules agreed under the CFP. An EU Community Fisheries Control Agency (CFCA) was established in 2007 to strengthen and coordinate controls across all national enforcement authorities to bring about improved uniformity and effectiveness of enforcement. This is further reinforced by the new EU control regulation which came into force on 1st January 2010, and aims to foster a new culture of compliance (1224/2009). In Denmark, the responsible authority is the Agrifish Agency. The introduction of e-logbooks has facilitated consistent enforcement and compliance.

Specifically on the topic of monitoring of non-target catch, both self-reporting in electronic logbooks and official sampling are employed. The self-reporting is done by visually assessing the catch as it rolls by on its way to the hold. There is no common procedure so each vessel develops its own. The official sampling is performed at sea or dockside by taking buckets from the holds. The number of samples taken is very low. The logbook

[1] http://ec.europa.eu/environment/marine/good-environmental-status/index_en.htm

[2] Directive 2009/147/EC of the European Parliament and the Council of 30 November 2009 on the conservation of wild birds (codified version).

reporting is controlled to be within 10% of the findings from the control's sampling. Both procedures are fairly uncertain, but generally report low catches of non-target species.

There is a significant discrepancy between the numbers from the logbooks and official landings: the logbooks report much smaller catch of non-target species than the control. This discrepancy is a concern that the fishery is urged to solve. The officially catches report the highest landings of non-target species, and these values are used in the assessments performed here, as an upper bound on the landings of non-target species.

Non-compliance is dealt with through the Danish criminal justice system, and using agreed and tested procedures.in event of an infringement being detected, details of the infringement are passed to the public prosecutor, who determines the appropriate fine / sanction. This process also enables the fisher to prepare a defense against the charge and provides full right of appeal.

Within the Danish fisheries organization, mechanisms exist to apply sanctions to vessels that break quota allowances (requiring additional quota to be sought).

The MCS system enforcing national regulations implementing the CFP, along with some self-regulation by the industry are consistently applied and expected to provide effective deterrence. In the sandeel fishery, vessels have quota for certain management areas and there has been misreporting of catch in the past (i.e. reporting from the wrong area; Agrifish 2015). The fact that this was detected demonstrates that there is an effective control system.

Within the DFPO mechanisms exist to apply sanctions to vessels that break their Code of Conduct, including the loss of MSC certification for fish that they land from certified fisheries.

In addition to this all DFPO member vessels are required to abide by their own code of contact (to be part of the MSC group), covering a wide range of compliance issues, with specific provisions relating to catches of ETP species.

3.5.5 Research and management system evaluation

ICES strategically establishes study groups based on information requirements-identified by national delegates, including through industrial representations.-Members of various ICES Working Groups focused on such elements as climate-change, plankton, multi-species fisheries (ecosystem), etc. All review research, identify research requirements and undertake appropriate work. There is good-communication between Working Groups (via ACOM), and between researchers-through their specialist interests.

Research / investigation is undertaken in relation to specific requirements, which-generally come from the recommendations of the Stock Assessment Working Group.-Members of the ICES community keep abreast of developments within the scientific-community of relevance to the fishery under consideration. This ICES community is wider than Europe and includes relevant research elsewhere.

The Danish AgriFish Agency is responsible for-the implementation of the Danish National Program for the collection of data in-the fisheries sector in in Denmark. This contributes to the EC Data Collection Framework (DCF) which evaluates the fisheries sector, i.e. the collection of economic, biological, and-global variables (fishery statistics) as well as fishery-independent surveys at sea.

There is a comprehensive system of routine monitoring of information relevant for management decision-making and stock assessment purposes. The monitoring program in place principally focuses on landings from the fishery, i.e. quota uptake, and implementation of the Landings Obligation, as well as catch sampling ashore to monitor catch composition. With the systems described in 3.2.3 this monitoring now forms a substantially more accurate reflection of actual fishing mortality. Additional monitoring is also in place to provide sufficient information to support stock-assessment purposes.

Additionally there is a well-established system to of management evaluations. For example, there have been a number of directly relevant evaluations of the management system. These include:

- Annual review of survey information and scientific advice (by ICES and STECF)
- Review of the CFP (every 10 years)
- Annual Reports on Fishing Fleet Capacity
- Annual report on implementation of the European Fisheries Fund

The ICES Working Groups also effectively serve as routine evaluations of management performance, by comparing fishery performance to pre-determined targets.

Environmental management addressing P2 elements is also subject to evaluation via the delivery of the Natura 2000 network. Catch reporting, including discarding and ETP interactions via observers, also enables the evaluation of P2 elements.

4 Evaluation Procedure

4.1 Harmonised Fishery Assessment

Although there are no other assessments of these three species that have taken place in this area, these fisheries do impact some of the same habitat types as other North Sea trawl fisheries that have been previously assessed. Two recent MSC assessments have evaluated the impact of bottom trawling in the North Sea: the "DFPO Denmark North Sea Plaice Fishery" assessment and the "Danish and Swedish Nephrops Fisheries (Danish)". Our evaluation of the habitat impact are generally consistent with these two assessments, though with some specific differences.

The plaice fishery has a condition on information on the different habitats, and active participation in the MPA process. This was based on a score of SG75 in 2.4.1. The plaice fishery is performed with bottom trawls fitted with tickler chains designed to lure the plaice up from the bottom and into the trawl. The gear used in the plaice fishery therefore has a higher potential impact on the bottom than the gear used in the present fishery for sandeel sprat and Norway pout, where tickler chains are not employed although the fishery takes place over similarly sandy habitat for sandeel and sprat. However, the Norway pout fishery takes place on a muddy bottom, which is more sensitive than the sand and gravel where the plaice fishery occurs. Taken together, the lighter gear but more sensitive habitat, makes our assessment and condition in 2.4.1 consistent with the plaice assessment.

The Nephrops fishery occurs on mud habitats similar to the NP fishery. The fishery is, however, heavier as it need to catch a benthic species, and therefore employs brushes with a stronger impact on the habitat than the ground-rope used in the NP fishery. The nephrops fishery gave a partial SG80 in 2.4.1a, where we have given only a SG60. Our somewhat harsher judgment of a fishery with a lighter gear is based on the explicit knowledge of sea pens in the trawled area and by the absence of acknowledgement of potential issues and mitigating measures in the Norway pout fishery. Finally, the nephrops gave information (2.4.3) an SG85, where we have given a condition. Our condition was motivated by the absence of information of the combined impact of all trawl fisheries, in particular on the mud habitats.

4.2 Previous assessments

There have been no previous MSC assessments of North Sea, Skagerrak or Kattegat sandeel, Norway pout, or sprat.

4.3 Assessment Methodologies

The DFPO North Sea, Skagerrak and Kattegat sandeel, Norway pout, and sprat fisheries were assessed against the default assessment tree contained in the MSC Certification Requirements version 1.3 (January 14th, 2013). The assessment process also followed the MSC Fisheries Certification Requirements version 2.0 (1 October, 2014).

4.4 Evaluation Processes and Techniques

4.4.1 Site Visits

Information supplied by the client and management agencies was reviewed by the assessment team ahead of the onsite meeting, and discussions with the client, fishermen, and management agencies centred on the content within the provided documentation. In cases where relevant documentation was not provided in advance of the meeting, it was requested by the assessment team and subsequently supplied during, or shortly after the meeting.

Thirty days prior to the site visit, all stakeholders identified by DFPO were informed of the visit and the opportunity to provide information to the auditors in advance of, or during, the site visit. We received a request from one stakeholder for a meeting with representatives of the industrial fish processing industry in Denmark.

The audit visit was held at the offices of DTU-Aqua in Charlottenlund, Denmark, at the offices of Danish Fishermen and the Danish AgriFish Agency in Copenhagen, Denmark, and in Skagen, Denmark between June 9th and 12th, 2015. Table X lists the participants in attendance and their affiliations, and Table X summarizes the participation, location, and topics of the meetings.

Note the site visit for the DFPO/DPPO sandeel, sprat and Norway pout fishery was conducted simultaneously with the site visit for the DFPO/DPPO/SPFPO herring fishery, but only topics discussed in relation to sandeel, sprat, and Norway pout are listed in the below agenda.

Table 30. List of site visit participants and their affiliations.

Name	Affiliation
Amanda Stern-Pirlot	MRAG Americas, Assessment team
Jake Rice	Assessment team
Ken Haste Andersen	Assessment team
Heinrich Mosegaard	DTU-Aqua
Morten Vinther	DTU-Aqua
Anna Rindorf	DTU-Aqua
Rasmus Nielsen	DTU-Aqua
Jacob Handrup	AgriFish Agency, Control coordinator
Bent Pallisgaard	AgriFish Agency, EU policy officer
Fridi Magnussen	Industrial fisherman, HG 265 ASBJØRN, Skagen harbour
Claus Vede	Industrial fisherman, S 105 SEBASTIAN, Skagen harbour
Gunnar Nolsø	Industrial fisherman, HG 62 BEINUR, Skagen harbour
Benny Rasmussen	Industrial fisherman, HM 379 LINGBANK, Skagen harbour
Jens Schneider Rasmussen	Industrial fisherman, HM 379 LINGBANK, Skagen harbour
Søren Anker Pedersen	Marine Ingredients Denmark
Peter Dørsig	Dørsig $ Partnere (processor)
Jonathan Broch Jacobsen	DFPO, client (all locations except AgriFish Agency and DTU-aqua)
Claus Sparrevohn	DPPO, client (all locations except AgriFish Agency and DTU-aqua)
Bengt Gunnarson	SPFPO, client for the herring assessment, Skagen harbour
Björn Lindblad	SPFPO, client for the herring assessment, Skagen harbour

Table 31. Summary of site visit participation, location, and meeting topics.

Date 2015	Location	Name (see above table for affiliation)	Topic
June 8, 2015	The Square Hotel, Copenhagen	Amanda Stern-Pirlot, Ken Haste Andersen, Jake Rice	Pre-site visit assessment team meeting to go over objectives and agenda for the site visit and discuss information reviewed in advance of site visit.
June 9, 2015	Charlottenlund—DTU Aqua	Amanda Stern-Pirlot, Ken Haste Andersen, Jake Rice Henrich Mosegaard Anna Rindorf Morten Vinther Rasmus Nielsen	Sandeel, sprat and Norway pout stock assessment and management in the North Sea and Skagerrak. The management arrangements with respect to TAC and quota allocation for sandeel, the allocation of bycatch quota, and information on seabird dependence were particular focuses
June 10, 2015	Skagen Harbor—Skagen Skipper School and Fishermen's association building	Amanda Stern-Pirlot, Ken Haste Andersen, Jake Rice Fridi Magnussen Claus Vede Gunnar Nolsø Benny Rasmussen Jens Schneider Rasmussen Jonathan Broch Jacobsen Claus Sparrevohn Bengt Gunnarson Björn Lindblad	Discussion of seasonality within the Danish industrial fisheries for the sandeel, sprat and Norway pout in relation to what is targeted when and how quota is used. Tour of an industrial fishing vessel where the captain was interviewed and vessel operations were viewed. In particular, discussion focused on the means of estimating bycatch of herring in the industrial fisheries and the differences between vessel estimation procedures and official sampling.
June 11, 2015 (morning)	Copenhagen-DFPO offices	Amanda Stern-Pirlot, Ken Haste Andersen, Jake Rice Jonathan Broch Jacobsen Claus Sparrevohn	Review of documents available at the time of the site visit and requests for information from the client for any gaps identified. Discussion of EU-Norway agreement in the context of sandeel management areas in the North Sea, and the existence of multiple indistinguishable sandeel species.
June 11, 2015 (morning)	Copenhagen-DFPO and Marine Ingredients Denmark offices	Amanda Stern-Pirlot, Ken Haste Andersen, Jake Rice Jonathan Broch Jacobsen Claus Sparrevohn Søren Anker Pedersen	The assessment team heard a presentation by Marine Ingredients Denmark and a representative from the Danish industrial fish processors and held a question and answer session about the MSC certification process and the

Date 2015	Location	Name (see above table for affiliation)	Topic
		Peter Dørsig	specific assessment process for these fisheries.
June 11, 2015 (afternoon)	AgriFish Agency, Copenhagen	Amanda Stern-Pirlot, Ken Haste Andersen, Jake Rice Bent Pallesgaard Jakob Handrup	Herring management and fishery enforcement in Denmark.

Standards and Guidelines used:
MSC Certification Requirements version 1.3
Guidance to the MSC Fisheries Certification Requirements version 2.0
MSC Full Assessment Reporting Template version 2.0

4.4.2 Consultations

See Table 30 and Table 31, above, with respect to details of the individuals interviewed during the site visit, and summary of topics discussed.

4.4.3 Evaluation Techniques

MRAG published an announcement of the assessment on our website, and the MSC posted the announcement on its DFPO/DPPO North Sea and Skagerrak sandeel, sprat and Norway pout webpage, as well as sent it by email in their Fishery Announcements newsletter to all registered recipients. At this time, MRAG Americas also announced the assessment site visit dates and location, as well as the assessment team. This was done according to the process requirements as laid out in MSC's Fisheries Certification Requirements v2.0. The site visit for this assessment was held at the same time as the site visit for the DFPO/DPPO/SPFPO herring fishery, and the announcements for both went to stakeholders in both fisheries. Together, these media presented the announcement to a wide audience representing industry, agencies, and stakeholders.

The assessment team and the clients set up meetings with Danish fishery management and science personnel, and industry and harvest-sector representatives relevant to the fishery assessment.

In the CR v1.3 default assessment tree used for this assessment, the MSC has 31 'performance indicators', seven in Principle 1, 15 in Principle 2, and nine in Principle 3. The performance indicators are grouped in each principle by 'component.' Principle 1 has two components, Principle 2 has five, and Principle 3 has two. Each performance indicator consists of one or more 'scoring issues;' a scoring issue is a specific topic for evaluation. 'Scoring Guideposts' define the requirements for meeting each scoring issue at the 60 (conditional pass), 80 (full pass), and 100 (state of the art) levels.

Note that some scoring issue may not have a scoring guidepost at each of the 60, 80, and 100 levels; in the case of the example above, scoring issue (b) does not have a scoring issue at the SG60 level. The scoring issues and scoring guideposts are cumulative; this means that a performance indicator is scored first at the SG60 levels. If not all of the SG scoring issues meet the 60 requirements, the fishery fails and no further scoring occurs. If all of the SG60 scoring issues are met, the fishery meets the 60 level, and the scoring moves to SG80 scoring issues. If no scoring issues meet the requirements at the SG80 level, the fishery receives a score of 60. As the fishery meets increasing numbers of SG80 scoring issues, the score increases above 60 in proportion to the number of scoring issues met; performance indicator scoring occurs at 5-point intervals. If the fishery meets half the scoring issues at the 80 level, the performance indicator would score 70; if it meets a quarter, then it would score 65; and it would score 75 by meeting three-quarters of the scoring issues. If the fishery meets all of the SG80 scoring issues, the scoring moves to the SG100 level. Scoring at the SG100 level follows the same pattern as for SG80.

Principle scores result from averaging the scores within each component, and then from averaging the component scores within each Principle. If a Principle averages less than 80, the fishery fails.

Scoring for this fishery followed a consensus process in which the assessment team discussed the information available for evaluating performance indicators to develop a broad opinion of performance of the fishery against each performance indicator. Review of sections 3.2-3.5 by all team members assured that the assessment team was aware of the issues for each performance indicator. Subsequently, the assessment team member responsible for each principle, filled in the scoring table and provided a provisional score. The assessment team members reviewed the rationales and scores, and recommended modifications as necessary, including possible changes in scores.

Performance Indicator scores were entered into MSC's Fishery Assessment Scoring Worksheet (see Table 35 below) to arrive at Principle-level scores.

Table 32. Scoring elements assessed in this report.

Component	Scoring elements	Main/Not main	Data-deficient or not
P1	*A.marinus* Area 1	N/A	Not
P1	*A.marinus* Area 2	N/A	Not
P1	*A.marinus* Area 3	N/A	Not
P1	*A.marinus* Area 4	N/A	Yes
P1	*A.marinus* Area 6	N/A	Yes
P1	Other sandeel species	N/A	Yes
P1	North Sea, Skagerrak and Kattegat Norway Pout	N/A	Not
P1	North Sea Sprat	N/A	Not
Retained	North Sea Herring	Main (sprat and Norway pout units) Minor (all sandeel units)	Not
Retained	Whiting	Minor	Not
Retained	Blue whiting	Minor	Not
Retained	Dab	Minor	Not
Retained	Flounder	Minor	Not
Retained	Haddock	Minor	Not
ETP	Harbour seal	N/A	Not
ETP	Grey seal	N/A	Not
ETP	Minke whale	N/A	Not
ETP	Roseate tern	N/A	Not
ETP	Spotted ray	N/A	Not
ETP	Thornback skate/ray	N/A	Not
ETP	Black-legged kittiwake	N/A	Not
Habitat	Sandy	N/A	Not
Habitat	Muddy	N/A	Not
Ecosystem	North Sea	N/A	Not

The RBF was used to evaluate sandeel in Areas 4 and 6, as well as “other sandeel species.” This was permitted by way of a variation granted by the MSC to hold an additional stakeholder consultation period following the site visit where it was discovered that there is in fact a complex of sandeel species about which little is known (as described under Principle 1), as well as a lack of quantitative stock assessments in Areas 4 and 6 where exploitation of sandeel is very low (see notification here: https://cert.msc.org/FileLoader/FileLinkDownload.asmx/GetFile?encryptedKey=2hsjHTRPK7qdaMOcs9NdinzTJrLGeOT5XRN9apjQOc/fmiWQLc7/uogJ/iTHpUKI) . A full description of the RBF proceedings and outcome is given in Appendix 1.3 as well as specifically under each Performance Indicator where it is relevant in Principle 1.

5 Traceability

The target eligibility date for this fishery is the date of the publication of the Public Comment Draft Report (12 January, 2017) per version 2.0 of the Fishery Certification Requirements. This date was chosen because it is the earliest possible date for eligibility. The traceability and segregation systems within the fishery are adequate to ensure proper product segregation.

5.1 Traceability within the Fishery

Table 33. Traceability Factors within the Fishery:

Traceability Factor	Description of risk factor if present. Where applicable, a description of relevant mitigation measures or traceability systems (this can include the role of existing regulatory or fishery management controls)
Potential for non-certified gear/s to be used within the fishery	All gears used in the sandeel, sprat, and Norway pout fisheries in Denmark are covered in the certified Units of Certification. Purchasers at the first point of sale have a protocol for ensuring they are receiving MSC certified species via referencing a live list of eligible vessels within the fishery as a whole.
Potential for vessels from the UoC to fish outside the UoC or in different geographical areas (on the same trips or different trips)	Low risk. Vessels are monitored with VMS, and TAC and quota are allocated to specific areas.
Potential for vessels outside of the UoC or client group fishing the same stock	The Danish industrial fishing fleet comprises the majority of the fishery on these three species in these areas. There are a few other EU vessels from Sweden and Germany who target these stocks, as well as a Norwegian fishery in the Norwegian waters of SA 3 for sandeel and for Norway pout in the North Sea. Within the Danish fleet, there is also potential for vessels outside the ‘client group’ (those not on the MSC lists within the DPPO membership) fishing on the same stocks. However, purchasers at the first point of sale have a protocol for ensuring they are receiving MSC certified fish via referencing a live list of eligible vessels within the fishery as a whole.
Risks of mixing between certified and non-certified catch during storage, transport, or handling activities (including transport at sea and on land, points of landing, and sales at auction)	As noted above, the buyers use the MSC vessel list, and already know the system from other certified stocks. A list of vessels eligible to use the MSC certificate is available to buyers at: http://mscfiskere.fiskeriforening.dk/opkoeber-forhandler/danske-msc-fartoejer/ This list is kept constantly up-to-date by the DPPO and DFPO, and buyers are instructed (and know this from previous certificates) that only vessels present on the online list are eligible.

Traceability Factor	Description of risk factor if present. Where applicable, a description of relevant mitigation measures or traceability systems (this can include the role of existing regulatory or fishery management controls)
	This is a reduction fishery and as such, the majority of the contents from the net are pumped on board vessels into the hold then again onto shore for processing. This means there is a risk of non-target species ending up in the final product. However as shown in Principle 2, the only significant amount of non target catch in these fisheries is of herring, and these herring stocks are already MSC certified, thus do not need to be assessed as IPI. Of other potential retained catch, the quantities are extremely negligible. There are sorting grates in the pout fishery that prevent the small quantity of non-target fish from mixing with pout, and in all fisheries, the pumping mechanism limits the size of fish that can be processed, therefore most of the non-target catch is mechanistically excluded through this means. Chain of custody commences at landing (either directly to processing plant, or though separated overland transportation to the plant).
Risks of mixing between certified and non-certified catch during processing activities (at-sea and/or before subsequent Chain of Custody)	There is no processing at sea, and the buyers use the MSC vessel list.
Risks of mixing between certified and non-certified catch during transhipment	There is no transhipment of these species.
Any other risks of substitution between fish from the UoC (certified catch) and fish from outside this unit (non-certified catch) before subsequent Chain of Custody is required	This is a reduction fishery and as such, the majority of the contents from the net are pumped on board vessels into the hold then again onto shore for processing. This means there is a risk of non-target species ending up in the final product. However as shown in Principle 2, the only significant amount of non target catch in these fisheries is of herring, and these herring stocks are already MSC certified, thus do not need to be assessed as IPI. Of other potential retained catch, the quantities are extremely negligible. There are sorting grates in the pout fishery that prevent the small quantity of non-target fish from mixing with pout, and in all fisheries, the pumping mechanism limits the size of fish that can be processed, therefore most of the non-target catch is mechanistically excluded through this means.

5.2 Eligibility to Enter Further Chains of Custody

Only North Sea and Skagerrak sandeel, sprat, and Norway pout caught by DFPO and DPPO-registered vessels in the manner defined in the Unit of Certification (Section 3.1) under restrictions detailed throughout the body of the final Public Certification Report for this fishery shall be eligible to enter the Chain of Custody (CoC). Any landings of these species from outside these UoCs can be identified as such because catches from different vessels, different gear types, different areas etc. must be kept separate during landing (EC 1224/2009).

Chain of custody commences at landing (either directly to processing plant, or though separated overland transportation to the plant), at which point the product shall be eligible to carry the MSC logo. There are no restrictions on the certified product entering further chains of custody. The DFPO/DPPO Danish sandeel, sprat, and Norway pout fishery does not require its own CoC certificate.

It is a legal requirement that buyers must document the exact origin (vessel, date etc.) of all fish, and any non-MSC certified sandeel, sprat, or Norway pout (either from non-certified vessels, non-certified areas or non-certified gears) would be identifiable to CoC holders as well as auditors. All this information is collected, stored and transferred in a single common industry-driven electronic traceability database (called SIF)– and linked to the individual boxes through RFID tags.

Fish covered in this assessment may be landed to Danish registered ports, or other registered ports in Norway and the EU. Landing ports are given below, however, there is no requirement for the vessels to land at ports named in this report.

Major landing ports in Denmark:
<u>Denmark:</u>
Gilleleje
Klintholm
Rødvig
Skagen
Hirtshals

5.3 Eligibility of Inseparable or Practically Inseparable (IPI) stock(s) to Enter Further Chains of Custody

No IPI stocks are involved in this certification. All species of sandeel that are not *A. marinus* are considered under Principle 1 as data-deficient scoring elements, for which the RBF was used to assess. They are indistiguishble from the target standeel and caught in unknown quantities, which is why they are ineligible as IPI stocks (IPI stocks may comprise no more than 15% of the total target catch).

6 Evaluation Results

6.1 Principle Level Scores

Table 34. Final Principle Scores

Final Principle Scores				
Principle	**Sandeel**	**Sprat**		**Norway Pout**
Principle 1 – Target Species	82.3	84.4		81.3
	Trawl	**Trawl**	**Purse seine**	Trawl
Principle 2 – Ecosystem	82.3	82.3	85.0	82.3
Principle 3 – Management System	87.5			

6.2 Summary of PI Level Scores

Table 35. Summary of Performance Indicator Scores

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in			Score		
						Either		Or		Sandeel	Sprat	Norway pout
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	0.333	0.1667	65	90	80
				1.1.2	Reference points	0.5	0.25	0.333	0.1667	80	80	80
				1.1.3	Stock rebuilding			0.333	0.1667	100		
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125			85	100	85
				1.2.	Harvest control rules & tools	0.25	0.125			75	70	75
				1.2.	Information & monitoring	0.25	0.125			80	80	80
				1.2.	Assessment of stock status	0.25	0.125			85	85	90
										purse seine	demer sal	
Two	1	Retained species	0.2	2.1.	Outcome	0.333	0.0667			85	85	
				2.1.	Management	0.333	0.0667			80	80	
				2.1.	Information	0.333	0.0667			90	90	
		Bycatch species	0.2	2.2.	Outcome	0.333	0.0667			100	100	
				2.2.	Management	0.333	0.0667			80	80	
				2.2.	Information	0.333	0.0667			75	75	
		ETP species	0.2	2.3.	Outcome	0.333	0.0667			90	90	
				2.3.	Management	0.333	0.0667			90	90	
				2.3.	Information	0.333	0.0667			80	80	
		Habitats	0.2	2.4.	Outcome	0.333	0.0667			80	70	
				2.4.	Management	0.333	0.0667			85	75	
				2.4.	Information	0.333	0.0667			95	75	
		Ecosystem	0.2	2.5.	Outcome	0.333	0.0667			80	80	
				2.5.	Management	0.333	0.0667			75	75	
				2.5.	Information	0.333	0.0667			90	90	
Three	1	Governance and policy								DK		
			0.5	3.1.1	Legal & customary framework	0.25	0.125			95		
				3.1.2	Consultation, roles &	0.25	0.125			95		
				3.1.3	Long term objectives	0.25	0.125			100		
				3.1.4	Incentives for sustainable fishing	0.25	0.125			90		
		Fishery specific management system	0.5	3.2.	Fishery specific objectives	0.2	0.1			70		
				3.2.	Decision making processes	0.2	0.1			80		
				3.2.	Compliance & enforcement	0.2	0.1			80		
				3.2.4	Research plan	0.2	0.1			90		
				3.2.5	Management performance	0.2	0.1			80		

6.3 Summary of Conditions

Table 6: Summary of Conditions

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/NA)
1	By the 4th annual audit, the management system must provide evidence that A. marinus stocks are at or fluctuating around target reference point for areas 1, 2, and 3.	Sandeel (Areas 1,2,3): 1.1.1	NA
2	By the 4th annual audit, information on 'other sandeel species' must either be sufficient to determine that this fishery is catching only negligible amounts of those species (less than 2% of the total catch) so they may be considered as IPI stocks; or information must be sufficient to determine that, within the RBF framework, susceptibility of other sandeel species to this fishery is low enough to raise the RBF-derived MSC score for these species to greater than 80.	Sandeel: Other sandeel species	NA
3	By the fourth annual audit, well defined harvest control rules must be in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached for sandeel areas 1-3	Sandeel: 1.2.2	NA
4	By the 4th annual audit, there must be well defined harvest control rules in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	Norway pout: 1.2.2	NA
5	By the 4th annual audit, there must be well defined harvest control rules in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	Sprat: 1.2.2	NA
6	By the 4th annual audit there must be positive evidence that slipping is not occurring in the sprat and Norway pout fisheries. This information should be sufficient to act as qualitative information and some quantitative information available on the amount of main bycatch species (herring) taken by the sprat and Norway pout fisheries.	2.2.3 (purse seine/sprat)	NA
7	By the 4th annual audit, the client must be able to demonstrate that the fishery is unlikely to cause serious or irreversible harm to sensitive habitats, particularly the muddy Fladen ground habitat..	2.4.1 (Norway pout for bottom gear)	NA
8	By the fourth annual surveillance audit, there must be some objective basis for confidence that the partial strategy for achieving the habitat outcome level of 80 or above will work, based on information directly about the fishery and/or habitats involved.	2.4.2 (muddy substrate/Fladen ground)	NA
9	By the fourth annual surveillance audit sufficient data must continue to be collected to detect any	2.4.3	NA

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/NA)
	increase in risk to habitat types affected by this fishery.		
10	By the fourth annual audit, short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, must be explicit within the fishery-specific management systems for sandeel, sprat, and Norway pout.	3.2.1	NA
11	By the fourth annual audit, there must be some evidence that measures comprising the partial strategy to ensure the sprat fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function, are being implemented successfully.	2.5.2	NA

6.4 Recommendations

Recommendation 1 (PIs 2.5.2 and 2.5.3): The assessment team has noted that the stomach samples used for the main fish species in the multi-species modelling are dated (latest from 1991). This is not currently a serious concern as the stomach sampling only supports the preferences of species, not the actual impacts (M2s), which are continuously updated. The incipient recovery of large gadoid species in the North Sea may lead fundamental changes in wiring of the trophic network in the fish community. Information about that can only be obtained by new stomach samples. We therefore recommend that stomach sampling is updated to maintain confidence in the models supporting multi-species management.

Recommendation 2 (PI 2.1.3): The assessment team has noted a systematic discrepancy between the numbers from the logbooks and official landings: the logbooks report much smaller catch of non-target species than the official landings. We recommend that the source of this discrepancy is found and measures are taken to bring the two set of numbers into accord.

Recommendation 3 (PIs 2.1): The assessment team recommends that the code of conduct developed by the DFPO and DPPO be updated to explicitly mention slipping.

Recommendation 4 (PIs 2.3): The assessment team recommends that new censuses of sensitive shore birds are performed in the near future.

6.5 Determination, Formal Conclusion and Agreement

(REQUIRED FOR FR AND PCR)

Based on the above results, the DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, sprat and Norway pout fishery under assessment meets the MSC requirement that each MSC Principle has an aggregated, weighted score higher than the required score of 80. Additionally, as indicated in the summary of scores table, no individual Performance Indicator scored less than 60. As such, **it has been determined that this fishery is recommended for certification under the MSC Sustainable Fishery program.**

(REQUIRED FOR PCR)

1. The report shall include a formal statement as to the certification action taken by the CAB's official decision-makers in response to the Determination recommendation.

6.6 Changes in the fishery prior to and since Pre-Assessment

N/A

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Appendices

Appendix 1 Scoring and Rationales

Appendix 1.1 Performance Indicator Scores and Rationale

Principle 1 Sandeel

Evaluation Table for PI 1.1.1 – Sandeel

<table>
<tr><td colspan="2">PI 1.1.1</td><td colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>It is likely that the stock is above the point where recruitment would be impaired.</td><td>It is highly likely that the stock is above the point where recruitment would be impaired.</td><td>There is a high degree of certainty that the stock is above the point where recruitment would be impaired.</td></tr>
<tr><td>Met?</td><td>Area Outcome
1 Y
2 Y
3 Y
4 See RBF results
6 See RBF results
Other sandeel species: See RBF Results</td><td>Area Outcome
1 Y
2 Y
3 Y
4 See RBF results
6 See RBF results
Other sandeel species: See RBF Results</td><td>Area Outcome
1 N
2 N
3 N
4 See RBF results
6 See RBF results
Other sandeel species: See RBF Results</td></tr>
<tr><td>Justification</td><td colspan="3">All sandeel management units show very weak dependence of recruitment on SSB, with high CVs on fitted stock recruit relationships. However all sandeel management units also show an increasing likelihood of poor recruitment at very low SSB, and a decreasing likelihood of particularly strong year-classes at low SSB as well, although inflection points in an S-R relationship are very poorly defined. (ICES 2015a, 2014a stock annex, figure 4.1). There is evidence that physical oceanographic conditions may play a role in both the production of exceptionally strong year classes (favourable environment), and exceptionally poor ones (Unfavourable environment) (Arnott and Ruxton 2002, Bergsted et al.2001, Gauld and Hutcheson 1990, Van Dours et al. 2009) Therefore a specific biomass below which recruitment would be impaired is poorly defined for each stock until, although escapement limits have been set for each unit (see 1.1.1b).

For area 1, sandeel SSB is estimated to be 179,000 t (ICES 2015a, Table 11.2.9), which is above the SSBs consistently associated with below average recruitments, and in a neighborhood where strong year-classes have been produced in some years (ICES 2015a, Figure 11.2.7 and ICES 2014, stock annex Figure 4.1 top panel).</td></tr>
</table>

<table>
<tr><th colspan="2">PI 1.1.1</th><th colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</th></tr>
<tr><td></td><td></td><td colspan="3">For area 2, sandeel SSB is estimated to be 91,500 t (ICES 2015a, Table 11.3.8), which is above the SSBs consistently associated with below average recruitments, and in a neighborhood where strong year-classes have been produced in some years (ICES 2015a, Figure 11.3.7 and ICES 2014a, stock annex Figure 4.1 middle panel).

For area 3, sandeel SSB is estimated to be 202,000 t (ICES 2015a, table 11.4.9), which is above the SSBs consistently associated with below average recruitments, and in a neighborhood where average or above average year-classes usually have been produced in some years (ICES 2015 Figure ICES 2014a, stock annex Figure 4.1 bottom panel).

Thus scoring guidepost SG 80 met for all three management units. However, with substantial uncertainty regarding the stock-recruit relationship, the location of an inflection point in that relationship, and in actual SSB the guidepost of SG 100 requiring a high degree of certainty is not met.

Areas 4 and 6 were assessed against this PI using the Risk Based Framework (see Appendix for full results), and an MSC score of 98 was received for Area 4, while Area 6 received a score of 88.

The indistinguishable sandeel species that could potentially be caught alongside the lesser sandeel in all areas received MSC scores of 61 for this PI.</td></tr>
<tr><td rowspan="3">b</td><td>Guide post</td><td></td><td>The stock is at or fluctuating around its target reference point.</td><td>There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.</td></tr>
<tr><td>Met?</td><td></td><td>Area Outcome
1 N
2 N
3 N
4 See RBF results
6 See RBF results
Other sandeel species: See RBF Results</td><td>Area Outcome
1 N
2 N
3 N
4 See RBF results
6 See RBF results
Other sandeel species: See RBF Results</td></tr>
<tr><td>Justification</td><td colspan="3">Unit 1 – the SSB has been fluctuating around the B_{lim} for this unit since 2000, with SSB below B_{lim} for eight of the 16 years (ICES 2015a Table 11.2.9 and Figure 11.2.10 – middle panel.). It has only been above B_{pa}, which functions in the scientific advice as if it were a management target, for four of those years. So that although the stock is presently between its B_{lim} and its B_{pa}, it has been fluctuating below its target reference point for most of the past 15 years. Hence SG 80 is not met,

Unit 2 – The SSB the SSB has been fluctuating between B_{lim} and B_{pa} for this unit since 2000. SSB has been below B_{lim} for only four of the 16 years, but</td></tr>
</table>

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing
	It has only been above B_{pa}, which functions in the scientific advice as if it were a management target, for four of those years as well (ICES 2015a Table 11.3.8 and Figure 11.3.10 – middle panel.). So that although the stock is presently nearly at its B_{pa}, it has been fluctuating below its target reference point for most of the past 15 years. Hence SG 80 is not met. Unit 3 – the SSB has been fluctuating around or below the B_{lim} for this unit since 2000, with SSB below B_{lim} for 11 of the 16 years (ICES 2015a Table 11.4.9 and Figure 11.4.10 – middle panel.). It has only been above B_{pa}, which functions in the scientific advice as if it were a management target, for three of those years. So that although the stock is presently above its B_{pa}, due to recruitment of a very strong year-class, it has been fluctuating well below its target reference point for most of the past 15 years. However, since 2009, SSB has been above B_{pa} for 3 of the 6 years, and below B_{lim} for only two of them. Hence for the more recent period the stock has been fluctuating around B_{pa}. With the addition of an F_{cap} to the de facto harvest strategy (see 1.2.1) and an apparent modest improvement in recruitment in the 2010's, the more recent period may be more indicative of present stock dynamics and population development. Hence the SG 80 is at least approximated and may be met.
References	Arnott, S.A., and Ruxton, G.D. 2002. Sandeel recruitment in the North Sea: demographic, climatic and trophic effects. Marine Ecology Progress Series 238:199–210. Bergstad, O.A., Høines, A.S., and Krüger-Johnsen, E.M. 2001, Spawning time, age and size at maturity, and fecundity of sandeel, Ammodytes marinus, in the north-eastern North Sea and in unfished coastal waters off Norway Aquatic Living Resources 14: 293−301 Gauld, J.A., and Hutcheson, J.R., 1990. Spawning and fecundity in the lesser sandeel, Ammodytes marinus Raitt, in the north-western North Sea. Journal of Fish Biology 36, 611–613. ICES. 2014. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp. (Part 11, and Stock Annex for Sandeel) ICES. 2015d. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11) Van Deurs, M., van Hal, R., Tomczak, M.T., Jónasdóttir, S.H., Dolmer, P. 2009. Recruitment of lesser sandeel Ammodytes marinus in relation to density dependence and zooplankton composition. Marine Ecology Progress Series 381: 249–258

Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Target reference point	Consistent with ICES practice, B_{pa} was set to manage the risk of SSB falling below B_{lim} due	Area 1 – 215,000 t Area 2 - 100,000 t Area 3 – 195,000 t.	2015 estimates of SSB from ICES 2015a (tables 11.2.9, 11.3.8, and 11.4.9), and Percent of B_{pa}. Which is the de facto target

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
	to uncertainty in the assessment. Thus is if the 90th percentile of the estimate of Blim (see below) taking into account the CV on biomass estimates in the assessment (ICES 2014 Stock annex). Although B_{pa} is a risk management tool for avoiding falling below a limit, in the EU it is treated like a management target (which does not fully allow for the fact that by treating B_{pa} as a target with SSB varying without trend around it, such management will have the stock at a higher than 10% risk of being below the B_{lim} in half of all years.		Area 1 – 178,700 t, which is 83% of B_{pa} Area 2 – 91,545 t, which is 91% of B_{pa} Area 3 – 202,100 t, which is 104% of B_{pa}
Limit reference point	Inspection of the stock–recruitment plots from area 1, 2 and 3 revealed a decrease in recruitment at low SSB in all areas (ICES 2014 – Stock Annex Figure 6.4.1). However, no clear plateau was visible and this was reflected in a very flat surface of the likelihood when attempting to estimate. Consequently a B_{lim} was set based on evaluation of historic	Area 1 – 160,000 t Area 2 - 70,000 t Area 3 - 100,000 t	2015 estimates of SSB from ICES 2015a (tables 11.2.9, 11.3.8, and 11.4.9), and Percent of Bpa. Which is the de facto target Area 1 – 178,700 t, which is 112% of B_{lim} Area 2 – 91,545 t, which is 131% of B_{lim} Area 3 – 202,100 t, which is 202% of B_{lim}

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
	patterns of trend in SSB and Recruitment. For area 1 and 2, B_{lim} was set as the median biomass in a set of years of low SSB (2000–2006), when most recruitments were also below average. In area 3, B_{lim} was set at 100 000 t, encompassing the lowest eight SSBs recorded in the time series (2001–2007). The level was set at the highest SSB observed in the period rather than the median as there has been no really good recruitment years in the latter half of the period.		

OVERALL PERFORMANCE INDICATOR SCORE: 65

Element	Score
Area 1	70
Area 2	70
Area 3	70
Area 4	98
Area 6	88
Other sandeel species	61

CONDITION NUMBER 1,2

Condition 1: By the 4th annual audit, the management system must provide evidence that A. *marinus* stocks are at or fluctuating around target reference point for areas 1, 2, and 3.

Condition 2 (other sandeel species): By the 4th annual audit, Information on 'other sandeel species' must either be sufficient to determine that this fishery is catching only negligible amounts of those species (less than 2% of the total catch) so they may be considered as IPI stocks; or information must be sufficient to determine that, within the RBF framework, susceptibility of other sandeel species to this fishery is low enough to raise the RBF-derived MSC score for these species to greater than 80.

Evaluation Table for PI 1.1.2 – Sandeel

<table>
<tr><th colspan="2">PI 1.1.2</th><th colspan="3">Limit and target reference points are appropriate for the stock</th></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.</td><td>Reference points are appropriate for the stock and can be estimated.</td><td></td></tr>
<tr><td>Met?</td><td>Area 1 - Y
Area 2 - Y
Area 3 – Y</td><td>Area 1 - Y
Area 2 – Y
Area 3 - Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Reference points for short-lived stock with large inter-annual variation in recruitment and strong impacts of environmental conditions on year-class strength were considered in detail in ICES Study Group SGPRP, and documented in SGPRP advised that B_{lim} should be set after evaluation of historic patterns (ICES 2003, particularly Figures. 6.4.2 to 6.4.4). That expert group concluded that Biomass reference points for ensuring a minimum SSB after removals for harvests and natural mortality were an appropriate and feasible approach for such stocks. Use of such reference points would allow F to vary with recruitment variation, and close the fishery when periods of weak recruitment occurred.
The approach was reconsidered by the ICES MSY benchmarking workshop (ICES 2014b), and for other similar stocks it was concluded that an F_{cap}, limiting fishing mortality in years when SSB was large due to strong recruitment, was necessary for management to be precautionary. Values for F_{cap} have been explored for these management units of sandeel, but have not yet been fully incorporated in ICES advice. This will be discussed further in 1.2.1.
The estimates of B_{lim} and $B_{escapement}$ (Bpa), are considered appropriate for the units 1 and 3, particularly if they are accompanied by an F_{cap} when the stocks are substantially larger than they are at present, and the SG 80 is met for these two stock units.

As Areas 4 and 6 and the other sandeel species were scored using the RBF, they receive a score of 80 by default in this PI per MSC requirements.</td></tr>
<tr><td rowspan="3">b</td><td>Guide post</td><td></td><td>The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.</td><td>The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.</td></tr>
<tr><td>Met?</td><td></td><td>Area 1 – Y
Area 2 – Y
Area 3 - Y</td><td>Area 1 – N
Area 2 – N
Area 3 – N</td></tr>
<tr><td>Justification</td><td colspan="3">With the inflection point and plateau in the relationship between SSB and recruitment poorly defined for sandeel in all three areas, it is not possible to have high confidence that any biomass reference point will ensure a high</td></tr>
</table>

PI 1.1.2		Limit and target reference points are appropriate for the stock		
		likelihood of maintaining the stock above levels where there is an appreciable risk of impairing reproductive capacity (ICES 2015a, 2014a). Particularly given the changes documented in oceanographic conditions in the southern and central North Sea (Beaugrand 2004, Drinkwater 2010, Reid et al. 2001) it could even be that different escapement biomasses might be required under different conditions. A fully precautionary management approach would have considered these factors more fully. However, with the data available and given the variation in year-class strength due to factors other than SSB, the limit reference point is a reasonable limit for keeping the SSB I areas where likelihood of impaired productivity is as low as can be achieved by management. This Justification would apply to all three sandeel management units for which reference points have been used in formulating the science advice. Thus SG 80 is met for all the units.		
c	Guide post		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		Area 1 – Y Area 2 – Y Area 3 - Y	Area 1 – N Area 2 – N Area 3 – N
	Justification	Both the Study group SGPRP in 2003 and the workshop on MSY and MSY surrogate reference points in 2013 concluded that if $B_{escapement}$ values were set at a level that maintained a low likelihood that the SSB would fall below a biologically based B_{lim}, then $B_{escapement}$ would be a suitable surrogate for B_{msy}. Actual values of MSY are difficult to estimate for short lived stock experiencing high recruitment variation due to environmental conditions and exposed to high predation mortality on most or all ages. In fact, MSY estimates would not be stable in the face of changing spectra of predator abundances and sized, since such variation would change predation mortality levels on the populations, and require recalculating MSY each time the predator field changed substantially (ICES 2014b). In such cases surrogates for MSY with more inter-annual stability might be preferred to MSY-type reference points, as long as there was a sound biological basis for consider the surrogate to ensure, to the extent possible given the population dynamics of the species, high productivity of the species and appropriately high yields on the stock over the medium term. As described in 1.1.2 a and b, the $B_{escapement}$ (B_{pa}) reference points for all three stock have those properties, and would be appropriate surrogates for MSY. The estimation of the reference points does take into account the ecological role of the species in the ecosystem. However, given the large uncertainties in the annual assessments, the large variation in recruitment, and the poorly determined relationship between SSN and recruitment, there		

PI 1.1.2		Limit and target reference points are appropriate for the stock		
		is not a high degree of certainty in the effectiveness of the target reference point. This justification applies to all three stock units for which reference points have been set. SG 80 is met for all the units.		
d	Guide post		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
	Met?		Areas 1-3 – Y	
	Justification	Sandeel are a lower trophic level species complex. The target reference points for Area 1-3 were derived from stock recruit data and uncertainty in both single species and multispecies assessment models (SMS – ICES 2014c– WGSAM, see also ICES 2009). The annual single species assessments focus on relationships between catches and effort levels, and survey results as direct estimates of abundance of the various age groups. However, it was the multispecies models that were used to test the performance and robustness of the reference points and harvest strategies for area 1 – 3. In the multispecies models natural mortality values are estimated with the most current data available on a spectrum of predators and prey abundances in the North Sea, including fish, seabirds, and marine mammals. The ability of these multispecies models to account for the needs of predators are examined in depth in P2. Consequently the de facto target reference point for Areas 1-3 does allow for predation by a wide spectrum of fish, seabird and marine mammal predators, taking the ecological role of the species into account. The $B_{escapement}$ target reference point for each unit is considered a surrogate (proxy) for an MSY-based reference point for these key lower trophic level sandeel stocks(ICES 2014a), The scoring guidelines for CB 2.3.17 to 2.3.19 all require that the "ecosystem needs" for the species be taken into account. More specifically, 2.3.17 sets standards for the target reference point in terms of percentage of B_0 for the stock, or more than half the "ecosystem needs". For these sandeel management units, no estimate of B_0 was made, because ICES deals with needs of predators explicitly in the assessments (ICES 2014b). This is a more robust strategy, and consistent with MSC CR v1.3 section CB2.3.20, because the notion of a B_0 for a stock with the recruitment dynamics of sandeel is highly questionable as a basis for any management target. Likewise the concept of B_0 for a system that has been exploited for as long as the North Sea is questionable. Rather for the North Sea ICES estimates the "ecosystem needs" empirically for key LTL stocks as part of the SMS modeling (ICES 2014b). Then the needs of the ecosystem are fully accounted for even before the target is estimated.. Extensive simulation modelling reported in ICES 2010, ICES2014a, and ICES 2014c all demonstrate that the approach explicitly accounting for predation mortality before calculating SSB, fully allows the proxies to fully meet the estimated ecosystem needs both for target and limit reference points. Thus the defaults specified in CB 2.3.17-19 are all met or exceeded.		

PI 1.1.2	Limit and target reference points are appropriate for the stock
References	Boulcott P., and Wright P. J. 2011. Variation in fecundity in the lesser sandeel: implications for regional management. Journal of the Marine Biological Association of the United Kingdom. 93: 1273-1280. Gauld, J. A. 1990. Spawning and fecundity in the lesser sandeel, Ammodytes marinus (Raitt), in the north-western North Sea. Journal of Fish Biology, 36: 611–613. Holland, G. J., Greenstreet, S. P. R., Gibb, I. M., Fraser, H. M., Robertson, M. R. 2005. Identifying sandeel Ammodytes marinus sediment habitat preferences in the marine environment. Marine Ecology Progress Series, 303: 269–282. ICES (2003) Study group on Precautionary Reference Points for Advice on Fishery Management (SGPRP). ICES CM 2003/ACFM: 15 (2003) ICES. 2008. Report of the Working Group on Multispecies Assessment Methods (WGSAM). ICES CM 2008/RMC:06. ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 201 pp. ICES. 2014a. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp. (Part 11, and Stock Annex for Sandeel)) ICES. 2014b. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 20–24 October 2014, London, UK. ICES CM 014/SSGSUE:11. 104 pp. ICES. 2014c. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp. ICES. 2014c. Interim Report of the Working Group on Multispecies Assessment Methods(WGSAM), 20–24 October 2014, London, UK. ICES CM 2014/SSGSUE:11. 104 pp. ICES. 2015d. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11) Jensen, H., Rindorf, A., Wright P. J., and Mosegaard, H. 2010. Inferring the location and scale of mixing between habitat areas of lesser sandeel through information from the fishery. ICES Journal of Marine Science. 68:45-51.

OVERALL PERFORMANCE INDICATOR SCORE: **80**

Element	Score
Area 1	80
Area 2	80
Area 3	80
Area 4 (per RBF)	80
Area 6 (per RBF)	80
Other sandeel species (per RBF)	80

PI 1.1.2	Limit and target reference points are appropriate for the stock
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 1.1.3 – Sandeel

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?	All units Y		All units Y
	Justification	Considering the status of sandeel over the past decade, the stocks were below $B_{escapement}$ and in some cases below B_{lim} for several years. Although to poor stock status was considered to be a consequence of poor recruitment because of unfavorable environmental conditions (See Justifications for 1.1.2) the stock technically qualified as depleted. All those measures were implemented, including application of an Fcap in scientific advice. The effectiveness of the combination of measures is demonstrated by the very rapid recovery of all management units to above Bpa, as soon as even average year-classes again recruited to the stock. Therefore there is strong evidence that rebuilding is complete within the shortest possible timeframe given the recruitment dynamics of the stock (ICES 2015 Figures 11.2.10, 11.3.10. and 11.4.10). Note per MSC requirements, this PI is not scored for those scoring elements for which the RBF was used (Areas 4 and 6 and other sandeel species).		
b	**Guide post**	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
	Met?	all units Y	all units Y	all units Y
	Justification	For all three stock units the stock rebuilt within one generation, as soon as an average or near-average year class recruited to the stock. This empirically demonstrated that harvest rates are now being managed at a		

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
		level that allows rapid growth of the stock from a series of poor year-classes, as soon as an average or better than average recruitment occurs.		
c	Guide post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
	Met?	All units Y	All units Y	
	Justification	The annual assessments are sufficient to demonstrate stock status relative to the reference points.		
References		ICES. 2014d. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 014/ACOM:06. 1257 pp. (Part 11, and Stock Annex for Sandeel)) ICES. 2015c. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11)		
OVERALL PERFORMANCE INDICATOR SCORE:				100
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.1 – Sandeel

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y	Area 1 – N Area 2 – N Area 3 – N Area 4—N Area 6—N

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
		Other sandeel spp. – Y	Other sandeel spp. – Y	Other sandeel spp. –N
	Justification	For Areas 1-3: The Danish fishery in Area 1-3 is managed by the EU, with regulations on gears and fishing operations, and area-based TACs and opening and closing times. Until 2015, ICES advice on the area based TACs applied a $B_{escapement}$ strategy. This strategy identifies a Biomass escapement minimum for each area that is considered sufficient to ensure recruitment is not impaired by inadequate spawning biomass, taking estimates of natural mortality and some uncertainties in the assessment into account. The SSB estimated for the fishing year in the annual assessment is compared to the $B_{escapement}$, and the maximum TAC is the difference between current SSB and $B_{escapement.}$ If the current SSB is less than $B_{escapement}$, the scientific advice is for no fishery in that area (ICES 2010, 2015). The $B_{escapement}$ harvest strategy was reviewed in 2010 and found to be suitable for the stock (ICES 2010). However in the WGMSY review in 2014 (ICES 2014) found that in general $B_{escapement}$ strategies were not adequately precautionary unless an F_{cap} was also implemented. The F_{cap} is an upper limit on fishing mortality that that should be applied in years when the annual SSB estimate is substantially larger than $B_{escapement}$. It required that no matter how large the difference between current SSB and $B_{escapement}$, harvests should be restricted to a size where the realized F on the stock does not exceed F_{cap} ICES advice on sandeel in Areas 1-3 applied the $B_{escapement}$ harvest strategy until 2014, and in 2015 added the F_{cap}, although future work to refine estimates of area-specific F_{cap} values is needed (ICES 2015). The EU annual regulations included quotas that were generally consistent with the ICES advice. This included closing some areas to sandeel fishing during the periods of low biomass in 2002-2006 and then at the end of the 2000s (depending on Area). The 2015 quotas are also consistent with the scientific advice that included consideration of preliminary estimates of F_{cap} for the three areas (ICES 2015). The two components of the harvest strategy – $B_{escapement}$ and F_{cap} – do work together to manage harvests consistent with a precautionary approach. Both components are responsive to the state of the stock, with one offering protection to the resource when SSB is low and the other protecting against overfishing when the biomass is high. Both components have been examined in simulations and Management Strategy Evaluations and should achieve precautionary management if fully implemented. On those standards the harvest strategy should meet the SG 60, 80 and 100 guideposts. However, the management authority for the Unit of Certification has not formally adopted the harvest strategy nor its component reference points, and has not even developed a full management plan for the fishery (ICES 2015a, 2014b). Therefore, even though past decisions on area-specific quotas generally have not exceeded TACs advised by ICES, there is no certainty that decisions will remain consistent with scientific advice over the duration of the certification. Further, coordination of the harvest strategy with Norway has not occurred, demonstrating that the strategy is not		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
		designed to achieve stock management objectives. This prevents the harvest strategy from reaching SG100. For Areas 4 and 6 (and 5 and 7) the harvest strategy is for total closure or for allowance of only harvests large enough to monitor developments in the stock. However, the Fs associated with these monitoring TACs are expected to be very small, and not contribute to any depletion of the sandeel within the area. In many years the industry does not even take the monitoring TAC in Areas 5 and 7, if larger fishing opportunities are available in area 1-3. In Area 6 the annual harvests have been decreasing in recent years, consistent with precautionary ICES advice, and have only exceed 500 tons once since. These strategies for areas 4-7 are considered highly effecting in preventing the fishery from depleting the resource or affecting availability of sandeel to dependent predators. So the SG 80 is met. Other sandeel species have varying degrees of overlapping distribution with *A. marinus* and the sandeel fishery depending on fishing area, although their distributions are not well known. However, since they are not the target of the fishery in any area, and we do know that at least 75% of the catch overall is A. marinus, logic leads us to the conclusion that the harvest strategy for these species is at least as precautionary as for Areas 4 and 6. MSC guidance for this indicator when the RBF is used is to put the harvest strategy in the context of the ability to ensure the risk of exploitation does not increase, e.g. through changing the risk score for one or more susceptibility attributes. Again, what is known about the distributions of the different species relative to each other and the fishery allows us to do this. SG 80 is met.		
b	**Guide post**	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp. - Y	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp. - Y	Area 1 – N Area 2 – N Area 3 – N Area 4—N Area 6—N Other sandeel spp. - N
	Justification	The harvest strategy used in the ICES advice and de facto in guiding the management decisions has been tested with simulations in a management strategy evaluation framework at the last sandeel benchmark workshop (ICES 2010), and the added F_{cap} component has been examined for stocks with life history characteristics similar to sandeel at the MSY workshop (ICES 2014b) and in the most recent sandeel assessment (ICES 2015a). The strategy cannot be considered fully tested until there is more		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
		information about the performance of the strategy with both components specifically parameterized for the three area where sandeel fishing has been concentrated. There is evidence from the trajectory of annual SSBs in assessments that the harvests are being managed in ways that reduce or eliminate harvests at times of weak recruitment, which in a short-lived species would lead to rapid decreases in SSB even if the stock were unfished. The de facto management objectives of maintaining the stock at or above $B_{escapement}$ has not been fully realized, because of sequences of weak year-classes that recruited to the area in the early and the end of the 2000s. However, in those years the harvest strategy did reduce the rate of decline of the stock units during those periods. Hence the SG 80 guidepost can be considered to be met. However because the harvest strategy is unable to maintain stocks at the de facto target levels, the SG 100 guidepost is not met. Moreover the concerns about the harvest strategy not being formally adopted by the management authority remain. The condition that would address the concerns in 1.2.1a would address the concerns for this scoring criterion as well. For area 4, 5, 6, and 7 the strategy of complete closures or only harvests large enough to track developments in the stock is succeeding in preventing the fishery from reducing the stock and possibly affecting dependent predators on sandeel. However, with such limited harvesting opportunities presented by the "Monitoring" TACS, in some years it was been difficult to attract any fishing at all to areas 5 and 7. In area 6 there has some catch under the monitoring cap in each year, but the information are insufficient to conduct an assessment of stock status and trajectory. Thus the management objective of gaining monitoring information on the stock is not being fully met. Hence SG 80 is being met for those areas, but SG 100 is not. As above, other sandeel species are not separately managed and they are considered data-deficient. However, because the harvest strategy for all the sandeel areas under evaluation has shown evidence of effectiveness, it can logically be inferred that, since other sandeel species are only incidentally caught as part of the A. marinus fishery (potentially in all sandeel management areas), that this judgement applies here as well. SG 80 us given.		
c	**Guide post**	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Area 1 – Y Area 2 – Y Area 3 – Y Area 4 – Y Area 6—Y Other sandeel species-Y		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
	Justification	Industry based dredge surveys have been performed for just over a decade in areas 1-3 (ICES 2014b, 2015). Although the survey design has been improved over time and effort levels in the survey have changed, the dredge surveys are contributing a time series that is informative about changes in sandeel biomass (ICES 2015, figures 11.1.4, 11.2.4, 11.2.5, 11.3.5, 11.4.4, 11.4.5). These dredge surveys are combined with catch and effort data from the fisheries in the assessments, to provide time series of SSBs and F for the stocks (ICES 2015 figures 11.2.10, 11.3.10 and 11.4.10, in each case panels a and b) . This monitoring, when used in the assessment, is sufficient to determine if the harvest strategy is working. In areas 4 and 6 there has some landings each year, and samples are taken. Hence the limited monitoring objectives for these stock units are met. Thus the SG 60 is met for all areas where fishing regularly occurs, and this includes other sandeel species in these areas.		
d	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Area 1 – Y Area 2 – Y Area 3 – Y Area 4--Y Area 6—Y Other sandeel species-Y
	Justification	Sandeel was subjected to a benchmark review in 2010 (ICES 2010). The benchmark review considered performance of the fishery, dynamics of the stock, explored multiple scenarios for performance of management strategies, and evaluated performance of the harvest strategy with different parameters for management triggers. Some key biological parameters used in the annual assessment and as inputs to action under the harvest strategy were updated following the review. In addition, the MSY review by ICES (ICES 2014) considered the generic $B_{escapement}$ strategy for all stocks with short life spans, high variability in recruitment, and high predation mortality. The conclusion that harvest strategies using $B_{escapement}$ should be augmented by using an F_{cap} is being implemented in sandeel as well. A new benchmark assessment is being planned for 2017 or 2018. Hence the harvest strategy is being reviewed periodically, and improved as necessary, and the SG 100 is being met. For areas 4 and 6, the harvest strategies are precautionary and intended to limit harvesting to a very low level until there is sufficient information to assess stock status and estimate sustainable yields. ICES reviews the monitoring data annually are part its assessment to the entire stock. When data are sufficient for an assessment, the assessment will include consideration of appropriate harvest strategies for the stock in all sandeel management areas. As above, this logic extends to the other sandeel species caught as part of *A. marinus* harvest in these management areas. Thus the intent of SG 100 is being met for these stock units.		
e	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	NA for all areas	NA for all areas	NA for all areas

PI 1.2.1		There is a robust and precautionary harvest strategy in place
	Justification	This fishery does not target sharks.
References		ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 201 pp.
		ICES. 2014d. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp. (Part 11, and Stock Annex for Sandeel))
		ICES. 2014c. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp.
		ICES. 2015c. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11)

OVERALL PERFORMANCE INDICATOR SCORE: **85**

Element	Score
Area 1	85
Area 2	85
Area 3	85
Area 4	85
Area 6	85
Other sandeel species	85

CONDITION NUMBER (if relevant):

Evaluation Table for PI 1.2.2—Sandeel

<table>
<tr><td>PI 1.2.2</td><td colspan="4">There are well defined and effective harvest control rules in place</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.</td><td>Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.</td><td></td></tr>
<tr><td>Met?</td><td>Area 1 – Y
Area 2 – Y
Area 3 – Y
Area 4—Y
Area 6—Y
Other sandeel spp-Y</td><td>Area 1 – N
Area 2 – N
Area 3 – N
Area 4—Y
Area 6—Y
Other sandeel spp-N</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">The harvest strategy that is used by ICES in provision of scientific advice, and is de facto applied by the management authority of the fishery lends itself well to application of specific harvest control rules. ICES has used area-specific values for $B_{escapement}$ for nearly two decades, set at a value that was B_{pa} rather than B_{lim} (ICES 2010). ICES is exploring area-specific values for F_{cap}, now that it has been recommended as part of the harvest strategy. These biomass values serve de facto as management targets (see 1.1.b) for each area. As SSB approaches the $B_{escapement}$ value, advice on harvests already recommends that harvests be reduced, so exploitation rate is reduced even before the target is reached, and advice is to stop harvests once the stock is below the target $B_{escapement}$ (ICES 2014). Management decisions have generally been consistent with the science advice. Nevertheless in all three areas there have been non-zero quotas in some years when SSB was below $B_{escapement}$., and even below B_{lim}. This resulted in F’s above 0.1 and even as high or higher than 0.4 on some ages in some years when SSB was below in B_{lim}, and often F’s of between 0.15 and 0.4 on some ages when SSB was below $B_{escapement}$. However, if there were a sequence of three or more years of poor recruitment, F’s did fall to below 0.05 (ICES 2015, Tables 11.2.7, 11.3.6 and 11.4.5).This pattern indicates that an initial poor recruitment might not be picked up by management in the year that it occurred. However, if poor recruitments came in sequence, then as B_{lim} was reached fisheries were closed. Consequently, in practice the management is reducing exploitation as the limit is approached. This means that SG 60 is reached for all three areas.

The harvest control rules are being applied for all three stocks in the science advice and in the management decisions on quotas (ICES 2015). The management authority has not adopted the reference points and harvest strategy in any formal way, nor prepared management plans for the fishery that contain the rules. Consequently there is no assurance that in future harvest rate will continue to be reduced as SSB approaches $B_{escapement}$ and reach zero by the time SSB passes B_{lim}. As this control rule has not been adopted by the management authority, it cannot be concluded</td></tr>
</table>

PI 1.2.2		There are well defined and effective harvest control rules in place		
		that "well defined harvest control rules *are in place*". It appears that such rules are being applied in practice, but with no objectives, reference points and harvest control rules formally adopted, at best "generic rules" may be in place. The results of the annual stock assessments (ICES 2014b, 2015), and specifically the estimates of fishing mortality in those assessments (ICES 2015, Tables 11.2.7, 11.3.6 and 11.4.5) factored into the scoring decision for this scoring issue. Those tables clearly show that in the short term the rules are not achieving the exploitation rates required by the de facto harvest control rules. In some years when the stock is below even B_{lim}, and certainly below $B_{escapement}$, (ICES 2015, Tables 11.2.7, 11.3.6 and 11.4.5) fishing mortality on some ages are above zero by amounts too large be overlooked as assessment uncertainty or only small oversights or error in management. Illustrations are available from all three main stock areas, using F from the first half of the year: for example: Area / Year / SSB / $B_{escapement}$ / B_{lim} / Age / F 1 / 2006 / 145Kt / 215 Kt / 160Kt / 1 / 0.436 2 / 2013 / 76Kt / 100 Kt / 70Kt / 2 / 0.119 3 / 2013 / 49Kt / 195 Kt / 100Kt / 1 / 0.301 Examining the time series of F's, performance of management appears to be improving the ability to reduce F when SSB declines below $B_{escapement}$. Hence the SG 80 guidepost is met in terms of technical quality but it does not appear that the management actions have well defined harvest control rules or that the rules are in place. Because other sandeel species are found in these management areas as well but are not technically the targets of this fishery, and management areas 1-3 are by far larger than areas 4 and 6 in terms of catch of *A. marinus* and thus potential catch of other sandeel species included in the above estimates of stock parameters, we conclude that the scoring for this scoring issue should be the same for the other sandeel species complex scoring element. The fishery meets the SG 60, but not the SG80. For areas 4 and 6 the harvest control rule is simply that catches should not exceed a highly precautionary TAC until there is sufficient information to conduct an analytical assessment to establish if a higher catch level is sustainable. Thus the harvest control rule is clearly defined, and although the HCR does not reduce catch as a defined Limit Reference Point is approached, the intent of keeping harvests at a very low level, to protect the stock in times of weak recruitment, is achieved under this HCR.		
b	**Guide post**		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		Area 1 – Y Area 2 – Y Area 3 – Y	Area 1 – Y Area 2 – Y Area 3 – Y

PI 1.2.2		There are well defined and effective harvest control rules in place		
			Area 4 –Y Area 6—Y Other sandeel spp-Y	Area 4—N Area 6—N Other sandeel spp.-Y
	Justification	The design of the harvest control rule was investigated in detail during the sandeel benchmarking assessment (ICES 2010) and in a general way again on the MSY Workshop (ICES 2014a). Both investigations involved simulations exploring the harvest control rule performance under a wide range of uncertainties, including top down and bottom up ecological effects on sandeel productivity, uncertainties in the catch data and effort data (including uncertainties about spatial distribution of each), uncertainty about the dredge survey data, and uncertainty biological parameters including growth, maturation and natural mortality. These investigations were often carried out for all three stock units, but in some cases were only conducted for one stock unit of the stock as a whole and then the results were generalized to all three units. Given the inherent challenges of conducting analytical assessments on short-lived species with high recruitment variation, a wide range of uncertainties were taken into account in design of the harvest control rules for all three areas. Because other sandeel species are found in these management areas as well but are not technically the targets of this fishery, and management areas 1-3 are by far larger than areas 4 and 6 in terms of catch of *A. marinus* and thus potential catch of other sandeel species included in the above estimates of stock parameters, we conclude that the scoring for this scoring issue should be the same for the other sandeel species complex scoring element. Hence both SG 80 and SG100 guideposts are met for this scoring criterion. For areas 4 and 6 the HCR was set on precautionary bases for both stocks, taking into account the history of catches and available information on historical changes in stock status. The precautionary levels are expected to restrict the impact of harvests on stock productivity at all stock abundances observed historically. Thus the uncertainties regarding any causes of fluctuations in stock productivity are taken into account in the HCR (Precautionary TAC), which are the main uncertainties in ensuring protection of the stock unit, and the SG 80 is met for both minor stock Units. However, with a simple precautionary TAC it cannot be assured that a wide range of uncertainties have all been accounted for.		
c	**Guide post**	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met?	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp—Y	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp—Y	Area 1 – N Area 2 – N Area 3 – N Area 4—N Area 6—N Other sandeel spp—N

PI 1.2.2		There are well defined and effective harvest control rules in place
	Justification	With an escapement strategy as the de facto management strategy for Areas 1, 2, and 3, there is no specific maximum exploitation rate required under the harvest control rule. Rather exploitation has to be kept below a rate that would not leave the SSB above the $B_{escapemen}$t value for the stock. The IBTS trawl survey each year gives reliable estimates of stock status and age composition of the stock, with uncertainty estimated. That provides evidence of the degree of success of management to maintain the stock at or above $B_{escapement}$. Operational regulations of the fishery do not allow any catch sorting once the trawl is brought on board, and dockside monitoring rates are sufficient to quantify catches. All vessels also have VMS, so spatial and temporal pattern of fishing are documented. Thus there is high confidence in the catch records for the fishery. So there is available evidence that gives some confidence that the tools are managing the harvest within the parameters of the escapement harvest strategy. However there cannot be a clear demonstration that the tools will be working in medium or longer term, without medium term certainty about management objectives, reference points, and choice of a specific harvest strategy. Because other sandeel species are found in these management areas as well but are not technically the targets of this fishery, and management areas 1-3 are by far larger than areas 4 and 6 in terms of catch of *A. marinus* and thus potential catch of other sandeel species included in the above estimates of stock parameters, we conclude that the scoring for this scoring issue should be the same for the other sandeel species complex scoring element. Thus the SG 80 Guidepost is met or exceeded but the SG 100 Guidepost is not met. For the minor stock units 4 and 6, the catch and landings records are considered reliable, so the tools used to limit catches to Precautionary levels are effective in controlling exploitation and the SG 60 is met. Moreover, although the available evidence is very limited, what evidence is available from catch monitoring, predator diets, etc. all suggests that the precautionary TAC is achieving the objective of preventing depletion of the stock unit, and the SG 80 is also met for these minor stock units. However, the evidence available is not sufficient to clearly show the outcomes of these fisheries for the stock units, so the SG100 is not met..
		ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 201 pp. ICES. 2014a. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp. ICES. 2014b. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp. (Part 11, and Stock Annex for Sandeel)) ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11)

<table>
<tr><td>PI 1.2.2</td><td colspan="2">There are well defined and effective harvest control rules in place</td></tr>
<tr><td colspan="2">OVERALL PERFORMANCE INDICATOR SCORE:
<table>
<tr><td>Element</td><td>Score</td></tr>
<tr><td>Area 1</td><td>75</td></tr>
<tr><td>Area 2</td><td>75</td></tr>
<tr><td>Area 3</td><td>75</td></tr>
<tr><td>Area 4</td><td>80</td></tr>
<tr><td>Area 6</td><td>80</td></tr>
<tr><td>Other sandeel species</td><td>75</td></tr>
</table></td><td>75</td></tr>
<tr><td colspan="2">CONDITION NUMBER (if relevant):
Condition 3. By the fourth annual audit, well defined harvest control rules must be in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached for sandeel areas 1-3.</td><td>3</td></tr>
</table>

Evaluation Table for PI 1.2.3 – Sandeel

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp-Y	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp-Y	Area 1 – N Area 2 – N Area 3 – N Area 4—N Area 6—N Other sandeel spp.-N
	Justification	The fishery is prosecuted in a manner that prevents any sorting of catch prior to arriving at the dock, and the level of dockside monitoring and catch sampling in quarters when there is substantial effort is high enough for accurate information on size and age composition of the catches. Detailed reporting of catch location is also required of the vessels, and VMS has been accurate enough to detect possible issues with reporting of locations of catches (ICES 2015 Section 11.1.6). In addition the dredge surveys and an exploratory hydroacoustic survey provide fishery independent data on abundance and biological parameters of all three units supporting directed exploitation (ICES 2015, Section 11.1.7.1. Complete data on fleet composition is available and updated annual, and effort data are available at the unit of the individual vessel. Substantial monitoring of the North Sea physical oceanography is conducted, and spatially resolved time series data on a number oceanographic parameters are available (Drinkwater 2010, http://www.bodc.ac.uk/projects/uk/north_sea/). Likewise populations of key fish, bird and marine mammals are monitored on an annual basis, and extensive diet data are available for use in trophodynamic models (ICES 2014). The only shortfall in information is with regard to stock structure. Largely based on oceanographic model-based estimates of transport of sandeel eggs and larvae, the seven current management units were identified, and considered to provide a better basis for assessment and management than treating the entire North Sea as a single unit. However, this is substantial concern that more fine scales stock structure does exist (ICES 2010. Section 2). In addition, it has been recognized that there are at least three other sandeel species with distributions that overlap with the target *A. marinus*. Because these other sandeel species are found in these management areas but are not technically the targets of this fishery, and management		

PI 1.2.3		Relevant information is collected to support the harvest strategy		
		areas 1-3 are by far larger than areas 4 and 6 in terms of catch of *A. marinus* and thus potential catch of other sandeel species included in the above estimates of stock parameters, we conclude that the scoring for this scoring issue should be the same for the other sandeel species complex scoring element. Hence the SG 60 and SG 80 guideposts are met and exceeded, although the SG 100 is not fully met. For the minor stock units 4 and 6 the information on the general biology and life history of sandeels is considered to apply to these stock units as well, and is sufficient to inform the aspects of the harvest strategy that take into account the overall productivity and mortality schedules for the stocks. With effort data, monitoring of landings etc sufficient information is available to document removals accurately and provide some confidence that the restricted harvest levels are not resulting in depletion of the stock units. With the objective of limiting catches to a very low level and preventing stock depletion, the SG 80 is met for these stock units. However, a comprehensive range of data are not available, so the SG 100 is not met.		
b	**Guide post**	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp-Y	Area 1 – Y Area 2 – Y Area 3 – Y Area 4—Y Area 6—Y Other sandeel spp-Y	Area 1 – N Area 2 – N Area 3 – N Area 4 -–N Area 6—N Other sandeel spp-N
	Justification	Stock abundance and fishery removals are both monitored annually, (see Justification of 1.2.3a for details). Indicators of biomass and abundance by half year, and corresponding half-year estimates of fishing mortality are available. All this information is available with sufficient accuracy and precision to allow the $B_{escapement}$ strategy to be applied in developing scientific advice and management decision-making. However, there are large CVs on all the survey data and on the twice-annual estimates of total and spawning biomass and F (ICES 2015, Sections 11.2.9, 11.3.10. 11.4.9). In addition details of predation mortality and environmental impacts on productivity are not known with sufficient precision to allow some potentially large inter-annual changes in productivity to be detected in advance of the commencement of the fishing year (ICES 2010).		

<table>
<tr><th colspan="2">PI 1.2.3</th><th colspan="3">Relevant information is collected to support the harvest strategy</th></tr>
<tr><td></td><td></td><td colspan="3">Consequently it is not possible to be confidant that application of the $B_{escapement}$ strategy will actually make it unlikely that the fishery will not reduce the stock below the $B_{escapement}$ de facto target. Hence the SG 80 is met but not exceeded. Because other sandeel species are found in these management areas as well but are not technically the targets of this fishery, and management areas 1-3 are by far larger than areas 4 and 6 in terms of catch of A. marinus and thus potential catch of other sandeel species included in the above estimates of stock parameters, we conclude that the scoring for this scoring issue should be the same for the other sandeel species complex scoring element.

For the minor stock units 4 and 6, catches and landings are recorded accurately, and samples of the catches are taken each year. These records produce a reliable indicator of catch levels but not stock abundance. However the indicators from catch monitoring for size and age composition of the samples are sufficient to provide warning signs were the stock to be depleted. This the intent of SG 80 is being met by the combination of biological sampling of catches, and a highly precautionary catch limit.</td></tr>
<tr><td rowspan="3">c</td><td>Guide post</td><td></td><td>There is good information on all other fishery removals from the stock.</td><td></td></tr>
<tr><td>Met?</td><td></td><td>Area 1 – Y
Area 2 – Y
Area 3 – Y
Area 4—Y
Area 6—Y
Other sandeel spp-Y</td><td></td></tr>
<tr><td>Justifi cation</td><td colspan="3">Specialized gears are needed in order to take substantial amounts of sandeel, such that bycatches of sandeels in other demersal fisheries are generally very low. There are fisheries on North Sea sandeel by Norway, and in some years by vessels form Scotland, and very occasionally other countries that are members of the EU. The Norwegian and all EU fisheries are fully monitored and carry VMS equipment. Hence there is good information on all other fishery removals from all these sandeel management areas, including other sandeel species.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Drinkwater, K. F. 2010. Marine European climate: past, present, and future. In Resolving Climate Impacts on Fish Stocks. pp. 49–75. Ed. by A. D. Rijnsdorp, M. A. Peck, G. H. Engelhard, C. Mollmann, and J. K. Pinnegar. ICES Cooperative Research Report, 301. 370 pp.
ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 201 pp.
ICES. 2014. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 20–24 October 2014, London, UK. ICES CM 2014/SSGSUE:11. 104 pp.</td></tr>
</table>

PI 1.2.3	Relevant information is collected to support the harvest strategy	
	ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11)	
OVERALL PERFORMANCE INDICATOR SCORE:		**80**
Element	**Score**	
Area 1	**80**	
Area 2	**80**	
Area 3	**80**	
Area 4	**80**	
Area 6	**80**	
Other sandeel species	**80**	
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 1.2.4 – Sandeel

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		Y	N
	Justification	Effort has been shown to be a reasonable proxy for F, and this relationship is the basis for the SMS model, which models fishing mortality as a function of total commercial fishing effort. The model has options to estimate rates for technical creeping and thereby take into account increases in efficiency in the sandeel fishing fleet. The benchmark assessment (ICES 2010) concluded that the model fits the input data from surveys and particularly the commercial fishery in a reasonable way, and give results without retrospective bias. The model can be applied for assessments with just catch and effort, and for assessment where additional fisheries independent data are available. In the SMS version used for sandeel, fishing mortality, Fy,q,a was modelled as an A function of observed effort. $F_{y,q,a}$ = Season Effect($_{Y,A1}$) * AgeEffect($_{Y,A2,q}$) * Effort $_{y,q}$ where indices A1 and A2 are groups of ages, (e.g. ages 0, 1–2, 3–4) and Y is grouping of years (e.g. 1983–1998, 1999–2009). The SMS-effort defines that the years included in the model can be grouped into a number of period clusters (Y), for which the age selection and seasonal selection are assumed constant. All these options allow for the possibility of changes in amount of fishing effort by quarter of the year, which in a short-lived, rapidly growing species can make a substantial different to the impact of the fishery on the exploited population. SMS is a statistical model where two types of observations are considered: Total international catch-at-age, and research survey CPUE (a third possibility to include stomach data from predators exists, but is not used in the key runs of the annual sandeel assessments). For each type of observation a stochastic model is formulated and the likelihood function is calculated. As the t types of observations are independent the total log likelihood is the sum of the contributions from all types of observations. A stock–recruitment (penalty) function is added as a fourth contribution. The parameters are estimated using maximum likelihood (ML) i.e. by minimizing the negative log likelihood. The variance of functions of the estimated parameters (such as biomass and mean fishing mortality) has been calculated using the delta method. Of all the models considered during the benchmark assessment meeting, SMS was considered to make the most appropriate use of the data available, and allow the necessary flexibility to deal with the life history features of a short lives species experiencing high predation mortality and large inter-annual variation in recruitment. It takes into account the major features of both the stock and fishery, and provides estimates of SSB and F		

PI 1.2.4		There is an adequate assessment of the stock status		
		by half year, which are sufficient for application of the de facto harvest control rules used in the scientific advice. However the Harvest Strategy and Control Rules do not take into account that all fisheries, but particularly in assessment unit 2, take a mixture of sandeel species. Thus, although the strategy and measures that account of the generic features of all sandeel, they do not take account of any differences among the species of sandeels. Thus the SG 80 Guidepost is exceeded and SG 100 is approached but not met for the stock. Since the RBF is used for Areas 4 and 6 and the other sandeel species, this PI defaults to a score of 80 for these elements.		
b	**Guide post**	The assessment estimates stock status relative to reference points.		
	Met?	Area 1 – Y Area 2 – Y Area 3 - Y		
	Justifi cation	The $B_{escapement}$ de facto reference points are defined in terms of spawning biomass, and the F_{cap} de facto reference points are defined in terms of fishing mortality. The annual assessments estimate both F and SSB, and report them in tabular form (ICES 2015, Tables 11.2.9, 11.3.8 and 11.4.9). This the SG 60 is met for the three areas.		
c	**Guide post**	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
	Met?	Area 1 – Y Area 2 – Y Area 3 - Y	Area 1 – Y Area 2 – Y Area 3 - Y	Area 1 – N Area 2 – N Area 3 - N
	Justifi cation	The assessments for all three areas use SMS as the primarily analytical tool. This analysis method does take into account uncertainty due to the relationship between effort and catch, and the CVs of catch at age and in the survey estimates of abundance and age composition (ICES 2015). Although the simulations in the benchmark assessments explored performance of the SMS model to uncertainty in many of the biological parameters of sandeel life histories (ICES 2010), the annual assessments do not incorporate uncertainty in many of the model parameters. Rather, the influence of potential sources of uncertain are discussed in the sections of the assessment document on quality of the assessment and implications for management (ICES 2015, Sections 11.91, 11.2.10; 11.3.10, 11.3.12; 11.4.11, 11.4.13). This may be a reasonable strategy for dealing with some types of uncertainty, because the short life history and potentially high seasonal and inter-annual variation makes it difficult to represent major deviations from "typical" conditions analytically with the short time between observing a potentially atypical condition for a life history parameter and the need for a		

<table>
<tr><th colspan="2">PI 1.2.4</th><th colspan="3">There is an adequate assessment of the stock status</th></tr>
<tr><td></td><td></td><td colspan="3">management response to the event – and including all plausible values of all life history and fishery parameters in simulations would provide such a wide range of possible futures that the assessments would provide little information that management could use in decision-making (sometimes called the “chasing last year’s noise, syndrome). The low retrospective pattern in the reference SMS assessments suggests that the present methods for dealing with uncertainty is producing more consistent assessments, compared to earlier approaches with less robust formulations (ICES 2015 Figures 11.2.8. 11.3.8 and 11.4.8).

For all the three areas, the key model outputs, including time series of F, SSB, and recruitment are presented with coefficients of variation and confidence intervals (Area 1 - Figures 11.2.9 and 11.2.10; Area 2 – Fig 11.3.9 and 11.3.10; Area 3 – Figs 11.4.9 and 11.4.10). Hence the general uncertainty of the assessments are communicated to decision-makers. However the status of SSB and F relative to their respective reference points are not presented probabilistically.

Thus for all three areas receiving analytical assessments, SG 60 is exceeded, SG 80 Guidepost is met but not exceeded, and SG 100 is not met.</td></tr>
<tr><td>d</td><td>Guide post</td><td></td><td></td><td>The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.</td></tr>
<tr><td></td><td>Met?</td><td></td><td></td><td>Area 1 – Y
Area 2 – Y
Area 3 - Y</td></tr>
<tr><td></td><td>Justifi cation</td><td colspan="3">The Bench Assessment meeting for sandeel (ICES 2010) explored the robustness of the assessment to assumptions/hypotheses and uncertainties in all the major potential sources of uncertainty and inaccuracies in sandeel assessments; including:
• Top-down effects on sandeel productivity (ICES 2010,Section 3.1)
• Bottom-up effects on sandeel productivity (ICES 2010, Section 3.2)
• Other ecosystem impacts on stock productivity (ICES 2010, Section 3.6)
• Commercial catch-at-age and weight-at-age (ICXES 2010, Section 4.1.1)
• Commercial catch-per-unit-effort (ICES 2010, Section 4.1.3)
• Dredge survey catches and age-weight composition (ICES 2010 Section 4.2)
• Maturity at age (ICES 2010, Section 4.3)
• Natural mortality (ICES 2010, Section 4.4)
• Fleet and gear characteristics (ICES 2010, Section 4.5)
In addition, the comparisons among the different assessment modelling approaches explored the robustness of the methods to different hypotheses regarding the relationships between catch and effort and between recruitment and SSB.</td></tr>
</table>

PI 1.2.4	There is an adequate assessment of the stock status

Performance of four different methods of assessment were examined in the benchmark assessment, including Seasonal Extended Survivors Analysis (SXSA – ICES 2010, Section 5.1,), a multispecies F-effort model (SMS – ICES 2010, Section 5.2), and a temporally explicit statistical catch at age model (TED – ICES 2010, Section 5.3). The differences among the modelling approaches are captured in the table below, taken from ICES 2010, Section 5.4, page 75).

	SXSA	SMS–effort	TED
Model type	Deterministic VPA	Statistical catch-at-age	Statistical catch-at-age
Catch at age data	Assumed exact	Observation error estimated within model	Observation error estimated within model
Tuning data	Commercial CPUE & survey	Survey	Survey
Timestep	Half-year	Half-year	Yearly catches, weekly effort
Catchability	Constant by age ('83–98 & '99–)	Constant by age ('83–98 & '99–)	seasonal pattern, constant for all years
Use of Commercial effort	Into cpue	F Proportional to effort	F Proportional to effort
Natural mortality	Half-yearly	Half-yearly	Half-yearly
Ability to estimate technical creep?	none	Possible	Possible
Statistical distribution of parameter estimates	No	Yes (all)	Yes (all)
Forecast internal to model	No	Built-in	No
implementation	Fortran	ADMB & R	ADMB & R
Stock-recruit	None assumed	Can be included in likelihood	None assumed
Number of stocks currently used for	N Sea Norway Pout & North Sea Sandeel	N. Sea multispecies, Baltic multispecies, Blue Whiting (core SMS only)	Bespoke for N Sea Sandeel.
Documentation	Skagen, 1994	Lewy and Vinther, 2004; Vinther 2010	Nielsen, 2010
Peer-reviewed?	ICES acceptance	ICES acceptance (core SMS only)	New model

The comparisons of assessment approaches concluded that both the SMS and the TED modeling frameworks provided robust fits to the data available, although CVs of estimated parameters were large relative to those in assessments of many longer-lived species. However the SMS framework was preferred because of greater experience with its performance, and ability to better address uncertainty in the commercial catch-at-age data.

Thus the robustness of the model have been tested thoroughly, alternative hypotheses and alternative assessment models have been considered, and the SG 100 Guidepost is met.

e				
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		All Areas - Y	All Areas - Y
	Justification	Although the periodic benchmark assessments are organized by ICES, which is the scientific body that also conducts the annual assessments, efforts are taken to ensure that participants in benchmark meetings include		

PI 1.2.4		There is an adequate assessment of the stock status
		experts in assessment methods relevant for the stock(s) under consideration, but not involved in the annual working group meetings where the assessments are tabled and reviewed. The views of the independent experts have strong influence in the conclusions and recommendations from the benchmark assessments. The annual assessments are prepared by a small group of experts, often from a single research center. They are tabled at a Working Group meeting where they are reviewed by all the participating experts, few of whom have been involved in preparation of the assessment. Moreover the ICES Advisory Committee (ACOM) reviews all Working Group Reports and finalizes the advice on each stock. This process routinely requires one or two addition experts, independent of any engagement in the relevant working group, to review each assessment for quality and for coherence of the draft advice with the assessment. Hence both SG 80 and SG 100 are met for this stock.
References		ICES. 2010. Report of the Benchmark Workshop on Sandeel (WKSAN), 6–10 September 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:57. 201 pp. ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Part 11)

OVERALL PERFORMANCE INDICATOR SCORE: **85**

Element	**Score**
Area 1	**90**
Area 2	**90**
Area 3	**90**
Area 4 (per RBF)	**80**
Area 6 (per RBF)	**80**
Other sandeel species (per RBF)	**80**

CONDITION NUMBER (if relevant):

Principle 1 Norway Pout

Evaluation Table for PI 1.1.1 – Norway Pout

<table>
<tr><td colspan="2">PI 1.1.1</td><td colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>It is likely that the stock is above the point where recruitment would be impaired.</td><td>It is highly likely that the stock is above the point where recruitment would be impaired.</td><td>There is a high degree of certainty that the stock is above the point where recruitment would be impaired.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The assessment is considered to be reliable, and the 2014 estimate of SSB is 274,000 t (ICES 2014, table 5.3.6). This is substantially above the value of B_{pa} used for this stock. The B_{pa} of 150,000 t was reviewed by ICES in Benchmark assessments in 2006 and 2012 (ICES 2006, 2012a, 2012b), and accepted as being a biomass above which recruitment would not be impaired by inadequate spawning biomass. However, environmental conditions are known to affect recruitment strongly, so even at very high spawning biomasses the stock has been observed to provide poor year-classes (e.g. 2010), and occasional strong year classes have been produced but some of the smaller SSBs in the time series (e.g. 1994) – Table 5.3.6 and Figure 5.3.5 panels a and c). Thus the SG 80 guidepost is exceeded but the SG 100 is not met (ICES 2015).</td></tr>
<tr><td rowspan="3">b</td><td>Guide post</td><td></td><td>The stock is at or fluctuating around its target reference point.</td><td>There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The Total Stock Biomass and Spawning Stock Biomass fluctuate substantially from year to year, reflecting variation in incoming recruitment. At fishing mortalities characteristic of the past decade or more this variation is much more driven by variation in the physical environment and predation mortality than by harvests (ICCES 2012a, 2014, Vinther and Nielsen 2012, 2013). Although the stock has been below the $B_{escapement}$ value in 4 of the last 20 years, the average SSB over that period is above 175,000 t, well above the $B_{escapement}$ value. Thus the SG 80 Guidepost is exceeded, although the SG 100 is not met because of the missed escapement.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES 2006 Report Of The Study Group On Management Strategies (SGMAS) 23 - 27 January 2006. ICES Headquarters 2006. ICES CM 2006/ACFM:15

ICES 2012a IBP Norway Pout Inter-benchmark assessment report. ICES CM 2012/ACOM:0x.

ICES. 2012b. Report of the North-Western Working Group (NWWG), 26 April - 3 May 2012, ICES Headquarters, Copenhagen. ICES CM 2012/ACOM:07. 1425 pp</td></tr>
</table>

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
	ICES. 2014. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 28 April-7 May, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1031 pp. Part 5. ICES. 2015. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 28 April-7 May, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1031 pp. Vinther, M. and Nielsen, J.R. 2012. Evaluations of management strategies for Norway pout in the North Sea and Skagerrak Report (NOP-MSE). ICES NOP-MSE Report 2012. ICES CM 2012/ACOM:69. Vinther, M. and Nielsen, J.R. 2013. Evaluations of management strategies for Norway pout in the North Sea and Skagerrak. Working document to ICES WGNSSK, May 2013. ICES CM2013/ACOM: xx.		
Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Target reference point	The management authority has not adopted a specific target reference point for this stock. Advice is provided using a $B_{escapement}$ value of 150,000 t as a functional target, and two Benchmark reviews concluded that it was a reasonable surrogate for B_{msy} for this type of stock. The management authority has set TACs at or below the scientist advice since the early 2000.	The de facto target for North Sea Norway Pout is 150,000 SSB	Current stock status is 116%of the de facto target.
Limit reference point	The management authority has not adopted a specific limit for this stock. The scientific advice uses 90,000 as B_{lim} for this stock, This value was originally an estimate of B_{loss} for the stock, made in the mid- 1990s. Although the initial estimate was rough,	The de facto limit for North Sea Norway Pout is 90,000 t.	The current SSB is 193% of the value used as a limit in the scientific advice and recent management decisions.

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
	the two benchmark reviews of this value have not recommended any change, and note that inflection point of a stock-recruit relationship for the stock is very poorly defined by the data. The management authority has closed the fishery several times at SSBs between this value and the functional target, always when the estimates of SSB have been below this value.		
OVERALL PERFORMANCE INDICATOR SCORE:			**80**
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 1.1.2 – Norway Pout

PI 1.1.2		Limit and target reference points are appropriate for the stock		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	Y	Y	
	Justification	As noted in 1.1.1b, the Total Stock Biomass and Spawning Stock Biomass fluctuate substantially from year to year, reflecting variation in incoming recruitment. At fishing mortalities characteristic of the past decade or more this variation is much more driven by variation in the physical environment and predation mortality than by harvests. This is a consideration for both limit and target reference points (ICES 2009, 2012) The reference points for North Sea Norway pout have been evaluated in two benchmark reviews (ICES 2006, 2012), including simulations to explore sensitivity to different assumptions about recruitment variation, and considered to be appropriate guides for management decision making to maintain the stock above levels were recruitment might be impaired by insufficient spawning biomass. However, the reference points have not been formally adopted by the management authority, although management decisions since the early 2000s have been consistent with scientific advice using the reference points. Note: North Sea Norway Pout are a shared stock between the EU and Norway. For some North Sea stocks the EU and Norway have negotiated and adopted formal agreements, containing management objectives and harvest control rules. No such agreement exists for Norway Pout. The EU is considered the management authority for the Danish fishery for Norway Pout, because all Danish harvests occur in EU waters. The EU Common Fishery Policy has general objectives related to maintaining stocks at or above B_{msy} and not exploiting stocks at levels above $F_{msy.}$ These general objectives have not been translated into adopting any specific reference points for this stock, nor formal harvest control rules to keep harvests within the general bounds set by the CFP, but are implicit in the management system. Consequently the reference points used in developing science advice for the stock are appropriate for the stock and can be estimated, meeting the SG60 and SG80.		
b	Guide post		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		Y	N

PI 1.1.2		Limit and target reference points are appropriate for the stock		
	Justification	At fishing mortalities characteristic of the past decade or more this variation is much more driven by variation in the physical environment and predation mortality than by harvests Environmental conditions are known to affect recruitment strongly, so even at very high spawning biomasses the stock has been observed to provide poor year-classes (e.g. 2010), and occasional strong year classes have been produced but some of the smaller SSBs in the time series (ICES 2014 e.g. year-class from 1994 – Table 5.3.6 and Figure 5.3.5 panels a and c). The most recent benchmark examined the stock recruitment relationship with a number of analytical methods, and concluded that the inflection point indicating the SSB below which the expected year-class strength is likely to be decreasing because of insufficient SSB is poorly determined by the available data (ICES 2012). Hence the SG 80 Guidepost is exceeded but the Guidepost for 100 is not met because the value of the limit reference point used in the assessment is poorly determined by the available data, and the factors that determine stock productivity are incompletely known. There is extensive evidence that environmental conditions can influence stock productivity greatly. Consequently "precautionary considerations" would call for more directed investigation of the appropriateness of the limit reference point used in assessment to maintain a low risk of impairing reproductive capacity under plausibly unfavourable environmental conditions. In addition the reference points are estimated and used in the assessments, but have no explicit role in any management plan or agreement for the stock. Both of these correctable weaknesses indicate that the scoring benchmark of 100 has not yet been met.		
c	Guide post		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		Y	N
	Justification	The two benchmark assessment reviews for this stock concluded that MSY is poorly determined for this stock, both because of environment factors affecting year class strengths, and variation in predation mortality due to the role of Norway Pout as a forage species and substantial variation in aggregate predator biomass over time. However, reviews concluded that the $B_{escapement}$ target was a reasonable surrogate for B_{msy}, a generic management target used by the EU management authority (ICES 2005, 2006, 2012). It does take the role of Norway pout as a lower trophic level into account through the predation mortalities estimated by multispecies models and updated whenever new information comes available. However, there are sufficient uncertainties in the estimates of predation mortality and the breakpoint in the stock recruit relationship that there cannot be a high		

<table>
<tr><th colspan="2">PI 1.1.2</th><th colspan="3">Limit and target reference points are appropriate for the stock</th></tr>
<tr><td></td><td></td><td colspan="3">degree of certainty that all precautionary issues have been taken fully into account.

Hence the SG 80 Guidepost is met but the Guidepost for 100 is not met because the stock dynamics do not allow a higher degree of certainty than any harvest strategy can ensure the stock will always be in the neighborhood of B_{msy}.</td></tr>
<tr><td>d</td><td>Guide post</td><td></td><td>For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.</td><td></td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td></td></tr>
<tr><td></td><td>Justifi cation</td><td colspan="3">Norway pout may be a lower trophic level stock. It has a small Linf, is short-lived, for most ages predation mortality exceeds fishing mortality, and it appears in the diets of many piscivorous predators in the North Sea (Pinnegar 2011). The target and limit reference points were derived from stock recruit data and uncertainty in a single species assessment. However the predation mortality values used in that assessment are produced by a multi-species model that attempts to take predation mortality of all main predators into account. When the original values for the B_{pa} (later $B_{escapement}$) and B_{lim} were adopted, calculations used fixed values for season-specific natural mortality, that included estimates of predation mortality from key runs of Multispecies Virtual Population Analysis for the North Sea (ICES 2005, 2006. 2012). The more recent evaluations of the reference points have used more sophisticated multispecies models (see P2 for details), that are considered to more fully account for provision of sufficient food for predators (ICES 2014a,b).

The B_{pa} target reference point for Norway pout is considered a surrogate (proxy) for an MSY-based reference point for small, short-lived species (ICES 2014b), The scoring guidelines for CB 2.3.17 to 2.3.19 all require that the “ecosystem needs” for the species be taken into account. More specifically, 2.3.17 sets standards for the target reference point in terms of percentage of B_0 for the stock, or more than half the “ecosystem needs”. For Norway pout no estimate of B_0 has been made, because ICES deals with needs of predators explicitly in the assessments (ICES 2014a,b). This is a more robust strategy, and consistent with MSC CR v1.3 section CB2.3.20, because the notion of a B_0 for a stock with the recruitment dynamics of Norway pout is highly questionable as a basis for any management target. Likewise the concept of B_0 for a system that has been exploited for as long as the North Sea is questionable. Rather for the North Sea ICES estimates the “ecosystem needs” empirically for key LTL stocks as part of the SMS modeling (ICES 2014b). Then the needs of the ecosystem are fully accounted for even before the target is estimated. Extensive simulation modelling reported in ICES 2010, ICES2014a, and ICES 2014c all demonstrate that the approach explicitly accounting for predation mortality before calculating SSB, fully allows the proxies to fully meet the estimated ecosystem needs both for target and limit reference points. Thus the defaults specified in CB 2.3.17-19 are all met or exceed</td></tr>
</table>

PI 1.1.2		Limit and target reference points are appropriate for the stock	
		Hence the SG 80 can be considered to be met as long as the reference points continue to be used in management.	
References		ICES 2005. SGMAS Report. ICES CM 2005 / ACFM:09 ICES 2006 Report Of The Study Group On Management Strategies (SGMAS) 23 - 27 January 2006. ICES Headquarters 2006. ICES CM 2006/ACFM:15ICES. 2009 Report of the Benchmark Workshop on Short-lived Species (WKSHORT). ICES CM 2009/ACOM:34. 164 pp. ICES. 2009 Report of the Benchmark Workshop on Short-lived Species (WKSHORT). ICES CM 2009/ACOM:34. 164 pp. ICES-WGSAM. 2011. Report of the Working Group on Multispecies Assessment Methods (WGSAM), 10–14 October 2011, Woods Hole, USA. ICES CM 2011/SSGSUE:10. 229 pp. ICES. 2012. Report of the Inter-Benchmark Protocol on Norway Pout in the North Sea and Skagerrak (IBP Pout 2012), March–April 2012, By correspondence. ICES CM 2012/ACOM:43. 157 pp. ICES. 2014a. Report of the Working Group for the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 30 April–7 May 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:13. 1493 pp. Part 5. ICES. 2014b. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 20–24 October 2014, London, UK. ICES CM 2014/SSGSUE:11. 104 pp. ICES. 2014c. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp., Pinnegar, J.K. 2011. DAPSTOM. An integrated database and portal for fish stomach records. Version 3.6. Cefas, Lowestoft. www.cefas.defra.gov.uk/dapstom.	
OVERALL PERFORMANCE INDICATOR SCORE:			**80**

Evaluation Table for PI 1.1.3 – Norway Pout

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?	NA		
	Justification			
b	**Guide post**	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
	Met?	NA		
	Justification			
c	**Guide post**	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
	Met?	NA		
	Justification			
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**NA**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.1 – Norway Pout

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	Y	Y	Y
	Justification	Three harvest strategies have been explored in both the 2006 and 2012 benchmark reviews – in fact the 2012 review examined variants of some of the strategies. These included a constant F, a constant catch, and a common escapement strategy. Values for a maximum F, a maximum non-zero catch, and a minimum escapement parameter were found, such that each of the three strategies could be capable of maintaining the stock above the $B_{escapement}$ value (ICES 2012, Vinther and Nielsen 2012, 2013). That outcome has not been formally adopted by the EU management authority as the objective for this stock, even though the requests for advice from the EU authority for the benchmark reviews included that outcome in the requests (see Justification for 1.1.2a for additional information on this point). Note: North Sea Norway pout are a shared stock between the EU and Norway. For some North Sea stocks the EU and Norway have negotiated and adopted formal agreements, containing management objectives and harvest control rules. No such agreement exists for Norway pout. The EU is considered the management authority for the Danish fishery for Norway pout, because all Danish harvests occur in EU waters. The EU Common Fishery Policy has general objectives related to maintaining stocks at or above B_{msy} and not exploiting stocks at levels above F_{msy}. However these general objectives have not been translated into adopting any specific reference points for this stock, nor formal harvest control rules to keep harvests within the general bounds set by the CFP. The scientific advice has been based on applying the fixed escapement strategy and the management decisions have been consistent with the science advice. The variable TACs produced when the strategy is applied is fully responsive to variation in SSB, as updated by the most recent annual survey values. So the harvest strategy is responsive to state of the stock and can deliver the outcomes expected from application of the strategy, meeting the SG100.		
b	Guide post	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
				to maintain stocks at target levels.
	Met?	Y	Y	Y
	Justification	The 2007 and 2012 benchmark meeting evaluated three different harvest strategies relative to their likelihood of maintaining the stock above its $B_{escapement}$. All three strategies were considered to be effective at achieving their respective objectives in the medium and long term. However because of the magnitude of observed inter-annual variation in year-class strength that is not thought to be due primarily to variation in SSB, none of the strategies could be considered to prevent the stock falling below $B_{escapement}$, and even B_{lim} occasionally, and possibly for a period of more than one year. This is taken into account in the scientific advice on management, and management decisions consistent with the advice also take it into account, and short periods of low SSB due to poor recruitment from unfavourable environmental conditions are not considered to be failures to achieve management objectives. Thus the harvest strategy has been evaluated reasonably thoroughly and there is evidence that the harvest strategy is achieving the objectives for which it was designed, and on those grounds a score of SG100 is justified.		
c	**Guidepost**	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
	Justification	The annual IBTS trawl survey is the main source of information on stock status and productivity, supported by catch monitoring. These time series have been maintained for more than three decades. Although coverage of the northern part of the stock's range has been slightly less intense in some recent years, the IBTS survey and catch monitoring are considered secure for the duration of the period of possible certification of this fishery. The survey and monitoring of catches provide sufficient information to support assessments that determine whether the harvest strategy is achieving the objectives for which it was designed. This this scoring criterion is fully met.		
d	**Guidepost**			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
	Justification	The stock has been subjected to benchmark reviews every five years; in the past on 2012 and 2006. The benchmark reviews consider performance of the fishery, dynamics of the stock, explore multiple scenarios for performance of the alternative management strategies, and evaluate performance of the harvest strategies with different parameters for management triggers. Although the overall fixed escapement strategy and trigger points has been kept following both reviews, most key biological parameters used in the annual assessment under the harvest strategy have been updated following each review. Thus this scoring guideline has been fully met.		

<table>
<tr><th colspan="2">PI 1.2.1</th><th colspan="3">There is a robust and precautionary harvest strategy in place</th></tr>
<tr><td rowspan="3">e</td><td>Guide post</td><td>It is likely that shark finning is not taking place.</td><td>It is highly likely that shark finning is not taking place.</td><td>There is a high degree of certainty that shark finning is not taking place.</td></tr>
<tr><td>Met?</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>Justification</td><td colspan="3"></td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES 2006 Report Of The Study Group On Management Strategies (SGMAS) 23 - 27 January 2006. ICES Headquarters 2006. ICES CM 2006/ACFM:15
ICES 2012 IBP Norway Pout Inter-benchmark assessment report. ICES CM 2012/ACOM:07.
ICES. 2015. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 28 April-7 May, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1031 pp. Part 5.
Vinther, M. and Nielsen, J.R. 2012. Evaluations of management strategies for Norway pout in the North Sea and Skagerrak Report (NOP-MSE). ICES NOP-MSE Report 2012. ICES CM 2012/ACOM:69.
Vinther, M. and Nielsen, J.R. 2013. Evaluations of management strategies for Norway pout in the North Sea and Skagerrak. Working document to ICES WGNSSK, May 2013. ICES CM2013/ACOM: xx.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>100</td></tr>
<tr><td colspan="4"></td><td></td></tr>
</table>

Evaluation Table for PI 1.2.2 – Norway Pout

PI 1.2.2		There are well defined and effective harvest control rules in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
	Met?	Y	N	
	Justification	The harvest control rules explored by ICES in the benchmark assessment meetings are well defined (ICES 2012). The scientific advice and management decisions by the management authority are consistent with the application of $B_{escapement}$ as a harvest control rule – that is, ensuring that after harvests and estimated of natural mortality are removed from the stock, remaining spawning biomass is above 150,000 t. However this control rule has not been adopted by the management authority, so it cannot be concluded that "well defined harvest control rules *are in place*". It appears that such rules are being applied in practice, but with no objectives, reference points and harvest control rules formally adopted, at best "generic rules" may be in place. Hence the SG 80 guidepost is met in terms of technical quality but it does not appear that the management actions have well defined harvest control rules or that the rules are in place. The fishery meets the SG 60, but not the SG80.		
b	Guide post		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		Y	N
	Justification	The simulations done in the two benchmark assessment meetings, considered uncertainty in stock recruitment relationships, environmental effects on recruitment, some operational aspects of the fishery, and predation mortality (ICES 2006 and 2012, Vinther and Nielsen 2012, 2013). These are major sources of uncertainty for North Sea Norway Pout dynamics. However many uncertainties that are relevant to the stock and fishery, particularly spatial and temporal patterns of harvesting and stock distributions could be relevance to sustainability of the fishery and stock, and have not been fully explored. Hence the SG 80 is met or exceeded for any of the three harvest strategies examined by ICES, but not SG 100.		
c	Guide post	There is some evidence that tools used to implement harvest control rules are appropriate and effective in	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.

PI 1.2.2		There are well defined and effective harvest control rules in place		
		controlling exploitation.	required under the harvest control rules.	
	Met?	Y	Y	N
	Justification	With an escapement strategy as the de facto management strategy, there is no specific maximum exploitation rate required under the harvest control rule. Rather exploitation has to be kept below a rate that would not leave the SSB above the $B_{escapement}$ value for the stock. The IBTS trawl survey each year gives reliable estimates of stock status and age composition of the stock, with uncertainty estimated. That provides evidence of the degree of success of management to maintain the stock at or above $B_{escapement}$. Operational regulations of the fishery do not allow any catch sorting once the trawl is brought on board, and dockside monitoring rates are sufficient to quantify catches. All vessels also have VMS, so spatial and temporal pattern of fishing are documented. Thus there is high confidence in the catch records for the fishery. So there is available evidence that gives some confidence that the tools are managing the harvest within the parameters of the escapement harvest strategy. However there cannot be a clear demonstration that the tools will be working in medium or longer term, without medium term certainty about management objectives, reference points, and choice of a specific harvest strategy. Thus the SG 80 Guidepost is met or exceeded but the SG 100 Guidepost is not met.		
References		ICES 2006 Report Of The Study Group On Management Strategies (SGMAS) 23 - 27 January 2006. ICES Headquarters 2006. ICES CM 2006/ACFM:15 ICES 2012 IBP Norway Pout Inter-benchmark assessment report. ICES CM 2012/ACOM:07. ICES. 2015. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 28 April-7 May, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1031 pp. Part 5. Vinther, M. and Nielsen, J.R. 2012. Evaluations of management strategies for Norway pout in the North Sea and Skagerrak Report (NOP-MSE). ICES NOP-MSE Report 2012. ICES CM 2012/ACOM:69. Vinther, M. and Nielsen, J.R. 2013. Evaluations of management strategies for Norway pout in the North Sea and Skagerrak. Working document to ICES WGNSSK, May 2013. ICES CM2013/ACOM: xx.		
OVERALL PERFORMANCE INDICATOR SCORE:				**75**
CONDITION NUMBER (if relevant): Condition 4: By the 4th annual audit, there must be well defined harvest control rules in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.				**4**

Evaluation Table for PI 1.2.3 – Norway Pout

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
	Justification	Biomass, age composition, and spatial distribution of the stock are quantified annually in the IBTS survey (ICES 2012, 2015). Some but incomplete information about seasonal changes in distribution is available from other surveys and the fishery. General productivity can be estimated from annual recruitment and weight at age data from the survey, but more comprehensive information on productivity, including annual data on realized predation mortality is only available from modelling (ICES 2013). Only general information on stock structure is available, suggesting that there is not full mixing of spawners across the North Sea Norway Pout, but not resolving specific sub-stock boundaries. Full information on fleet composition, catch composition, and spatial details of harvesting is available annually from the industry and VMS monitoring records. There is good environmental monitoring of North Sea oceanographic conditions, but algorithms to link oceanographic information to stock productivity have not been developed. Biomass of major predators is also updated annually, but there is sufficient uncertainty about details of how predators distribute predation among potential prey that predation mortality, although large, cannot be updated annually. Hence the SG 80 benchmark is exceeded but SG 100 Guidepost is not met.		
b	Guide post	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N

<table>
<tr><td colspan="2">PI 1.2.3</td><td colspan="3">Relevant information is collected to support the harvest strategy</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Stock abundance and fishery removals are both monitored annually, and assessed with sufficient accuracy and precision to allow the $B_{escapement}$ strategy to be applied in developing scientific advice and management decision-making (ICES 2015; see justification of 1.2.3b for details). However, details of predation mortality and environmental impacts on productivity are not known with sufficient precision and with sufficient lead time to have a high degree of certainty that application of the $B_{escapement}$ strategy will actually make it unlikely that the fishery will not reduce the stock below the $B_{escapement}$ de facto target in all years. Hence the SG 80 is met and exceeded but the SG 100 is not met.</td></tr>
<tr><td rowspan="3">c</td><td>Guide post</td><td></td><td>There is good information on all other fishery removals from the stock.</td><td></td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Norway pout are a small demersal species and only targeted in the reduction fisheries of Denmark and Norway. The directed blue whiting fishery in the northern North Sea took substantial bycatches of Norway pout in some places and years with blue whiting TACs were high, but this fishery has been greatly reduced in recent years. Catches in all of these fleets are fully monitored with a high degree of accuracy, and included in the assessments of this stock. Retention of Norway Pout in other demersal fisheries is low, and all of these fisheries are also monitored, with catches included in the assessments (ICES 2015). In past years there was potential for unreported discarding in these demersal fisheries for larger groundfish, so a small amount of fishing mortality may have gone unreported. However the changes to retention regulations in EU fisheries make this possible source of unreported catches will be reduced even further or eliminated.
Thus the SG 80 is fully met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES. 2015. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 28 April-7 May, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1031 pp. Part 5.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 1.2.4 – Norway Pout

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		Y	N
	Justification	The assessment estimates total biomass, spawning biomass, and recruitment annually (ICES 2012a, 2015). In these calculations age specific natural mortality values from a multispecies model are used, and updated in the years when the multispecies model is run and accepted (ICES 2014). The frequency with which this happens has been variable, depending on developments in the model and availability of new information on predator or prey status. The approach is appropriate for the stock dynamics, which are largely driven by annual recruitment, and is sufficient to fully support application of a $B_{escapement}$ management strategy. However, the assessment does not use annual information on oceanographic conditions to refine the survey estimates of age 0 Norway pout, which, for a short lived species are important to management of the fishery and protection of the productive capacity of the stock, and cannot update abundances of all predator and prey populations in the multispecies model annually. Hence the SG 80 benchmark is met or exceeded for the stock, but the SG 100 is not met.		
b	Guide post	The assessment estimates stock status relative to reference points.		
	Met?	Y		
	Justification	The assessment estimates quarterly and annual total biomass and Spawning Biomass. The reference points used in formulation of scientific advice on harvests and in recent decisions by the management authority regarding TACs are for spawning biomass but not fishing mortality, which is allowed to fluctuate depending on spawning biomass. Hence the assessment does estimate SSB values that can be compared to $B_{escapement}$ reference points in annual science advice and management decisions. Although those reference points are implicit in management of the stock, this SG Guidepost is fully met.		
c	Guide post	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
	Met?	Y	Y	N
	Justification	The assessment document does explain many of the key sources of uncertainty in sections 5.1 (general introduction) and section 5.8 (Quality of the assessment), but only at the level of what are the major sources of		

PI 1.2.4		There is an adequate assessment of the stock status		
		uncertainty. Their relative magnitudes are not discussed, although some information on magnitude of the uncertainties can be extracted from the benchmarking analyses. The annual assessment uses Extended Survivors Analysis (SXSA), which does allow uncertainty in quarterly and annual SSB to be estimated. However none of the key figures and tables in the assessment document (Tables 5.3.3.-5.3.6 and Figures 5.3.2-5.3.5), include uncertainty measures, although the information in figure 5.3.1 could be used to generate confidence intervals of some alternative uncertainty metrics for some parameters of the stock (ICES 2015). Thus the assessment does identify the major sources of uncertainty in the assessment and meets the SG 60. The reporting of annual assessment results do communicate the uncertainty in key parameters of the stock in effective ways, but these estimates are not fully used in management decision-making. Rather the assessment assumes that the $B_{escapement}$ de facto target, combined with the very weak association of recruitment with SSB, is sufficient to allow management decisions to be guided by the point estimates for SSB. These issues have been explored in the benchmark assessments, which confirmed the robustness of escapement strategy decisions based on point estimates of SSB (ICES 2012a). However the uncertainty nevertheless may be underutilized in the annual TAC decisions. Thus the SG 80 Guidepost is met but not exceeded.		
d	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Y
	Justification	The benchmark assessments have tested the assessment of this stock, and of the multispecies models used to general predation mortality values used in the assessment (ICES 2006, 2012a). The benchmark assessments have explored alternative hypotheses for stock recruit relationships in some detail, concluding that independent of analytical formulation, the dependence of recruitment on spawning stock is weak, and environmental conditions influence productivity strongly. Specific environmental factors were explored in the benchmark meetings, without finding any analytical formulations of recruitment linked to specific oceanographic factors that performed better than the currently used SXSA assessment. Alternative formulations of the multispecies models used to estimate predation mortality were also explored in the relevant benchmark assessments, with the chosen formulation by WGSAM was considered to have best overall performance characteristics (ICES 2012b). These benchmark tests are considered sufficient to demonstrate the robustness of the assessment method to major sources of uncertainty, and alternative approaches have been considered. Thus the SG 100 may be met. However, the benchmark assessments also documented that the assessments are uncertain, due in large part to environmental variation that is not fully captured in the annual assessment point estimates. Hence the potential robustness of the assessment method can only be fully realized if		

PI 1.2.4		There is an adequate assessment of the stock status		
		the uncertainties in the analyses are carried all the way to advice and management decision-making.		
e	**Guide post**		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		Y	Y
	Justification	Although the periodic benchmark assessments are organized by ICES, which is the scientific body that conducts the annual assessments, efforts are taken to ensure that participants in benchmark meetings include experts in assessment methods relevant for the stock(s) under consideration, but not involved in the annual working group meetings where the assessments are tabled and reviewed. The views of the independent experts have strong influence in the conclusions and recommendations from the benchmark assessments, The annual assessments are prepared by a small group of experts, often from a single research center. They are tabled at a Working Group meeting where they are reviewed by all the participating experts, few of whom have been involved in preparation of the assessment. Moreover the ICES Advisory Committee (ACOM) reviews all Working Group Reports and finalizes the advice on each stock. This process routinely requires one or two addition experts, independent of any engagement in the relevant working group, review each assessment for quality and for coherence of the draft advice with the assessment. Hence both SG 80 and SG 100 are met for this stock.		
References		ICES 2006 Report Of The Study Group On Management Strategies (SGMAS) 23 - 27 January 2006. ICES Headquarters 2006. ICES CM 2006/ACFM:15 ICES 2012a IBP Norway Pout Inter-benchmark assessment report. ICES CM 2012/ACOM:0x. ICES WGSAM 2012b. Report of the Working Group on Multi Species Assessment Methods (WGSAM). ICES CM 2012/SSGSUE:1 ICES. 2015. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 28 April-7 May, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:13. 1031 pp. Part 5.		
OVERALL PERFORMANCE INDICATOR SCORE:				**90**
CONDITION NUMBER (if relevant):				

Principle 1 Sprat

Evaluation Table for PI 1.1.1 – Sprat

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
a	Guide post	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
	Met?	Y	Y	Y
	Justification	Due to recruitment of the strongest year-class ever recorded for this stock, the SSB is also at the highest level ever estimated for the stock (ICES 2015. Figure 8.6.8 lower panels). Hence at present there is a high degree of certainty that the stock is above the SSB where recruitment would be impaired. Because sprat are a relatively short-lived species, with SSB strongly influenced by incoming recruitment, there cannot be high certainty that the stock will remain at such high biomasses for the full period of certification. Hence if the fishery is certified, stock status should be reviewed at each audit. However, year-class strength has been at or above the geometric mean for the seven of the past ten years (ICES 2015, Figure 8.6.8, lower left panel, table 8.6.5), suggesting that stock productivity has been generally good under recent environmental conditions. Moreover the strong recruitment in 2014 should contribute to SSB for at least a few more years. Consequently there is no biological basis to expect SSB to drop to a level where recruitment would be impaired by inadequate SSB in the near future.		
b	Guide post		The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
	Met?		Y	N
	Justification	The SSB has been varying without trend since the 1990s, until the strong increase in SSB in the most recent years due to above average to strong year classes recruiting to the SSB (ICES 2015, Figure 8.6.7 middle panel). During that 25 year interval there have been four periods when SSB dropped below the de facto reference points used in the science advice on this stock, but none of those periods of low SSB lasted more than two years before the stock increased to above the precautionary reference points. Hence the stock exceeds the SG 80 guideline for this criterion. However, the reference points used in the science advice have not been adopted by management, so there cannot be a high degree of certainly that the stock has been above management reference points, since the jurisdiction has not adopted specific reference points for the stock.		
References		ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Section 8)		
Stock Status relative to Reference Points				
		Type of reference point	Value of reference point	Current stock status relative to reference point

PI 1.1.1	**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Target reference point	The assessors of the stock were not able to fit a parameterized stock recruit relationship well to the stock and recruit data, so MSY-based reference points cannot be estimated. However the stock – recruit scatterplot was examined, and a breakpoint roughly separating SSBs at which the occasional strong year-classes were observed from SSBs where the occasional very weak year-classes where observed. A precautionary reference point was then defined as the upper 90% confidence value of the estimate of this breakpoint. This is used as a target reference point in formulation of the advice, but has not been adopted by the management authority.(section 8.7, ICES 2015)	B_{pa} = 142,000 t	The estimate of 2015 SSB is 663,000 t, which is 467% of the $B_{pa.}$ The estimate of 2014 SSB, prior to recruitment of the exceptionally strong 2014 year-class, was 360,000 t, which is still 254% of the B_{pa} value.
Limit reference point	The assessors of the stock were not able to fit a parameterized stock recruit relationship well to the stock and recruit data, so MSY-based reference points cannot be estimated. However the stock – recruit scatterplot was examined, and a	B_{lim} = 90,000 t	The estimate of 2015 SSB is 663,000 t, which is 737% of the B_{lim}. The estimate of 2014 SSB, prior to recruitment of the exceptionally strong 2014 year-class, was 360,000 t, which is still 400% of the B_{lim} value.

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
	breakpoint roughly separating SSBs at which the occasional strong year-classes were observed from SSBs where the occasional very weak year-classes where observed. This breakpoint was used as a limit reference point in formulation of the advice, but has not been adopted by the management authority.(section 8.7, ICES 2015)		

OVERALL PERFORMANCE INDICATOR SCORE:	**90**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 1.1.2 – Sprat

PI 1.1.2		Limit and target reference points are appropriate for the stock		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	Y	Y	
	Justification	The de facto reference points on which science advice is based use a 40 year time series of stock and recruitment estimates. Although both oceanographic conditions and predation may cause variation in year class strength, analyses have demonstrated a modest tendency for recruitment to increase as spawning biomass increases. The relationship has been examined with a number of analytical methods, and no parameterized model fits the stock and recruitment data well. However, a breakpoint in SSB has been estimated, and most of the poorer year-classes were produced at SSBs below this breakpoint, whereas most of the especially strong year-classes were produced at SSBs above this value. Hence this provides some biological basis to serve as a limit reference point, and can be estimated. The uncertainty in the assessment has been quantified as well, and a precautionary reference point has been set at the upper 90th percentile of the possible values of the breakpoint serving as the limit, to manage the risk of SSB falling to a level where recruitment would be impaired by inadequate spawning biomass. (ICES 2015, Section 8.7) This precautionary limit can serve as a target reference point for the stock, as long as it is understood that management should not be designed to have the stock vary randomly around the B_{pa}. If that were to happen then the stock would spend 50% of the years at a higher than the 10% desired risk of true biomass being below the de facto limit. Instead management should be designed to prevent the stock from falling below the B_{pa}, and fishing mortality should be reduced as soon as the stock falls below B_{pa}. This is the case in the formulation of scientific advice by ICES, so it can serve as a target. However would not be an appropriate target if variation around the B_{pa} were considered noise, and additional management actions were not taken when SSB fell below the Bpa by a modest amount. Note: North Sea sprat are a shared stock between the EU and Norway. For some North Sea stocks the EU and Norway have negotiated and adopted formal agreements, containing management objectives and harvest control rules. No such agreement exists for sprat. The EU is considered the management authority for the Danish fishery for sprat, because all Danish harvests occur in EU waters. Consequently the reference points used in developing science advice for the stock are appropriate for the stock and can be estimated, meeting the SG80.		
b	Guide post		The limit reference point is set above the level at which there is an appreciable risk of impairing	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following

PI 1.1.2		Limit and target reference points are appropriate for the stock		
			reproductive capacity.	consideration of precautionary issues.
	Met?		Y	N
	Justification	The de facto limit reference is set at the breakpoint, below which there is some evidence that likelihood of poor year-classes might increase, and likelihood of particularly strong year classes might decrease (ICES 2015: section 8.7). The breakpoint is set at the best estimate for simultaneously minimizing likelihood of poor – year classes and maximizing likelihood of strong ones, meeting theSG80. No precautionary considerations were applied to set the reference point any higher than the point considered the best tradeoff of those tow likelihoods (i.e., equal weight was given to avoiding impaired recruitment and to possibly getting a strong year class. In addition, uncertainty in the assessment is taken into account in setting the value for B_{pa} and not in choosing a value for the de facto limit, thereby not meeting SG100.		
c	**Guide post**		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		Y	N
	Justification	The de facto target reference point is set at a value which make the risk of poor recruitments as low as possible, while keeping the probability of occasional strong recruitments high. In that sense it is a surrogate with many of the properties desired of MSY for stocks with a stronger dependence of recruitment on SSB. Possible density dependent effects on growth and / or fecundity do not appear to have been considered in choosing the target reference point, however, so it is not known if the actually maximizes overall productivity of the stock, so it may produce only some of the outcomes expected from B_{msy}, if B_{msy} could be estimated. Therefore, although the ecological role of sprat was taken into account to some extent in the natural mortality values used in the assessment producing the stock and recruit data, there cannot be a high degree of certainly that the target reference point will be applied in decision-making, nor that if the target is used, outcomes consistent with MSY management can be expected. Hence the SG 80 can be considered to be met (if it continues to be used in management), but it does not reach SG100.		
d	**Guide post**		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	

<table>
<tr><td colspan="2">PI 1.1.2</td><td colspan="3">Limit and target reference points are appropriate for the stock</td></tr>
<tr><td rowspan="2"></td><td>Met?</td><td></td><td>Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Sprat is a lower trophic level stock. It has a small L_{inf}, is short-lives, for most ages predation mortality exceeds fishing mortality, and it appears in the diets of many piscivorous predators in the North Sea (Pinnegar 2011). The target reference point was derived from stock recruit data and uncertainty in a single species assessment. However the predation mortality values used in that assessment are produced by a multi-species model that attempts to take predation mortality of all main predators into account. These natural mortality estimates were examined closely during the benchmark assessments for both the sprat assessment (ICES 2013a – WGSPRAT) and for the multispecies model (SMS – ICES 2013b – WGSAM). The annual assessments use natural mortality values updated by runs of SMS with the most current data on predator and prey abundances in the North Sea, Consequently the target reference point does allow for predation by a wide spectrum of fish, seabird and marine mammal predators, taking the ecological role of the species into account.

The B_{pa} target reference point for sprat is considered a surrogate (proxy) for an MSY-based reference point for sprat (ICES 2015), The scoring guidelines for CB 2.3.17 to 2.3.19 all require that the “ecosystem needs” for the species be taken into account. More specifically, 2.3.17 sets standards for the target reference point in terms of percentage of B_0 for the stock, or more than half the “ecosystem needs”. For sprat, no estimate of B_0 was made, because ICES deals with needs of predators explicitly in the assessments (ICES 2014a). This is a more robust strategy, and consistent with MSC CR v1.3 section CB2.3.20, because the notion of a B_0 for a stock with the recruitment dynamics of sprat is highly questionable as a basis for any management target. Likewise the concept of B_0 for a system that has been exploited for as long as the North Sea is questionable. Rather for the North Sea ICES estimates the “ecosystem needs” empirically for key LTL stocks as part of the SMS modeling (ICES 2014b). Then the needs of the ecosystem are fully accounted for even before the target is estimated. Extensive simulation modelling reported in ICES 2009, ICES2014a, and ICES 2014b all demonstrate that the approach explicitly accounting for predation mortality before calculating SSB, fully allows the proxies to fully meet the estimated ecosystem needs both for target and limit reference points. Thus the defaults specified in CB 2.3.17-19 for SG80 are all met or exceeded.

Hence the SG 80 can be considered to be met (if it continues to be used in management).</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES. 2009 Report of the Benchmark Workshop on Short-lived Species (WKSHORT). ICES CM 2009/ACOM:34. 164 pp.
ICES. 2014a. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 20–24 October 2014, London, UK. ICES CM 014/SSGSUE:11. 104 pp.
ICES. 2014b. Report of the Workshop to consider reference points for all stocks
(WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp.</td></tr>
</table>

PI 1.1.2	Limit and target reference points are appropriate for the stock	
	ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp. (Section 8) Pinnegar, J.K. 2011. DAPSTOM. An integrated database and portal for fish stomach records. Version 3.6. Cefas, Lowestoft. www.cefas.defra.gov.uk/dapstom.	
OVERALL PERFORMANCE INDICATOR SCORE:		**80**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 1.1.3 – Sprat

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?	NA		
	Justification	The stock is not depleted		
b	**Guide post**	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
	Met?	NA		
	Justification			
c	**Guide post**	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
	Met?	NA		
	Justification			
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				**NA**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.1 – Sprat

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	Y	Y	N
	Justification	An escapement strategy is used in providing the scientific advice on North Sea sprat (ICES 2015, Section 8.9). This strategy allows F to vary with variation in sprat SSB, with most of that variation in SSB due to inter-annual variation in year-class strengths but with variation in predation mortality potentially contributing a minor amount to variation in SSB. The 2014 benchmark assessment for North Sea sprat included management strategy evaluations of several alternative harvest strategies. (ICES 2014a). The benchmark meeting found that an escapement strategy alone was not sufficiently precautionary, and a cap on F was adopted to constrain fishing mortality in years when estimates of SSB were high. The Fcap estimate of 0.7 was considered the value that provided adequately precautionary protection to the stock, and was adopted by the ICES Advisory Committee for use in formulating science advice. Together the lower bound on SSB achieved by using the target reference point as $B_{escapement}$, and the upper bound on F should work together to maintain the stock above the de facto target reference point in the short and medium term. The variable TACs produced when the strategy is applied are fully responsive to variation in SSB, and are updated by the most recent annual survey values. So the harvest strategy is responsive to state of the stock and can deliver the outcomes expected from application of the strategy. Thus on biological grounds the harvest strategy exceeds the SG 80 Guidepost. However, there are no objectives set for the stock, so the SG 100 is not met. Importantly, the management authority for the stock has not committed in the medium or longer term to apply the harvest strategy in harvest management decisions, such that the stock would be maintained above the target, and to return the stock to above the target as quickly as possible, should poor recruitment (or excessive harvesting) reduce the SSB below the de facto target.		
b	Guide post	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
				to maintain stocks at target levels.
	Met?	Y	Y	N
	Justification	The management strategy evaluations conducted as part of the MSY benchmarking workshop (ICES b) evaluated six different harvesting strategies for sprat. Simulations representing both stock and fleet dynamics, found that strategies including both an escapement minimum for SSB and a cap on F could be sustainable, if the $B_{escapement}$ and F_{cap} were set to appropriate levels, This would not prevent the occurrence of occasional weak recruitments due to unfavourable environmental conditions, but the combination of measures in a strategy would prevent depletion of the SSB by harvests to levels where recruitment would be impaired. The simulations also indicated that for North Sea sprat the value of B_{pa} of 150,000 would function effectively an escapement goal, and an F of 0.7 would function effectively as a cap on fishing mortality. The science advice for over a decade was been formulated using the $B_{escapement}$ of 150,000 t as a de facto target, and management decisions have been consistent with the science advice. During that period the SSB has fallen below the escapement goal on a few occasions, due to recruitment of very weak year-classes. In each case the SSB recovered quickly, as soon as an average to above average year-class recruited to the stock. However, the F cap is a new addition to the harvest strategy, and there has been no experience with its consequences when used in management. Consequently there has been some testing of the harvest strategy and there some evidence that the escapement boundary is functioning as intended. However the testing cannot be considered to have *fully* evaluated the harvest strategy for a lower trophic level species where ecosystem functions are an important consideration in management, and evidence is incomplete with regard to the effectiveness of the new harvest strategy (both a lower boundary on escapement and an upper boundary on F) at maintaining the stock above the de facto target, even under unfavorable environmental conditions for recruitment. Hence an SG level of 80 is met or exceeded but not SG 100		
c	**Guide post**	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
	Justification	The stock is monitored by both the Quarter 1 and Quarter 3 IBES surveys, and by a hydroacoustic survey in the third quarter, The biomass estimates of sprat from each of the three surveys have substantial uncertainty (Figure 8.6.3-4), and track age classes over time through the population only weakly (Figure 8.3.5-7). However when they are used together with data from catch monitoring in the annual assessment, the CV on biomass estimates is around 0.3 (Section 8.6 and table 8.6.3). Used together the surveys and catch monitoring are sufficient to give reliable information on the impact of harvesting on the stock. Hence if the harvest strategy is being applied there would sufficient information to determine if the strategy is working.		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
d	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
	Justification	The stock has been subjected to benchmark reviews with the most recent one in 2014 (ICES 2014a). The benchmark reviews consider performance of the fishery, dynamics of the stock, explore multiple scenarios for performance of the alternative management strategies, and evaluate preference of the harvest strategies with different parameters for management triggers. Although the overall fixed escapement strategy has been kept following the review, it was augmented by an F_{cap} to further manage fishing mortality. In addition most key biological parameters used in the annual assessment and as inputs to action under the harvest strategy have been updated following each review. Hence the SG 100 Guidepost is met for the harvest strategy as it is used in practice, and if it were to be adopted formally.		
e	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	NA	NA	NA
	Justification			
References		ICES. 2014a. Report of the Benchmark Workshop on Sprat Stocks (WKSPRAT), 11–15 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:48. 220 pp. ICES. 2014b. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp. ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp.		
OVERALL PERFORMANCE INDICATOR SCORE:				85
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.2 – Sprat

<table>
<tr><td colspan="2">PI 1.2.2</td><td colspan="3">There are well defined and effective harvest control rules in place</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.</td><td>Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.</td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td>N</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Well-defined harvest control rules were explored by ICES in the MSY benchmark meeting (ICES 2014b). The scientific advice on North Sea sprat is formulated using a harvest control that performed well in the simulations, including a de facto $B_{escapement}$ of 150,000 t and a de facto F_{cap} of 0.7,
The control rules set TACs where total fishing removals from July of year X to June of year X+1 do not reduce the SSB below the $B_{escapement}$, <u>and</u> for large SSBs, if TACs produced by application of the escapement rule would result in an F greater than 0.7, then the TAC is no larger than harvest resulting from fishing at F=0.7,
Management decisions by the management authority over the past 15 years have been consistent with the application of $B_{escapement}$ as a harvest control rule. The F cap is a new feature in the ICES advice, but has been used in developing the advice on the 2015 TAC, given the exceptionally strong year-class recruiting to the stock (Table 8.9.2 ICES 2015), and the management decision is consistent with the advice.
Although this control rule has not been adopted by the management authority, it has been applied in practice for the last several years. Consequently it can be concluded that “well defined harvest control rules are in place”, but only at present. Such rules are being applied in practice, but with no objectives, reference points and harvest control rules formally adopted, only “generic rules” are be in place with certainty. Hence the SG 80 guidepost is met in terms of technical quality but it does not appear that the management actions have well defined harvest control rules or that the rules are in place. The fishery meets the SG 60, but not the SG80.</td></tr>
<tr><td rowspan="3">b</td><td>Guide post</td><td></td><td>The selection of the harvest control rules takes into account the main uncertainties.</td><td>The design of the harvest control rules takes into account a wide range of uncertainties.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The simulations reviewed at the both benchmark sprat meeting (ICES 2014a) and the benchmark MSY meeting (ICES 2014b) considered uncertainty in stock recruitment relationships, environmental effects on recruitment, and predation mortality, and some aspects of fishing strategies. These are major sources of uncertainty for North Sea sprat dynamics. However the range of scenarios considered in exploring these sources of uncertainty were not exhaustive. In addition other uncertainties that are</td></tr>
</table>

PI 1.2.2		**There are well defined and effective harvest control rules in place**		
		relevant to the stock and fishery, such as fishery performance, spatial and temporal patterns of harvesting and stock distributions could be relevant to sustainability of the fishery and stock, and have not been fully explored. With regard to the harvest control rules taking uncertainties into account the SG 80 is substantially exceeded for the joint $B_{escapement}$ – F_{cap} harvest strategy examined by ICES, but does not meet SG 100.		
c	**Guide post**	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met?	Y	N	N
	Justification	The IBTS trawl survey each year gives reliable estimates of stock status and age composition of the stock, with uncertainty estimated. That provides evidence of the degree of success of management in maintain the stock at or above $B_{escapement}$. Operational requirements of the fishery do not allow any catch sorting once the trawl is brought on board, and dockside monitoring rates are high. All vessels also have VMS, so spatial and temporal pattern of fishing are documented. Thus there is high confidence in the catch records for the fishery, although sampling rate in some quarters is low due to infrequent and relatively small landings. Consequently F can be estimated with an acceptable CV (approximately 30%) during the annual assessment of the stock, The joint $B_{escapement}$ – F_{cap} harvest strategy as the de facto management strategy has only been in place for one year. Consequently there are only modelling results to support the effective of a maximum exploitation rate as well as a minimum SSB required under the combined harvest control rule, or that management really will maintain F below F_{cap} over a wide range of stock sizes. Thus there is available evidence that gives some confidence that the tools are managing the harvest within the parameters of each year's management plan, but the full harvest strategy has not been in place long enough for a clear demonstration that management tools will meet all components of the harvest strategy. In addition there cannot be a clear demonstration that the tools will be working in medium or longer term, without medium term certainty about management objectives, reference points, and choice of a specific harvest strategy. In addition there cannot be a clear demonstration that the tools will be working in medium or longer term, without medium term certainty about management objectives, reference points, and choice of a specific harvest strategy. *Additional commentary added in late 2016*. In the 2016 ICES assessment and advice for 2017 landings in 2015 are reported to have exceeded the set TAC, and the TAC set for 2016 was set well above the ICES advice. It also reported that F had increased above 0.7 in the last two years. These developments all suggest that even if the reference points and HCR are being used in ICES advice, the lack of commitment to a medium term management plan for the stock, entrenching the reference points and harvest control rule in management is a serious concern for this stock, and		

PI 1.2.2		There are well defined and effective harvest control rules in place	
		possibly the others included in the this certification assessment. Consequently the SG 80 for this stock is not met.	
References		ICES. 2014a. Report of the Benchmark Workshop on Sprat Stocks (WKSPRAT), 11–15 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:48. 220 pp. ICES. 2014b. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp. ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp.	
OVERALL PERFORMANCE INDICATOR SCORE:			**70**
CONDITION NUMBER (if relevant): **Condition 5: By the 4th annual audit, there must be well defined harvest control rules in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.**			**5**

Evaluation Table for PI 1.2.3 – Sprat

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
	Justification	Biomass, age composition, and spatial distribution of the stock are quantified annually in the IBTS surveys in Quarters 1 and 3, and the hydroacoustic survey of the south-central part of the North Sea in quarter 3. There is good sampling of catches in quarters when catches are moderate to high, to allow estimation of age composition and weight at age for areas a small as four adjacent statistical rectangles. General productivity can be estimated from annual age composition and weight at age data from the survey and fishery, but more comprehensive information on productivity, including annual data on realized predation mortality is only available from modelling. Only general information on stock structure is available, suggesting that there is not full mixing of spawners across the North Sea, but not resolving specific sub-stock boundaries for sprat. Full information on fleet composition, catch composition, and spatial details of harvesting is available annually from the industry and VMS monitoring records. There is good environmental monitoring of North Sea oceanographic conditions, but algorithms to link oceanographic information to stock productivity have not been developed. Biomass of major predators is also updated annually, but there is sufficient uncertainty about details of how predators distribute predation among potential prey that predation mortality, although large, cannot be fully updated annually. Hence the SG 80 benchmark is exceeded, but the 100 guidepost is not met.		
b	Guide post	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N

PI 1.2.3		Relevant information is collected to support the harvest strategy		
	Justification	Stock abundance and fishery removals are both monitored regularly, with surveys in quarters 1 and 3 and catch monitoring throughout the fishing year. Sampling levels are sufficiently high to support an analytical assessment with sufficient accuracy and precision to allow both the $B_{escapement}$ and F_{cap} portions of the harvest strategy to be applied in developing scientific advice and informing management decision-making (see justification of 1.2.3b for details). However, spatial details of predation mortality and environmental impacts on productivity are not known with precision. Hence it is not possible to be confidant that application of the joint $B_{escapement}$ – F_{cap} harvest strategy will actually make it unlikely that the fishery will maintain the stock above the $B_{escapement}$ de facto target in the short term and on local scales. However, as long as the harvest control rules continue to be applied, management will react to recruitment-driven declines in SSB in appropriate ways. Hence the SG 80 is exceeded but SG 100 is not met.		
c	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
	Justification	Sprat is a small demersal species and only targeted in the reduction fisheries of Denmark and Norway. Aside from very small catches of sprat in Norwegian fiords, catches in all of these fleets are fully monitored with a moderate degree of accuracy, and included in the assessments of this stock. Retention of sprat in other demersal fisheries is low, and all of these fisheries are also monitored, with catches included in the assessments. In past years there was potential for unreported discarding in demersal fisheries for larger groundfish, so a small amount of fishing mortality may have gone unreported. However the changes to retention regulations in EU fisheries make this possible source of unreported catches will be reduced even further or eliminated. Hence the SG 80 guidepost is met.		
References		ICES. 2014a. Report of the Benchmark Workshop on Sprat Stocks (WKSPRAT), 11–15 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:48. 220 pp. ICES. 2014b. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp. (Part 11, and Stock Annex for Sprat) ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM 2015/ACOM:06. 850 pp.		
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.4 – Sprat

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		Y	N
	Justification	The SMS assessment model assessment estimates total biomass, spawning biomass, and recruitment with quarterly time steps (ICES 2011. 2012, ICES 2015, Section 8). In these calculations age specific natural mortality values from a multispecies model are used, and updated in the years when the multispecies model is run and accepted. Between updates of the multispecies model, the quarterly estimates of M from the multispecies model are used for years up to the year when the mode was run, and the average quarterly M of the last years of the multispecies model run is used for the most recent years of the sprat assessment. The frequency with which the natural mortality values are updated has been variable, depending on developments in the model and availability of new information on predator or prey status. The stock dynamics are largely driven by annual recruitment, and require quarterly time steps to account for changes in weight at age, natural mortality, and selectivity by the fishery, due to growth in size within the year. The assessment approach is appropriate for the stock and is sufficient to application of the harvest strategy (ICES 2015). However, the assessment does not use annual information on oceanographic conditions and predator and prey abundance to refine the survey estimates of age 0 sprat, which, for a short lived species are important to management of the fishery and protection of the productive capacity of the stock. Hence the SG 80 benchmark is substantially exceeded for the stock, but the SG 100 is not met.		
b	Guide post	The assessment estimates stock status relative to reference points.		
	Met?	Y		
	Justification	The assessment provides quarterly and annual estimates of total biomass, spawning biomass, and fishing mortality. The reference points used in formulation of scientific advice on harvests and in recent decisions by the management authority regarding TACs are for spawning biomass and, since 2014, also for fishing mortality. The assessment does estimate SSB and F values that can be compared to $B_{escapement}$ and F_{cap} reference points, although those reference points do not yet have fully accepted status in management of the stock.		
c	Guide post	The assessment identifies major	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status

PI 1.2.4		There is an adequate assessment of the stock status		
		sources of uncertainty.		relative to reference points in a probabilistic way.
	Met?	Y	Y	N
	Justification	The assessment document does explain many of the key sources of uncertainty in sections 8.6 (stock assessment) and section 8.10 (Quality of the assessment), but only at the level of what are the major sources of uncertainty. Their relative magnitudes are not discussed in the annual assessments. However information on magnitude of several important sources of uncertainties can be extracted from the benchmarking analyses both for the sprat assessment (ICES 2014a) and in estimation and use of the de facto reference points (ICES 2014b). The annual assessment uses SMS which does allow uncertainty in annual SSB to be estimated. However none of the key tables in the assessment document (Tables 8.6.4-5 include uncertainty measures, nor do the inputs to the projections from the assessment (Table 8.9.1). Figure 8.6.7 does present 95% confidence intervals for SSB, F and recruitment. However this information does not appear to be used in the projections or subsequent exploration of stock trajectories (Fig 8.6.8) Thus the assessment does identify the major sources of uncertainty in the assessment and meets the SG 60. The reporting of annual assessment results present the uncertainty in key parameters of the stock in effective ways that can be used in management decision-making, and to some extent discussed the results in the context of the uncertainties, so the SG 80 guideline is met and somewhat exceeded. However the science advice does not report probabilistic projections, nor compare SSB and F to their de facto reference points in a probabilistic way, so the SG 100 is not met.		
d	Guidepost			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			N
	Justification	The benchmark assessment meeting for sprat tested the assessment of this stock, and the multispecies models used to general predation mortality values used in the assessment were investigated in a separate meeting on the multispecies model (ICES 2014a, ICES 2012). The benchmark assessment explored alternative hypotheses for stock recruit relationships in some detail, concluding that independent of analytical formulation, the dependence of recruitment on spawning stock is weak but there is a tendency for recruitment to in increase with SSB over the entire observed range of SSB, and that there is some increase in likelihood of poor recruitment at low SSB. Alternative formulations of the multispecies models used to estimate predation mortality were also explored in the relevant benchmark assessments, with the chosen formulation by WGSAM was considered to have best overall performance characteristics. These benchmark tests are considered sufficient to demonstrate the robustness of the assessment method to major sources of uncertainty, and alternative approaches have been considered. However, the benchmark assessments also documented that the assessments are uncertain, due in part to environmental variation that is not fully captured in the annual		

<table>
<tr><td colspan="2">PI 1.2.4</td><td colspan="3">There is an adequate assessment of the stock status</td></tr>
<tr><td></td><td></td><td colspan="3">assessment point estimates. Hence the potential robustness of the assessment method can only be fully realized if the uncertainties in the analyses are carried all the way to advice and management decision-making, so the SG 100 guidepost is approached but not met fully.</td></tr>
<tr><td rowspan="3">e</td><td>Guide post</td><td></td><td>The assessment of stock status is subject to peer review.</td><td>The assessment has been internally and externally peer reviewed.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>Y</td></tr>
<tr><td>Justifi cation</td><td colspan="3">Although the periodic benchmark assessments are organized by ICES, which is the scientific body that conducts the annual assessments, efforts are taken to ensure that participants in benchmark meetings include experts in assessment methods relevant for the stock(s) under consideration, but not involved in the annual working group meetings where the assessments are tabled and reviewed. The views of the independent experts have strong influence in the conclusions and recommendations from the benchmark assessments,

The annual assessments are prepared by a small group of experts, often from a single research center. They are tabled at a Working Group meeting where they are reviewed by all the participating experts, few of whom have been involved in preparation of the assessment. Moreover the ICES Advisory Committee (ACOM) reviews all Working Group Reports and finalizes the advice on each stock. This process routinely requires one or two addition experts, independent of any engagement in the relevant working group, review each assessment for quality and for coherence of the draft advice with the assessment.

Hence both SG 80 and SG 100 are met for this stock.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES WGSAM 2011. Report of the Working Group on Multi Species Assessment Methods (WGSAM). ICES CM 2011/SSGSUE:10

ICES WGSAM 2012. Report of the Working Group on Multi Species Assessment Methods (WGSAM). ICES CM 2012/SSGSUE:1

ICES. 2014a. Report of the Benchmark Workshop on Sprat Stocks (WKSPRAT), 11–15 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:48. 220 pp.

ICES. 2014b. Report of the Workshop to consider reference points for all stocks

(WKMSYREF2), 8-10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp.

ICES. 2015. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 10-19 March 2015, ICES HQ, Copenhagen, Denmark. ICES CM

2015/ACOM:06. 850 pp.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>85</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Principle 2

Evaluation Table for PI 2.1.1—all fisheries

<table>
<tr><td colspan="2">PI 2.1.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Main retained species are likely to be within biologically based limits (if not, go to scoring issue c below).</td><td>Main retained species are highly likely to be within biologically based limits (if not, go to scoring issue c below).</td><td>There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.</td></tr>
<tr><td>Met?</td><td>Y-Herring</td><td>Y-Herring</td><td>Y-Herring
Y - Blue whiting
N – Dab
N – Whiting
N – Flounder
N – Haddock</td></tr>
<tr><td>Justification</td><td colspan="3">The fishery has limited catch of non-target species. Catch composition is detailed in Table 27Table 28 and Table for the three target fisheries. Catch composition is not differentiated by gear type because there is a one-to-one correspondence between gears and species (i.e. sprat is caught by pelagic gear, sandeel and Norway pout with demersal gear; see 3.4.6.1). In addition, while there is some difference in catch composition among the different target species, for the purposes of scoring Principle 2, we have treated the main and minor species as one group and scored them as one scoring element each per PI rather than separately per target. As this could only possibly have the effect of lowering the overall PI score we deemed it appropriately precautionary.

Sandeel:
The main non-target species landed are other sandeel species in the sandeel fishery. Because these are inseparable from the target sandeel species, they have been assessed under Principle 1 using the RBF.

Sprat and Norway pout:
The main non-target catch is herring. For herring, F < Fmsy, B > Bmsy and the biomass is increasing. Both SSB and the fishing mortality are reliably estimated by the stock assessment (ICES 2013). A bycatch quota is set aside in the herring assessment for landings of herring as non-target catch. There is therefore a high degree of certainty that herring is within biological based limits and SG100 is fulfilled.

The fishery for Norway Pout has historically resulted in high catch of gadoid non-target species, particularly whiting, blue whiting, haddock and saithe. Catch of gadoids can be avoided with sorting grids in the trawl. Sorting grids are mandatory by legislation since 2012 (ICES 2013), and now catches of gadoids are low.

Minor species:</td></tr>
</table>

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
		Minor species (catch less than 5% but larger than 0.2%) in the three fisheries are: blue whiting, dab, whiting, flounder, and haddock. According to MSC requirements, minor species are only scored at the SG100 level, or if they are not scored at all, the maximum score possible for the retained and bycatch PIs is 80. *Blue whiting* is managed according to ICES advice under the MSY approach. The fishing mortality is fluctuating around Fmsy and the biomass is well above all defined limit reference points (ICES, 2016a). SG100 *Dab:* is managed according to ICES advice under the precautionary approach as a category 3 data limited stock (ICES 2015). Being managed as a data poor stock there are no reference points and there is not high degree of certainty regarding the assessment of the stock. SG100 is therefore not reached. However, since it is a minor species, the score for this scoring element defaults to 80. *Whiting*: is managed according to ICES advice under the MSY approach (ICES 2016b). It is consistently exploited above Fmsy but below Fpa. The biomass is fluctuating around the limit reference points; in the last 6 years it has been at or above $B_{msytrigge}$r. Nevertheless, since it is exploited above Fmsy, it does not reach SG100. *Flounder* is managed according to ICES advice under the precautionary approach as a category 3 data limited stock (ICES 2016c). Being managed as a data poor stock there is not high degree of certainty on the assessment of the stock and SG100 is not reached. However, since it is a minor species, the score for this scoring element defaults to 80. *Haddock* is managed according to ICES advice under the MSY approach (ICES 2016d). The stock has historically been overexploited and the exploitation is now fluctuating around the limit reference points and above Fmsy. The biomass has been well above reference points, however in the last year it fell below $B_{msytrigger}$. SG100 is not reached.		
b	**Guide post**			Target reference points are defined for retained species.
	Met?			Y-herring Y - blue whiting N – Dab Y – whiting N – Flounder Y – Haddock
	Justification	A target reference point is set for herring caught in the sprat and Norway pout fishery under the EU-Norway management plan for herring (ICES 2015). For minor species, target reference points are set for blue whiting, whiting and haddock.		
c	**Guide post**	If main retained species are outside the limits there are measures in place that are expected to ensure that the	If main retained species are outside the limits there is a partial strategy of demonstrably effective	

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
		fishery does not hinder recovery and rebuilding of the depleted species.	management measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	NA	NA	
	Justification			
d	**Guide post**	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		
	Met?	NA		
	Justification	Status of main retained species is known.		
References		ICES (2013). Report of the ICES Advisory Committee 2013. *ICES Advice, 2013. Book 6*, 421 pp. van Deurs, M., Grome, T. M., Kaspersen, M., Jensen, H., Stenberg, C., Sørensen, T. K., ... & Mosegaard, H. (2012). Short-term and long-term effects of an offshore wind farm on three species of sandeel and their sand habitat. *Marine Ecology-Progress Series*, *458*, 169-180. ICES advice (2015) Herring (*Clupea harengus*) in Subarea IV and Divisions IIIa and VIId (autumn spawners) (North Sea, Skagerrak and Kattegat, Eastern English Channel) ICES (2016a) Advice on Blue whiting (*Micromesistius poutassou*) in subareas 1–9, 12, and 14 (Northeast Atlantic). ICES (2015) Advice on Dab (*Limanda limanda*) in Subarea IV and Division IIIa (North Sea, Skagerrak and Kattegat). ICES (2016b) Advice on Whiting (*Merlangius merlangus*) in Subarea 4 and Division 7.d (North Sea and eastern English Channel) ICES (2016c) Advice on Flounder (*Platichthys flesus*) in Subarea IV and Division IIIa (North Sea, Skagerrak and Kattegat) ICES (2016d) Advice on Haddock (*Melanogrammus aeglefinus*) in Subarea 4, Division 6.a, and Subdivision 3.a.20 (North Sea, West of Scotland, Skagerrak)		
OVERALL PERFORMANCE INDICATOR SCORE: **Per Table C2 in CRv1.3, since all elements meet SG80; some achieve higher performance but some do not, an overall score of 90 is given:**				**90**

PI 2.1.1	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species
Herring	100
Blue whiting	100
Dab	80
Whiting	90
Flounder	80
Haddock	90
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 2.1.2

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
	Met?	Y-herring	Y-herring	N
	Justification	Sprat and Norway pout: the main retained species is herring. The impact on the herring stock is managed by setting aside a bycatch quota (ICES 2016). Exceeding the quota will lead to a closure of the fishery for sprat or Norway pout. This constitutes a partial strategy to avoid that the fishery hinders recovery or rebuilding of the herring stock; SG80 is met. *Minor species:* Catch of gadoids in the Norway pout fishery is limited by using specially designed selective gear. However, there is no explicit general strategy for managing retained species in the fishery.		
b	Guide post	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y-herring	Y-herring	N
	Justification	The procedure with a bycatch quota for herring and closure of the sprat and Norway pout fisheries if the quota is exceeded seems to work well. The Norway pout and sprat fisheries are indeed halted when the quota is filled. Further, in the Norway pout fishery, the use of sorting devices has reduced retention of gadoids. Therefore, there is confidence that the partial strategy works, even though it has not been explicitly tested.		
c	Guide post		There is some evidence that the partial strategy is	There is clear evidence that the strategy is being implemented successfully.

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
			being implemented successfully.	
	Met?		Y-herring	N
	Justification	Sorting devices are being used successfully in the Norway pout fishery. There is evidence from the landings statistics that catch of herring is not exceeding the bycatch quota. At the same time the TAC in the sprat and Norway pout fisheries are not always used up. This is evidence that the fishery indeed halts when the bycatch quota is used. There is no explicit strategy.		
d	Guide post			There is some evidence that the strategy is achieving its overall objective.
	Met?			N
	Justification	There is no formulated strategy with objectives.		
e	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Sharks are not caught in the fishery.		
References		ICES 2013. Report of the ICES Advisory Committee 2013. *ICES Advice, 2013. Book 6 North Sea*, 421 pp. ICES 2016. ICES Advice on fishing opportunities, catch, and effort Greater North Sea Ecoregion: Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak, Kattegat, and eastern English Channel).		
OVERALL PERFORMANCE INDICATOR SCORE:				**80**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.1.3

PI 2.1.3		**Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
	Met?	Y-herring	Y-herring	N
	Justification	Quantitative information is available from logbooks and official landings data for all three fisheries. All records are subject to scrutiny at sea and on landing. There is, however, significant discrepancy between logbooks and official landings data. Bringing these two statistics to match, e.g. by standardizing logbook statistics, could make the data "verifiable". The consequences for retained species is assessed from analytical stock assessments based on catch information (partly from these fisheries) and surveys. Conclusion: There is sufficient information available about retained species to achieve the SG80 for this scoring issue, but questions on accuracy of logbooks preclude SG100.		
b	**Guide post**	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
	Met?	Y-herring	Y-herring	Y-herring N - blue whiting N – Dab N – whiting N – Flounder N – Haddock
	Justification	The main retained species is herring (caught in sprat and Norway pout fisheries). The stock is assessed by ICES with a state-based statistical assessment method. ICES considers the underlying data to be of good quality and: "[b]oth the spawning stock-biomass and the fishing mortality are reliably estimated by the stock assessment." (ICES 2015). Consequently, sufficiently information is available to quantitatively assess the status of herring with a high degree of certainty. *Minor retained species:* Blue whiting, whiting and haddock are classified by ICES as data category "1" stocks, assessed with analytical assessments (ICES 2016a,b,d). In all		

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
		cases some minor concerns are raised as to the quality of the assessments, which is SG100 is not reached.		
c	Guide post	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Y-herring	Y-herring	Y-herring N - blue whiting N – Dab N – whiting N – Flounder N– Haddock
	Justification	In the sprat and Norway pout fishery the main retained species is herring. There is adequate information to manage herring and set aside a bycatch quota. Herring is currently increasing in biomass (ICES 2015), so there is a high degree of certainty that the strategy is achieving its objective. *Minor species* The species for which management advice is provided by analytical assessments (blue whiting, whiting and haddock) have sufficient information to support a strategy.		
d	Guide post		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator score or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
	Met?		Y-herring	Y-herring Y - blue whiting N – Dab Y – whiting N – Flounder Y – Haddock
	Justification	Advice on all retained species (except other sandeel species) is provided by ICES and therefore subject to monitoring and stock assessment to a level where changes in risk levels are highly likely to be detected if they occur. Catches of the retained species are reported and the information fed into		

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
		the relevant stock assessments, where the information is also accounted for in the assessments. Except for the two species with data poor assessments (dab and flounder) there are therefore sufficient monitoring to assess mortalities on retained species.
References		van Deurs, M., Grome, T. M., Kaspersen, M., Jensen, H., Stenberg, C., Sørensen, T. K., ... & Mosegaard, H. (2012). Short-term and long-term effects of an offshore wind farm on three species of sandeel and their sand habitat. *Marine Ecology-Progress Series*, *458*, 169-180. ICES advice (2015) Herring (*Clupea harengus*) in Subarea IV and Divisions IIIa and VIId (autumn spawners) (North Sea, Skagerrak and Kattegat, Eastern English Channel) ICES (2016a) Advice on Blue whiting (*Micromesistius poutassou*) in subareas 1–9, 12, and 14 (Northeast Atlantic). ICES (2016b) Advice on Whiting (*Merlangius merlangus*) in Subarea 4 and Division 7.d (North Sea and eastern English Channel) ICES (2016d) Advice on Haddock (*Melanogrammus aeglefinus*) in Subarea 4, Division 6.a, and Subdivision 3.a.20 (North Sea, West of Scotland, Skagerrak)

OVERALL PERFORMANCE INDICATOR SCORE:

Per Table C2 in CRv1.3, since all elements meet SG80; a few achieve higher performance but most do not, an overall score of 85 is given:

Herring	**95**
Blue whiting	**85**
Dab	**80**
Whiting	**85**
Flounder	**80**
Haddock	**85**

85

CONDITION NUMBER (if relevant):

Evaluation Table for PI 2.2.1

<table>
<tr><td colspan="2">PI 2.2.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Main bycatch species are likely to be within biologically based limits (if not, go to scoring issue b below).</td><td>Main bycatch species are highly likely to be within biologically based limits (if not, go to scoring issue b below).</td><td>There is a high degree of certainty that bycatch species are within biologically based limits.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">No main bycatch species (more than 5% of catch) have been reported in logbooks or by official landing statistics. The only way to discard bycatch is by slipping an entire haul. The only species where slipping could be considered an option by the fishery is herring, because it acts as a choke species.
There could be some undocumented slipping of herring catch in the sprat or Norway pout fisheries. However, herring is considered explicitly in component 2.1 and therefore is not scored again here (although the potential for slipping is evaluated in 2.2.2 and 2.2.3). This PI receives a 100 score with no bycatch species.</td></tr>
<tr><td rowspan="3">b</td><td>Guide post</td><td>If main bycatch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.</td><td>If main bycatch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.</td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">As no main bycatch species outside biological safe limits are identified, SG80 is met.</td></tr>
<tr><td rowspan="2">c</td><td>Guide post</td><td>If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.</td><td></td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td></td><td></td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.2.1</td><td colspan="2">The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups</td></tr>
<tr><td></td><td>Justification</td><td colspan="2">As no main bycatch species outside biological safe limits are identified, SG80 is met.</td></tr>
<tr><td colspan="2">References</td><td colspan="2">ICES (2013). Report of the ICES Advisory Committee 2013. ICES Advice, 2013. Book 6, 421 pp.
ICES (2015b). ICES Advice on fishing opportunities, catch, and effort Greater North Sea Ecoregion, 6.3.49 Sprat (Sprattus sprattus) in Subarea IV (North Sea), 8 pp.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>100</td></tr>
<tr><td colspan="3">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.2.2

PI 2.2.2		There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	There are measures in place, if necessary, that are expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing and minimizing bycatch.
	Met?	Y	Y	Y
	Justification	The measure to manage bycatch is the banning of sorting devices (to avoid discard). Considered on its own (without the landing obligation), this measure amounts to a partial strategy. The fishery has operated under the landing obligation, where all fish have to be landed, since 1/1/2015. Quotas of herring bycatch are not allocated to individual fishers and, because of the landing obligation there are no direct punishment for the individual fisher for landing herring. In the sprat fishery, up to 9% of a catch of herring can be written off on the sprat quota; this is a measure to create a disincentive to slippage. There is however a risk of an Olympic fishery, where single vessels race to fish up the bycatch quota. The fishery is considering development of internal regulation of the fishery to avoid olympic fishing (Claus Sparrevorn, DPPO, pers. comm.). Such future internal regulation within the fishery could create incentives to slip a catch at sea, in particular in the Norway pout and sprat fisheries, and they need to be monitored. The landing obligation can be considered a strategy, as its explicit objective is to eliminate discard of bycatch.		
b	Guide post	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	Y	N
	Justification	It is likely that the landing obligation will reduce slipping. As the landing obligation has only just come into effect it is yet too early to state that the measure has been tested.		

<table>
<tr><th colspan="2">PI 2.2.2</th><th colspan="3">There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations</th></tr>
<tr><td></td><td></td><td colspan="3">The banning of onboard sorting devices clearly makes it impossible to discard a partial catch at sea.
Negligible bycatch of birds or marine mammals in trawl and seines has been documented by the observer program in the herring fishery, whose results are likely to apply also to the reduction fishery (ICES, 2014e). Despite this evidence not being directly related to the reduction fishery, it is related to the species (birds and mammals) involved. This provides a solid objective basis that this measure works.</td></tr>
<tr><td rowspan="3">c</td><td>Guide post</td><td></td><td>There is some evidence that the partial strategy is being implemented successfully.</td><td>There is clear evidence that the strategy is being implemented successfully.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The landing obligation was recently implemented. The Danish AgriFish agency provides some evidence as to a successful implementation: ‘During inspections conducted in 2015, our inspectors have informed and guided fishermen on the ban on discard in the Baltic Sea as well as for pelagic and industrial species in other areas.
Onboard sorting devices are easily observed by the authorities. It is therefore unlikely that any fishers have onboard sorting devices.
Slipping may occur; clear evidence for that not happening is not yet present.</td></tr>
<tr><td rowspan="3">d</td><td>Guide post</td><td></td><td></td><td>There is some evidence that the strategy is achieving its overall objective.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The information about whether the landing obligation is achieving its objective is not yet available.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES (2014e). Report of the Working Group on Bycatch of Protected Species (WGBYC), 4–7 February 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:28. 96 pp.
AgriFish (2016) Fisheries inspection 2015: Commercial and recreational. Report from the Danish AgriFish agency ISBN 978-87-7120-775-0</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>85</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.2.3

PI 2.2.3		**Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Qualitative information is available on the amount of main bycatch species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery.	Accurate and verifiable information is available on the catch of all bycatch species and the consequences for the status of affected populations.
	Met?	Y	Y (sandeel) N (sprat) N (Norway pout)	N
	Justification	The catch is sucked directly from the nets into the hull. Sorting devices are not allowed on board, and non-compliance is easy to spot. The operations are typically large, so hand-sorting is not an option. Consequently, discarding of a partial catch is not an issue. Slipping an entire catch is the only way to discard an unwanted catch. Herring acts as a choke species in the sprat and Norway pout fisheries, which could create an incentive to slip. Earlier, there was a catch-composition rule that one landing could contain no more than 50% herring in the Norway pout fishery or 20% in the sprat fishery. Therefore, at least in the sprat fishery, discarding (slippage) occurred but was not quantified (ICES 2015b). There is a closely monitored experimental sprat fishery in the German Bight. The fishery is monitored with tests of catch composition for each haul, though there are no on-board observers. The experimental fishery started in 2013 and is still ongoing. Slippage has, however, not been explicitly evaluated in the area (Lotte Worsøe, DTU Aqua, pers. comm.). Quantitative information about slippage in the sprat and Norway pout fisheries is therefore not available. Summary: one species out of three has SG80.		
b	**Guide post**	Information is adequate to broadly understand outcome status with respect to biologically based limits	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.
	Met?	Y	Y	Y
	Justification	The main potential discarded species is herring, which may be slipped. Although the status of the herring stock is considered under retained species and therefore not evaluated again here under 2.2.1, it is worth noting that the herring stock is assessed by ICES with a state-based statistical assessment method. ICES considers the underlying data to be of good quality and: "[b]oth the spawning stock-biomass and the fishing mortality are reliably estimated by the stock assessment." (ICES 2015). Consequently, sufficiently information is available to quantitatively assess the status of herring with a high degree of certainty.		

<table>
<tr><th colspan="2">PI 2.2.3</th><th colspan="3">Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch</th></tr>
<tr><td rowspan="3">c</td><td>Guide post</td><td>Information is adequate to support measures to manage bycatch.</td><td>Information is adequate to support a partial strategy to manage main bycatch species.</td><td>Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The information to manage the main (possibly) bycatch species (herring) is adequate to support a strategy to manage herring (ICES 2015)</td></tr>
<tr><td rowspan="3">d</td><td>Guide post</td><td></td><td>Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).</td><td>Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The low level of discarding is a consequence of the fishing methods adopted by the fleet. Those methods are subject to ongoing monitoring that would detect an increase in risk. The fishery thus meets the SG80 requirements, justifying the score.

If the client gathered more information to describe levels of slipping and adopted a comprehensive strategy for this issue, the score could be improved.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES (2015b). ICES Advice on fishing opportunities, catch, and effort Greater North Sea Ecoregion, 6.3.49 Sprat (Sprattus sprattus) in Subarea IV (North Sea), 8 pp.

ICES advice (2015) Herring (Clupea harengus) in Subarea IV and Divisions IIIa and VIId (autumn spawners) (North Sea, Skagerrak and Kattegat, Eastern English Channel)</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>75</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):

Condition 6: By the 4th annual audit there must be positive evidence that slipping is not occurring in the sprat and Norway pout fisheries. This information should be sufficient to act as qualitative information and some quantitative information available on the amount of main bycatch species (herring) taken by the sprat and Norway pout fisheries.</td><td>6</td></tr>
</table>

Evaluation Table for PI 2.3.1

<table>
<tr><td colspan="2">PI 2.3.1</td><td colspan="3">The fishery meets national and international requirements for the protection of ETP species
The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.</td><td>The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.</td><td>There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Roseate terms-Y
All others-N</td></tr>
<tr><td>Justification</td><td colspan="3">ETP species are those recognized by national legislation and/or binding international agreements. In the North Sea endangered species are defined by OSPAR.
The identified relevant ETP species by the team that may be exposed to potential direct or indirect impact by the fishery are: harbour and grey seals, harbour porpoises, minke whales, black-legged kittiwakes, roseate terns, and common skate (Dipturus batis), spotted ray (Raja montagui), thornback skate/ray (Raja clavata) and starry ray (Amblyraja radiata).

All the ETPs species are covered by the requirements of the EU habitats directive. The directive requires that “Member States shall establish a system to monitor the incidental capture and killing of the animal species listed […] In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned”.

Harbour and grey seals are not mentioned by OSPAR but are, as mammals, covered by the habitats directive. Seals are mainly coastal and therefore not expected to interact directly with the fishery. Populations of harbour seal and grey seal are improving (Søgaard et al, 2015). Negative effects on harbour seal abundances are mainly epidemics. Though sandeel are an important part of their diet (Table 26), the populations still increase. Bycatch is unlikely (Gislason et al 2013), and even if there is some bycatch it evidently does not keep the population from recovering. The direct and indirect effects of the fishery on seals has therefore not hindered a recovery of the seal populations, and the effect of the fishery is highly likely to be within the requirements of the habitat directive. SG80

Harbour porpoise is listed in Annex II of the Habitats Directive (92/43/EEC), which obligates all EU Member States to protect porpoises in their entire range and designate protected areas (Special Areas of Conservation;</td></tr>
</table>

PI 2.3.1		**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**
		SACs) in areas of high porpoise density. The risk of bycatch of large mammals such as harbour porpoises in active gear is highly unlikely to be significant (Gislason, 2013). A range of SACs have been set within the North Sea (Søgaard et al, 2015). Some limitations on activities apply within the SACs, however not for the reduction fishery. The effect of the fishery is therefore highly likely to be within national and international requirements. SG80 *Minke whales a*re listed in annex IV of the Habitats Directive which obligates all EU Member States to monitor and protect minke whales. Minke whales are monitored through continuous assessments by the International Whaling Commission, with the current assessment being a stable population of around 10-20,000 individuals (IWC, 2014). The International Whaling Commission considers the population to be in a "healthy state", despite a commercial catch of around 500 individuals per year by Norway. Minke whales are unlikely to be directly affected by the fishing operation (Gislason et al. 2013). There may be some indirect effects of food competition. Since the population is stable, despite hunting, it is highly likely that the effects of the fishery is within the requirements of the habitat directive. SG80. *Black-legged kittiwakes* are listed by OSPAR, and covered under the OSPAR convention annex V which requires nations to "…take the necessary measures to protect and conserve the ecosystems and the biological diversity". Direct effect on ETPs may occur through entanglement and drowning in fishing gear. The fishery is conducted with trawl and purse seines that are generally known to have negligible bycatch of birds or marine mammals. This has been documented by the observer program in the herring fishery, whose results are likely to apply also to the reduction fishery (ICES 2014e). Concern has been expressed about indirect effects of sandeel fishing on kittiwakes at Dogger Bank (Birdlife, 2015). This potential impact is unlikely to create an unacceptable impact, but it cannot be stated that there are no significant detrimental effects with a high confidence before the effect is fully documented. SG80 *Roseate terns* are covered by OSPAR on similar footing as kittiwakes. Roseate terns are considered rare, sensitive, and with a localized distribution of regional importance, particular in the UK (OSPAR, 2009). Roseate terns need dense shoals of forage fish (sprat, herring or sandeel) within 15 km of the colony. Despite this, food limitation is not listed as a concern. The key known threats affecting roseate terns are those that limit the number and quality of suitable nesting sites available to the species, in particular predation and disturbance at the breeding colonies (OSPAR, 2009). Fishing does not occur within 15 km of the roseate tern colonies. Therefore, the fishery is not expected to compete with food for roseate terns and is therefore not affecting breeding success of Roseate terns. SG100 *Skates and rays:*

PI 2.3.1		The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species		
		Common skate has been extirpated from most of the North Sea (except the northern part). The species is now assessed as "Critically Endangered" globally on the IUCN Red List of Threatened Species. EU Council Regulation 43/2009 prohibited all landings of *D. batis* in EU waters. *Spotted ray.* Listed by OSPAR as being in "good" condition with stable or increasing populations in most areas (OSPAR 2010; ICES 2015e). *Thornback skate/ray*. Thornback ray has been depleted by fisheries and its area of distribution has contracted significantly, however local population density is stable in the central area of its distribution in the south-western North Sea (OSPAR 2010b) and, in recent years, increasing (ICES 2015c). The population of *Starry ray* is in decline. There should not be a targeted fishery for this stock and measures should be taken to reduce bycatch (ICES, 2015d). The main threat to all skate and ray populations is fishing. Through European Union Council Regulation 23/2010 (12), the European Union has required that all catches of rays and skates must be reported separately. There are no reports of bycatch of rays or skates in any of the fisheries considered here, neither from the official Danish catch reports or from the fishers own logging. Either the catches of rays and skates are so small that they escape registration, or they are being discarded (as mandated by law for some species). Due to the large scale of the fishing operation and the absence of sorting devices, discard is considered unlikely (see 2.2). The catches of skates and rays in the reduction fishery is therefore highly likely negligible. The effect of the fishery is therefore highly likely within the national and international requirements, which mandates minimal killing. SG80		
b	**Guide post**	Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.
	Met?	Y	Y	Y-mammals and birds N-rays (4 spp.)
	Justification	Direct effect on mammals and birds may occur through entanglement and drowning in fishing gear. The fishery is conducted with trawl and purse seines that are generally known to have negligible bycatch of birds or marine mammals (Gislason et al 2013). This has been documented by the observer program in the North Sea herring fishery, whose results are likely to apply also to the reduction fishery (ICES 2014b). Purse seines, as used in the sprat fishery, have the potential for bycatch of mammals; however, a report for ASCOBANS gave no indication of any cetacean bycatch concerns in the North Sea, following a review of bycatch and mitigation measures being implemented in European fisheries (Northridge, 2011). The fishery has developed a code of conduct including logbook reporting of bycatch,		

PI 2.3.1		**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**		
		with no reported bycatches in 2014. Thus, the nature of the fishery operations makes direct impact on marine mammals and birds negligible. SG100 There are no reports of rays or skates being caught by the reduction fishery. As their populations are stable or increasing the effect of the fishery is highly unlikely to be unacceptable. SG80.		
c	**Guide post**		Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
	Met?		Y	Roseate terns, seals (2 spp.)-Y Harbour porpoises, minke whales, skates and rays (4 spp.), kittiwakes-N
	Justification	Indirect effect occurs through competition for fish between ETPs and the fishery. Indirect effects are accounted for in the management through escapement to ensure sufficient food for relevant ETPs. In practice this is done by increasing the natural mortality in the assessment to account for the needs of higher trophic level species. This mortality is assessed through multi-species statistical models and updated tri-annual (see 3.4.4). This procedure is highly likely to detect and counteract indirect effects on ETP species. The difficulties and inherent uncertainties in multi-species used in the assessments means that indirect effects cannot be completely ruled out. In cases where indirect effects have been substantial the fishery has been closed (kittiwakes at Firth of Forth). Seals forage sufficiently far from shore to compete with the fishery, however they not found to be significant predators on sandeel, sprat or Norway pout by Mackinson and Daskalov (2007). Further, since populations are increasing there are no significant negative effects of the fishery. SG100 *Harbour porpoises.* The porpoises in the North Sea eat mainly juvenile demersal species. They eat small amounts of Norway pout and sprat (compared to other predators). Though their impact on the sandeel population is small, (ICES, 2014e; Mackinson and Daskalov fig. 3.10, 2007), sandeel is about 20% of their diet (Table 26). Though they do eat sandeel, food limitation does not appear likely to limit the population of harbor porpoises. SG80. *Minke whales.* More than half of their diet in the North Sea is sandeel (ICES, 2014e; Table 26). This is a substantial consumption, though significantly smaller than the consumption by piscivorous fish (		

PI 2.3.1		**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**
		Figure **35**). The consumption is accounted for through escapement rules in the stock assessment. As the population is healthy they do not appear limited by food. SG80. *Kittiwakes.* "Birdlife" has expressed concern that breeding success of kittiwake at Flamborough will be negative affected by the fishing on Dogger bank. Even though Dogger bank is at the edge of the commonly accepted foraging range for Kittiwakes (50 km), tagging data show that some individuals go that far, likely to forage (Birdlife 2015). Analysis of the correlation between fishing mortality on sandeel and kittiwake breeding success shows that fishing mortality in one year has a negative effect on breeding success two years later. The reason for the two-year lagged response is unclear, and indicates that breeding success is not directly affected by the impact of fishing on the biomass of sandeel on Dogger bank. The lagged response therefore points to an indirect effect, e.g., that the recruitment of sandeel closer to the coast is negatively affected by fishing on Dogger bank. This could be because the coastal population relies on recruitment from the Dogger bank. Alternatively, the effect could be a spurious correlation. The effect is particularly strong during the years where the fishing effort on Dogger Bank sandeels was very high (F was 1.0 per year from 1999 to 2002, peaking at 1.5 per year in 2001). In the last decade, following the regional management of sandeel stocks, sandeel fishing mortality on Dogger Bank has been below 0.66 $year^{-1}$ (ICES, 2013). In the range of fishing mortality between 0 and 0.7 $year^{-1}$ the analysis shows no correlation between kittiwake breeding success and sandeel fishing mortality. The effects of sandeel fishing is therefore highly unlikely to create an unacceptable impact, but it cannot be stated that there are no significant detrimental effects with a high confidence before the effect is fully documented. SG80. *Roseate terns.* Roseate tern need dense shoals of forage fish (sprat, herring or sandeel) within 15 km of the colony (OSPAR, 2009). Fishing does not occur within 15 km of the roseate tern colonies. Therefore, the fishery is not expected to compete with food for roseate terns and is therefore not affecting breeding success of Roseate terns. SG100 *Thornback skates and spotted ray* have a large proportion of sandeel in their diet (47%; Mackinson and Daskalov, 2007). Food limitation, however, is not listed as threat (OSPAR 2010, 2010b). Since the populations of thornback skates and spotted ray are increasing in recent years, food limitation is unlikely to be hindering recovery. SG80. *Common skate and starry ray* have no significant fraction of sandeel, sprat or Norway pout in their diet (Mackinson and Daskalov, 2007). SG80
References		Søgaard, B., Wind, P., Bladt, J.S., Mikkelsen, P., Wiberg-Larsen, P., Johansson, L.S., Galatius, A. & Teilmann, J. 2015. Arter 2012-2013. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 82 s. - Videnskabelig rapport fra DCE - Nationalt Center for Miljø og Energi nr. 124

PI 2.3.1	**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**

Gislason, H., Jørgen Dalskov, Grete E. Dinesen, Josefine Egekvist, Ole Eigaard, Thomas Kirk Sørensen and Finn Larsen (2013) Miljøskånsomhed og økologisk bæredygtighed i dansk fiskeri. Notes from NaturErhversstyrelsen, Journal nr. 12/09478.

ICES. 2013. Report of the ICES Advisory Committee 2013. ICES Advice, 2013. Book 6, 421 pp.

ICES (2014e). Report of the Working Group on Bycatch of Protected Species (WGBYC), 4–7 February 2014, Copenhagen, Denmark. *ICES CM 2014/ACOM:28*. 96 pp.

ICES (2015c) Thornback ray (*Raja clavata*) in Subarea IV and Divisions IIIa and VIId (North Sea, Skagerrak, Kattegat, and eastern English Channel).

ICES (2015d) Starry ray (*Amblyraja radiata*) in Subareas II and IV and Division IIIa (Norwegian Sea, North Sea, Skagerrak, and Kattegat).

ICES (2015e) Spotted ray (*Raja montagui*) in Subarea IV and Divisions IIIa and VIId (North Sea, Skagerrak, Kattegat, and eastern English Channel)

IWC (2014) report of the scientific committee, annex D. J. cetacean res. Managemt. 16 (suppL.), 100-143.

Mackinson, S., and G. Daskalov (2007) An ecosystem model of the North Sea to support an ecosystem approach to fisheries management: description and parameterisation. *Cefas Science Series Technical Report* 142, 195 pp.

Northridge (2011) An overview of the state of bycatch monitoring and mitigation measures being implemented in European fisheries. Report from Sea Mammal Research Unit University of St Andrews St Andrews, *UK. SC/63/SM21*, 8 pp.

OSPAR (2009) Background Document for Roseate tern *Sterna dougallii.*

OSPAR (2010) Background Document for Spotted ray *Raja montagui*

OSPAR(2010b) Background Document for Thornback ray *Raja clavata*

OVERALL PERFORMANCE INDICATOR SCORE:

Per Table C2 in CRv1.3, since all elements meet SG80; some achieve higher performance but some do not, an overall score of 90 is given:

Harbour seals	**95**
Grey seals	**95**
Harbour porpoises	**85**
Minke whales	**85**
Black-legged kittiwakes	**85**
Roseate terns	**100**
Common skate	**80**
Spotted rays	**80**

90

PI 2.3.1	The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species	
Thornback rays	80	
Starry ray	80	
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.3.2

PI 2.3.2		The fishery has in place precautionary management strategies designed to: • Meet national and international requirements; • Ensure the fishery does not pose a risk of serious harm to ETP species; • Ensure the fishery does not hinder recovery of ETP species; and • Minimise mortality of ETP species.		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	There are measures in place that minimise mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
	Met?	Y	Y	N
	Justification	There is an overall strategy, formulated through legislation, to minimize adverse impacts on ETPs to achieve recovery. There is not a comprehensive strategy formulated specifically for the reduction fishery. The measures to avoid direct impact is the choice of fishing gear, which is unlikely to catch ETPs. This measure applies to all ETP species. The measures to avoid indirect impacts is a closure of the fishery if negative impacts are documented, e.g. failure of breeding success due to lack of food from forage fish. An example is the closure of the sandeel fishery at the Firth of Forth. This measure applies mainly to the bird species (no closed areas have been proposed to protect skates and rays). A further measure is the harvest limits, which are determined on the basis of the food consumption by dependent predators, including ETPs, informed by multi-species modelling.		
b	Guide post	The measures are considered likely to work, based on plausible argument	There is an objective basis for confidence that the strategy will work, based on	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The fishery has in place precautionary management strategies designed to:
• Meet national and international requirements;
• Ensure the fishery does not pose a risk of serious harm to ETP species;
• Ensure the fishery does not hinder recovery of ETP species; and
• Minimise mortality of ETP species.</td></tr>
<tr><td></td><td></td><td>(e.g., general experience, theory or comparison with similar fisheries/species).</td><td>information directly about the fishery and/or the species involved.</td><td>analysis supports high confidence that the strategy will work.</td></tr>
<tr><td></td><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The adopted measures in the strategy is the fishing gear and closure of areas with species of particular concern.
Birds and mammals. There is an objective basis supporting that the type of fishing gear used has limited impact on birds and mammals relevant ETP species; see 2.3.1.
Rays and skates. Through European Union Council Regulation 23/2010 (12), the European Union have required that all catches of rays and skates must be reported separately. There are no reports or indications of bycatch of rays in any of the reduction fisheries. This provides an objective basis of confidence that the measure works.
The implementation of closed areas for particular sensitive species is likely to work. An example is provided by the Isle of May kittiwakes: the breeding success of the Kittiwake population at the Isle of May is known to be directly linked to the nearby sandeel population. This effect prompted the closure of the fishery in Firth of Forth in 2000 (region IV), where there has since only been a monitoring fishery of 5000 t/yr to monitor the population (ICES, 2014d). The instigation of a closure provides confidence that the strategy will work, also for other species and cases. Despite an initial increased breeding success after the closure (ICES, 2014d), the population of kittiwakes at the Firth of Forth islands continues to decline (by 63.1% between 2000 and 2013; http://jncc.defra.gov.uk/page-2889). This demonstrates that kittiwake population dynamics is influenced by factors other than the fishery. Although primarily directed at protecting birds, this example, where the status of an ETP species has prompted the close of an area for the fishery, provides confidence that the measure will work, also for other species, should a threat be identified.</td></tr>
<tr><td>c</td><td>Guide post</td><td></td><td>There is evidence that the strategy is being implemented successfully.</td><td>There is clear evidence that the strategy is being implemented successfully.</td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td>Y</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The main measure – the fishing gear – is clearly implemented.

The measure to minimize indirect effects on kittiwakes has been implemented – evidence is that the fishery in Firth of Forth was actually, and still is, closed. There is concern about the possible indirect impact on kittiwakes from the fishery on Dogger Bank. They are not recovering, which could argue for a closure for the fishery on Dogger Bank. The evidence for the detrimental effect however shows that current fishing practice is not likely to blame (see 2.3.1a).</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The fishery has in place precautionary management strategies designed to:
Meet national and international requirements;
Ensure the fishery does not pose a risk of serious harm to ETP species;
Ensure the fishery does not hinder recovery of ETP species; and
Minimise mortality of ETP species.</td></tr>
<tr><td rowspan="3">d</td><td>Guide post</td><td></td><td></td><td>There is evidence that the strategy is achieving its objective.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The objective of the habitats directive is to ensure that incidental capture and killing does not have a significant negative impact on the species concerned. All non-bird ETP species have stable or increasing populations. This is evidence that the fishery is does not have a significant negative impact.

Kittiwakes and Roseate terns are declining, however, not directly due to impacts from this fishery, as explained in 3.2.1.

The populations of spotted ray and thornback skate are stable or increasing (OSPAR 2010, OSPAR 2010b; ICES 2015). This provides some evidence that the strategy is achieving its objective. Common skate and starry ray are not recovering, but the objective of minimal direct impact from the fishery is achieved, since they are not caught in the fisheries.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Birdlife (2015): The DFPO and DPPO North Sea, Skagerrak and Kattegat Sandeel (Ammodytes spp), Sprat (Sprattus sprattus) and Norway Pout (Trisopterus esmarkii) Fisheries MSC assessment. 12 pp.

ICES. 2014d. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp.

OSPAR (2010) Background Document for Spotted ray Raja montagui

OSPAR(2010b) Background Document for Thornback ray Raja clavata</td></tr>
</table>

OVERALL PERFORMANCE INDICATOR SCORE:		**90**
Harbour seals	**90**	
Grey seals	**90**	
Harbour porpoises	**90**	
Minke whales	**90**	
Black-legged kittiwakes	**90**	
Roseate terns	**90**	
Common skate	**90**	
Spotted rays	**90**	
Thornback rays	**90**	
Starry ray	**90**	
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.3.3

PI 2.3.3		**Relevant information is collected to support the management of fishery impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
	Met?	Y	Y	Y(6 species) N (skates and rays; 4 spp)
	Justification	There is sufficient general information to state that the direct impact of the various fishing gears used is very small (Gislason et al. 2013). This is supported by logbook registration from the fishery, though unverified, showing no bycatches. All ETPs populations are closely monitored by surveys and, for birds, by assessments of breeding success: *Seals:* The populations are continuously monitored by aerial surveys (Søgaard et al., 2015). *Harbour porpoises:* The population is monitored in Denmark as part of the NOVANA monitoring program since 2011 (Søgaard et al., 2015). *Minke whales*: the population is assessed by the International Whaling Commission (IWC, 2014). *Kittiwakes* are a relatively well-studied and monitored species throughout the OSPAR area (breeding abundance and breeding success), due to the relative ease with which this can be monitored (OSPAR, 2009) *Roseate terns.* Colony size at breeding sites are monitored (OSPAR, 2009b). *Rays and skates.* Data are available from catches and show no mortality on rays and skates. This is sufficient to evaluate the mortality impact of the fishery (SG80). The population sizes are continuously monitored through the catches and fisheries independent surveys (ICES, 2012). However, the stock assessments on rays and skates by ICES are data poor, and there are uncertainty on species identification. The status of rays and skates is therefore not known with a high degree of certainty.		
b	**Guide post**	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
	Met?	Y	Y	N

PI 2.3.3		Relevant information is collected to support the management of fishery impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.		
	Justification	The direct effects of the fishery are broadly understood to be negligible through information, though not verifiable, on direct impacts available from code of conduct logbook reporting. The indirect effects of fishing through food competition are quantitatively estimated through correlations between SSB of fish stocks and breeding success (birds; e.g. Frederiksen et al 2006; Furness, 2007; Cook et al 2014), and by estimations of predation mortality of ETPs on the fished stocks (all ETP species). This is sufficient to determine whether the fishery is a threat to protection of ETP species (SG80). The information does not reach the level of constituting accurate and verifiable information on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.		
c	Guide post	Information is adequate to support measures to manage the impacts on ETP species.	Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
	Met?	Y	Y	N
	Justification	Population trends of all ETP species are closely monitored, in particular the breeding success of relevant sea birds. Complete censuses are regularly performed, however, the last census was in 1998-2002 and we recommend that a new census is performed in the near future. An exception is skates and rays, whose populations sizes are not known accurately. Nevertheless, information is sufficient to support a full strategy to manage impacts (SG80). A comprehensive management strategy has not been developed by the fishery for any of the ETP species. Information on population trends needed to support such as strategy is available for mammals and birds, but not for skates and rays. For mammals and birds, however, there is insufficient information to evaluate mortalities with a high degree of accuracy, and SG100 is not reached.		
References		Søgaard, B., Wind, P., Bladt, J.S., Mikkelsen, P., Wiberg-Larsen, P., Johansson, L.S., Galatius, A. & Teilmann, J. 2015. Arter 2012-2013. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 82 s. - Videnskabelig rapport fra DCE - Nationalt Center for Miljø og Energi nr. 124 Gislason, H., Jørgen Dalskov, Grete E. Dinesen, Josefine Egekvist, Ole Eigaard, Thomas Kirk Sørensen and Finn Larsen (2013) Miljøskånsomhed og økologisk bæredygtighed i dansk fiskeri. Notes from NaturErhversstyrelsen, Journal nr. 12/09478. ICES. 2014d. Report of the Herring Assessment Working Group for the Area South of 62ºN (HAWG), 11-20 March 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014/ACOM:06. 1257 pp.		

<table>
<tr><td>PI 2.3.3</td><td>Relevant information is collected to support the management of fishery impacts on ETP species, including:
Information for the development of the management strategy;
Information to assess the effectiveness of the management strategy; and
Information to determine the outcome status of ETP species.</td></tr>
<tr><td></td><td>ICES. 2012. Report of the Working Group on Elasmobranch Fishes (WGEF). ICES CM 2012/ACOM:19 (chapter 15).
IWC (2014) report of the scientific committee, annex D. j. cetacean res. Managemt. 16 (suppL.), 100-143.
Furness RW (2007) Responses of seabirds to depletion of food fish stocks. J Ornithol 148:247-252.
Cook ASCP, Dadam D, Mitchell I, Ross-Smith VH, Robinson RA (2014) Indicators of seabird reproductive performance demonstrate the impact of commercial fisheries on seabird populations in the North Sea. Ecological Indicators 38:1-11.
Frederiksen M, Edwards M, Richardson AJ, Halliday NC, Wanless S (2006) From plankton to top predators: bottom-up control of a marine food web across four trophic levels. Journal of Animal Ecology 75:1259-1268.</td></tr>
</table>

OVERALL PERFORMANCE INDICATOR SCORE: 80

Per CR v1.3 Table C2, this PI is awarded a score of 80 since all scoring elements reach 80 and some achieve higher scores.

Harbour seals	**85**
Grey seals	**85**
Harbour porpoises	**85**
Minke whales	**85**
Black-legged kittiwakes	**85**
Roseate terns	**85**
Common skate	**80**
Spotted rays	**80**
Thornback rays	**80**
Starry ray	**80**

CONDITION NUMBER (if relevant):

Evaluation Table for PI 2.4.1 – bottom touching gear in the sandeel and Norway pout fisheries

<table>
<tr><td colspan="2">PI 2.4.1</td><td colspan="3">The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td><td>The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td><td>There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td>Y (sandy bottom)
Y (Fladen ground—muddy bottom)</td><td>Y (sandy bottom)
N (Fladen ground—muddy bottom)</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The gears are bottom-touching trawl (though in some cases with modifications; see later). The impact of the trawl on the bottom comes from the doors, from the middle-weight (when used), and from the ground rope (Eigaard et al. 2015). The doors and the weight produce trawl tracks on the bottom, while the rope interacts with organisms on the bottom and possibly produce a cloud of mud. The targeted species are fish are living off (not on) the sea bed (sandeel are not targeted by the fishery while they are buried in the sand). The fishery therefore does not need to scrape the fish off the bottom (such as in nephrops fishery) so there is little incentive for the fishery to interact strongly with the bottom, as it will only result in increased fuel costs. Therefore, gear riggings do not use any kind of tickling chains or bobbins on the footrope of the trawl, as is used in e.g. the plaice fishery. Consequently the gear has little subsurface impact (Eigaard et al, 2015).

The fishery is conducted on two types of habitat: sandy bottoms for the sandeel fishery, and muddy bottoms for the Norway pout fishery.

Sandy bottom: The sandeel fishery with otter trawls is conducted on sandy bottoms on fairly shallow water. The sandeel fishery operates mainly on the sides of the sand banks. Such habitats have a high energy input from tides and therefore high natural disturbance. Such habitats are considered “moderately sensitive” with “low” exposure to trawling, and a “moderate” vulnerability (JNCC 2012, table 1; Kaiser et al 2006). Special gear is being developed to minimize habitat impact, though it is not yet fully implemented in the fishery (H. Mosegaard, DTU Aqua, pers. comm.). Therefore, fishing for sandeel is highly unlikely to cause serious harm, though there is no direct evidence available. SG80.

Muddy bottom. The Norway pout fishery is conducted on the Fladen Ground, a large plain of fine mud, at water depths ranging from 15–200 m or more, designated by OSPAR as “burrowed mud”. This habitat is considered “sensitive” to mechanical disturbance (OSPAR 2010c). Further, there are registered widespread occurrences of sea pens over the entire area. Even though the habitat is sensitive, the impact of the gear is limited, and it is likely that most sea pen species are not seriously impacted. Fishing is also conducted within Central Fladen where the particular sensitive tall sea pens are found. An MPA is being considered for the area. Even though the fishery is unlikely to cause serious harm on the Fladen Ground, there is no direct evidence that this is the case, and the current fishery cannot be said to be “highly unlikely” to cause serious harm. SG60.</td></tr>
</table>

PI 2.4.1	**The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function**
References	Eigaard, O. R., Bastardie, F., Breen, M., Dinesen, G. E., Hintzen, N. T., Laffargue, P., & Rijnsdorp, A. D. (2015). Estimating seabed pressure from demersal trawls, seines, and dredges based on gear design and dimensions. *ICES Journal of Marine Science: Journal du Conseil*, doi:fsv099. JNCC (2012) Offshore Special Area of Conservation: Dogger Bank Conservation Objectives and Advice on Operations. *JNCC report ver. 6.0*. 24 pp. Kaiser, M. J., Clarke, K. R., Hinz, H., Austen, M. C. V., Somerfield, P. J., & Karakassis, I. (2006). Global analysis of response and recovery of benthic biota to fishing. *Marine Ecology Progress Series*, *311*, 1-14. OSPAR (2010c) Background Document for Seapen and Burrowing megafauna communities. *Biodiversity series*, 27 pp.

OVERALL PERFORMANCE INDICATOR SCORE: **70**

Per CR v1.3 Table C2, this PI scores a 70 because all elements meet SG60; some achieve higher performance, at or exceeding SG80, but some do not meet SG80 and require intervention action to make sure they get there:

Scoring Element	Score
Sandy Bottom (sandeel fishery)	**80**
Muddy bottom (Norway pout fishery)	**60**

CONDITION NUMBER (if relevant): **7**

Condition 7: By the 4th annual audit, the client must be able to demonstrate that the Norway pout fishery is unlikely to cause serious or irreversible harm to sensitive habitats, particularly the muddy Fladen ground habitat.

Evaluation Table for PI 2.4.2 – bottom touching gear in the sandeel and Norway pout fisheries

<table>
<tr><td colspan="2">PI 2.4.2</td><td colspan="3">There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.</td><td>There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.</td><td>There is a strategy in place for managing the impact of the fishery on habitat types.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">There are international and national legislation in place to limit the impact on sensitive habitats. Protection of sensitive habitats is regulated through international convention of biodiversity (OSPAR 03/17/1, Annex 9), amended by OSPAR Recommendation 2010/2 (OSPAR 10/23/1, Annex 7) and corresponding national legislation (Marine and Coastal Access Act (2009) in the UK; Natura2000 in DK).

The measures for the implementation of legislation are a series of Marine Protected Areas (MPAs). The objective is to make MPAs “well-managed” by 2016. The management of the habitats through MPAs can be considered a partial strategy.

The relevant MPAs for the reduction fishery, Central Fladen (Norway pout) and Dogger (sandeel), are not yet “well-managed”, but implementation is ongoing, e.g., with management for Central Fladen in review and an international proposal for a Dogger Bank MPA in the works. DPPO and DFPO are engaged in the process to implement MPA both at Central Fladen and Dogger bank.

A further measure (in the sandeel fishery) is that both fisheries with demersal gear (sandeel and Norway pout) employ gear with less bottom impact than other demersal fisheries, e.g. the North Sea plaice and Nephrops fisheries. Finally, in the sandeel fishery, experimental work with mid-water trawl doors instead of the doors with bottom contact has been conducted (H. Mosegaard, DTU Aqua, pers. comm.). This trawl has a reduced bottom contact. As the new trawl is more fuel efficient it has already been partly adopted by the fleet.</td></tr>
<tr><td rowspan="2">b</td><td>Guide post</td><td>The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).</td><td>There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.</td><td>Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
</table>

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
	Justification	MPAs will provide refuge for particular sensitive habitats, such as the tall sea pen on the proposed Central Fladen MPA. Further, the MPAs will act are a recruitment reserve for adjacent areas. The establishment of MPAs are therefore a relevant mitigation measure for trawl impact, both for reduction of direct impact and for recovery of impacted areas. As all fishing operations are registered with VMS, enforcement of MPAs is easy, so there is high incentive for fishers to avoid fishing in MPAs. For the sandeel fishery special mid-water trawl doors are being explored. Until trials are over there is not high confidence that the measure will work.		
c	Guide post		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		N	N
	Justification	Some MPAs have already been set up (OSPAR, 2015). However, these are not relevant for the sandeel and Norway pout fisheries. Until MPA with management measures specifically designed for the protection of the habitats are implemented, there is no objective basis for confidence that the partial strategy will work. Management measures need to be implemented in vulnerable areas, and should include the ability to modify fishing practices in the light of monitoring results, in order to achieve confidence in its effectiveness. However, DPPO is actively engaged in the process. Special mid-water trawl doors in the sandeel fishery is not fully implemented.		
d	Guide post			There is some evidence that the strategy is achieving its objective.
	Met?			N
	Justification	Without any fishery closures and consequent monitoring of outcomes to habitat impacts, there is no evidence that the strategy is achieving its objective, thus this scoring issue is not met.		
References		DEFRA (2015) Nature Conservation Marine Protected Areas Fisheries Management Options Paper, Central Fladen MPA. Version 0.3, 9 pp. JNCC (2012) Offshore Special Area of Conservation: Dogger Bank Conservation Objectives and Advice on Operations. *JNCC report ver. 6.0*. 24 pp. OSPAR 03/17/1, Annex 9): OSPAR Recommendation on 2003/3 adopted by OSPAR 2003. OSPAR (2015) 2014 Status Report on the OSPAR Network of Marine Protected Areas		

PI 2.4.2	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types	
OVERALL PERFORMANCE INDICATOR SCORE:		**75**
CONDITION NUMBER (if relevant): **Condition 8 : By the fourth annual surveillance audit, there must be some objective basis for confidence that the partial strategy for achieving the habitat outcome level of 80 or above will work, based on information directly about the fishery and/or habitats involved.**		**8**

Evaluation Table for PI 2.4.3 – bottom touching gear in the sandeel and Norway pout fisheries

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	There is basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
	Met?	Y	Y	Y
	Justification	The spatial extent of the fishing is available from VMS logging. EMODnet (http://www.emodnet-seabedhabitats.eu) maintains maps of the North Sea, with substrate type, topography and physical variables. Biota are included as the OSPAR habitat categories, which has special attention towards vulnerable habitat types.		
b	**Guide post**	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
	Met?	Y	Y	N
	Justification	Reliable VMS data show spatial and temporal location of the fishing operations. *Sand and muddy bottoms:* The general impacts of otter trawls are known on the affected habitats (sand and mud) to be of limited magnitude (Sanchez et al 2000) and with a low recovery time (Kaiser et al 2006). Nevertheless there is a lack of detailed knowledge on impact both on sand bank habitats (e.g. JNCC 2012), and on trawl impact on sea pens as found on the muddy Fladen ground. The physical impacts are therefore not fully quantified.		
c	**Guide post**		Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the	Changes in habitat distributions over time are measured.

<table>
<tr><td colspan="2">PI 2.4.3</td><td colspan="3">Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types</td></tr>
<tr><td rowspan="3"></td><td></td><td></td><td>fishery or the effectiveness of the measures).</td><td></td></tr>
<tr><td>Met?</td><td></td><td>N</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">VMS data are continuously collected from the fishery and the distribution of effort can be monitored from this.

Sand and muddy bottoms:

European research into impacts of fishing gear on benthic communities and seabed habitats is ongoing, with greater levels of research associated with the marine protected area designations being considered for the fisheries in question (Dogger bank for sandeel and Central Fladen for the Norway pout fishery). This will be required to continue into the future under the Habitats Directive and under commitments to OSPAR. However, the monitoring is not systematic and does not ensure that changes in habitat distributions over time are captured.

The fishery report impact with benthic organisms through Code-of-Conduct logging. It is surprising that no impacts with benthic organisms are recorded, in particular for the Norway pout fishery, which occur in an area with recordings of sea pens. The fishery needs to build confidence in the CoC logging and provide information about encounters to increase the detail of knowledge on the distribution of vulnerable habitats.

Maps of the fishery based on VMS data have been made available. However, the frequency of disturbance on a given area are unavailable. Thus, it is not possible to estimate the time that a habitat is allowed to recover between trawl impacts from the fishery. Further, not only the impact from the reduction fishery matters for the habitat; the cumulative impacts of all fisheries on the habitats needs to be collated and assessed, and we recommend the fishery to do this..

These concerns are relevant for both habitat types.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">JNCC (2012) Offshore Special Area of Conservation: Dogger Bank Conservation Objectives and Advice on Operations. JNCC report ver. 6.0. 24 pp.

Kaiser, M. J., Clarke, K. R., Hinz, H., Austen, M. C. V., Somerfield, P. J., & Karakassis, I. (2006). Global analysis of response and recovery of benthic biota to fishing. Marine Ecology Progress Series, 311, 1-14.

Sanchez, P., Demestre, M., Ramon, M., & Kaiser, M. J. (2000). The impact of otter trawling on mud communities in the northwestern Mediterranean. ICES Journal of Marine Science, 57(5), 1352-1358.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>75</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):

Condition 9: By the fourth annual surveillance audit sufficient data must continue to be collected to detect any increase in risk to habitat types affected by this fishery.</td><td>9</td></tr>
</table>

Evaluation Table for PI 2.4.1 – Pelagic gear in the sprat fishery: purse seines and midwater trawls

<table>
<tr><td colspan="2">PI 2.4.1</td><td colspan="3">The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td><td>The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td><td>There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Part of the sprat fishery is conducted with pelagic gears. In general, pelagic gears are highly unlikely to influence habitat structure (ICES 2008; Gislason et al., 2013). In shallow waters, along the west coast of Jutland, the seines may touch the bottom. In those areas, the bottom habitat is sand with a high natural disturbance from tides and surface waves. The impact from the purse seines is therefore highly unlikely to cause serious harm, even if it touches the bottom.

The fishery might have an impact due to lost gear. Though unlikely to be a major problem due to the cost of gear, this has yet to be documented. The code of conduct being implemented will provide this information in the future. Thus, the fishery meets the SG80 but not 100 level.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">ICES (2008) Report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO). ICES CM 2008/ACOM:41, 269 pp

Gislason, H., Jørgen Dalskov, Grete E. Dinesen, Josefine Egekvist, Ole Eigaard, Thomas Kirk Sørensen and Finn Larsen (2013) Miljøskånsomhed og økologisk bæredygtighed i dansk fiskeri. Notes from NaturErhversstyrelsen, Journal nr. 12/09478.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.4.2 – – Pelagic gear in the sprat fishery: purse seines and midwater trawls

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
	Met?	Y	Y	N
	Justification	The impact on the benthic habitat is managed by international legislation, backed by habitat mapping, and being implemented in MPAs as a partial strategy to limit impact on sensitive habitats. The use of pelagic gear is an important measure to minimize benthic habitat impact.		
b	Guide post	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
	Met?	Y	Y	N
	Justification	The gears do not normally touch the bottom, and where they do, their impact is likely small (see 2.4.1a). Further, studies assessing habitat impacts of pelagic trawl fisheries (Donaldson et al., 2010) demonstrate that pelagic gear have a negligible impact on the benthic habitat. SG80 is met. This has however not been specifically tested for the fishery in question and as such SG100 is not met.		
c	Guide post		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y	N
	Justification	MPAs are in the process of being implemented, but this work is not finalized. However the most important measure -- the use of pelagic gear -- is fully implemented.		
d	Guide post			There is some evidence that the strategy is achieving its objective.
	Met?			Y
	Justification	There is no evidence of habitat damage from the pelagic fishery. This provides some evidence that the strategy is achieving its objective.		

PI 2.4.2	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types	
References	Donaldson, A., Gabriel, C., Harvey, BJ, and Carolsfeld, J. (2010). Impacts of Fishing Gears other than Bottom Trawls, Dredges, Gillnets and Longlines on Aquatic Biodiversity and Vulnerable Marine Ecosystems. *DFO Can. Sci. Advis. Sec. Res. Doc. 2010/011*. vi + 84 p.	
OVERALL PERFORMANCE INDICATOR SCORE:		**85**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.4.3 – – Pelagic gear in the sprat fishery: purse seines and midwater trawls

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	There is basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
	Met?	Y	Y	Y
	Justification	The distribution of demersal habitats, including vulnerable habitats, is known (e.g. OSPAR mapping). Since the fishery is a pelagic fishery and does not impact demersal habitats, it was not considered necessary to understand habitats at a significant level of detail in order to evaluate the impacts of this fishery. SG100 is met.		
b	Guide post	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
	Met?	Y	Y	N
	Justification	There is ample information that pelagic gear is unlikely to have an impact on the pelagic habitat, besides the actual catch (Donaldson et al 2010). Being pelagic, the gear does not interact with potentially vulnerable benthic habitats. VMS provides reliable information on the spatial extent, timing, and location of the fishery The fishery might have an impact due to lost gear. Though unlikely to be a major problem due to the cost of gear, this has yet to be documented. The CoC being implemented will provide this information in the future. The impacts of the gear used in this fishery, however, have not been fully tested and quantified and SG100 is therefore not met.		
c	Guide post		Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to	Changes in habitat distributions over time are measured.

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types		
			changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	
	Met?		Y	Y
	Justification	As above, the team considered that the information available is sufficient for any increase in risk to vulnerable habitats to be detected since the gear does not interact with bottom habitats (SG80 is met). Moreover, information exists and continue to be collected to allow monitoring the locations where the vessels fish (i.e. VMS data, catches and fishing effort), and the habitats over which they operate to be accurately mapped (SG100 is met). Information about lost gear will be recorded in the future through the Code of Conduct.		
References		Donaldson, A., Gabriel, C., Harvey, BJ, and Carolsfeld, J. (2010). Impacts of Fishing Gears other than Bottom Trawls, Dredges, Gillnets and Longlines on Aquatic Biodiversity and Vulnerable Marine Ecosystems. *DFO Can. Sci. Advis. Sec. Res. Doc. 2010/011*. vi + 84 p.		
OVERALL PERFORMANCE INDICATOR SCORE:				**95**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.5.1

PI 2.5.1		The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guide post**	The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Sandeel-Y Sprat-Y Norway pout-Y	Sandeel-Y Sprat-Y Norway pout-Y	Sandeel-N Sprat-N Norway pout-N
	Justification	The ecosystem impact of the fishery is assessed on a tri-annual basis though model calculations (see 3.4.4 in main text). The most important model is the "SMS" statistical model, which is largely used a reference for other models (Lewy and Vinther, 2004), such as the Ecopath model (Mackinson and Daskalov, 2007). New functional groups are continuously being added to the multi-species models, in particular dependent ETP species (mammals, birds and rays). Many higher trophic-level species rely partly on the species in the fishery: predatory fish (e.g. gadoids, mackerel and piscivorous flatfish), minke whales, harbor porpoises, and some bird species. The food needs of higher trophic level is accounted for by allocation of escapements. The levels of escapements are based on multi-species assessments of food requirements of higher trophic level species. This procedure ensures that the fishery is highly unlikely to cause serious harm on dependent predators. Direct evidence that the fishery is disrupting dependent predators could be recovery of higher trophic level species, and/or the absence of changes in somatic growth or other effects related to food limitation. The higher trophic level fish species have over a long period been of very low abundance compared to historic abundances. The lack of recovery of these species is most likely due to high fishing mortality on the species. There is some evidence of an incipient recovery of cod in the North Sea (ICES, 2015) facilitated by reductions in fishing mortality. This indicates that forage fishing is not hindering recovery. Regarding growth changes, there are no systematic studies linking growth changes (or the absence of growth changes) to lower trophic levels in the North Sea. Further, the current model used in the assessment of natural mortality ("SMS") does not allow the estimation or simulation of food limitation on higher trophic levels. Some efforts have been made to solve this problems, by setting up an EcoSim model and including food-dependent growth, however conclusive evidence has yet to emerge (ICES 2014). Taken together, it is highly unlikely that the reduction fishery causes serious harm to dependent elements in the ecosystem. Therefore SG80 is met. The inherent uncertainties in any multispecies modelling activity – and the concerns about some dated input data (2.5.3) – means that a score of SG100 is not reached.		

<table>
<tr><td>PI 2.5.1</td><td colspan="2">The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function</td></tr>
<tr><td>References</td><td colspan="2">ICES (2015) Advice on Cod (Gadus morhua) in Subarea IV and Divisions VIId and IIIa West (North Sea, Eastern English Channel, Skagerrak)
ICES (2014) Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM) ICES CM 2014/SSGSUE:11</td></tr>
<tr><td colspan="2">OVERALL PERFORMANCE INDICATOR SCORE:
Per CR v1.3 the overall score given for this PI is 80 since all elements meet 80:
<table>
<tr><td>Scoring Element</td><td>Score</td></tr>
<tr><td>Sandeel fishery</td><td>80</td></tr>
<tr><td>Sprat fishery</td><td>80</td></tr>
<tr><td>Norway pout fishery</td><td>80</td></tr>
</table></td><td>80</td></tr>
<tr><td colspan="2">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.5.2

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Guide post	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan, in place.
	Met?	Y	Y	N
	Justification	Management of ecosystem effects of the fishery is mandated by the Common Fisheries Policy (CFP). The CFP recognizes the need to manage fisheries collectively on a multispecies basis as well as the need to increasingly account for ecosystem aspects in formulating future fishery management policy and in developing management plans. This is being expressed though the Marine Strategy Framework Directive. A partial strategy of implementing ecosystem effects of fishing on other components of the food web is the use of multi-species models to derive natural mortalities (M2s; ICES 2014). These M2s forms an explicit link between higher trophic level species (larger fish, birds and marine mammals) to lower trophic level species. The M2s are used in the stock assessment of sandeel, sprat and Norway pout, and they therefore directly influence the setting of TACs. There is no specific plan for the entire North Sea ecosystem with a clearly formulated objective; an implementation of the Marine Strategy Framework Directive is expected to be a key element of a future plan.		
b	Guide post	The measures take into account potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	The strategy, which consists of a plan, contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
	Met?	Y	Y	N
	Justification	The multi-species models are based on stomach sampling, surveys and catches and form a state-of-the-art assessment of the predation mortalities (M2s) imposed by the top predators. The stomach data used to calculate the preferences of fish species on their prey are old (from 1991) and made at the trailing edge of the gadoid outburst. Update of the preferences will		

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
		therefore improve the reliability of the M2 estimates. The M2s are updated on a tri-annual schedule, last time in 2014 (ICES 2014). This means that a future recovery of top predators, and resulting increases in M2s and decreases in the catch of forage fish that can be taken, will be accounted for. This ensures that fishing does not impede productivity or recovery of predatory species. The integration of multi-species modelling in the advice of fish stock management in the North Sea, including the assessment of indirect effects on ETPs, represent current state-of-the-art ecosystem management. This measure is highly likely to restrain the impact of fishing on forage fish to avoid disruption of ecosystem structure.		
c	**Guide post**	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.
	Met?	Y	Y	N
	Justifi cation	The partial strategy (calc. of M2s and setting quotas that explicitly recognize predation needs) is considered likely to work as it explicitly accounts for the dependent predators in single species management. There is some information to show the success of the measures, but only partial success in management of the lower trophic level species, despite them being highly dynamic, and from the incipient recovery of higher trophic level species in the system. Therefore, SG80 is met.		
d	**Guide post**		There is some evidence that the measures comprising the partial strategy are being implemented successfully.	There is evidence that the measures are being implemented successfully.
	Met?		Y-Sandeel and pout N-Sprat	Y-Sandeel and pout N-Sprat
	Justifi cation	M2s are continuously calculated (on a tri-annual basis) and used in single species management, incl. Fmsy calculations (ICES 2014). For the sandeel and Norway pout fisheries, this constitutes evidence that the measures are being implemented, since TACs have been set following scientific advice. For sprat, however, the situation is not as clear. Since the latest sprat benchmark held in February 2013, the advice year has been changed such that it now runs from 1. July to 31. June the following year. The calendar for the advice-to-TAC cycle has however not been changed. This has meant that the advice comes out the day before the advice year (30. June), but the TAC year has remained the calendar year. For two of the years, this has led to in-season revisions of the TAC (as new advice came out with very different results). This meant an increase in the TAC in 2015 and a		

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function
		decrease in 2016. This makes it somewhat difficult to compare advice and TACs directly to see if advice has indeed been heeded, and also difficult to ensure that the TACs are in line with advice for the entire year. In some years since 2013 TAC has ultimately been set above ICES advice because of this mismatch (ICES 2016). Therefore SG80 is not reached for sprat because the M2 strategy for protecting dependant predators relies on adherence to scientific advice for TAC setting (for sandeel and Norway pout TACs are set at or below ICES advice). Therefore for sprat, it is not possible to say that measures are being implemented successfully. However, it is worth noting that from now on, this calendar mismatch issue has been resolved because ICES advice will come out in April from now on, allowing the TAC to be adjusted before the season starts. However it remains to be seen if this alone will resolve the issue.
References		ICES (2014) Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM) ICES CM 2014/SSGSUE:11 ICES Advice (2016) Sprat (*Sprattus sprattus*) in Subarea 4 (North Sea)

OVERALL PERFORMANCE INDICATOR SCORE:

Per CR v1.3 the overall score given for this PI is 75 since all elements meet 60; most achieve higher performance, at or exceeding 80' and only a few fail to achieve 80 and require intervention action:

Scoring Element	Score
Sandeel fishery	85
Sprat fishery	75
Norway pout fishery	85

75

CONDITION NUMBER (if relevant):

By the fourth annual audit, there must be some evidence that measures comprising the partial strategy to ensure the sprat fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function, are being implemented successfully.

11

Evaluation Table for PI 2.5.3

<table>
<tr><td colspan="2">PI 2.5.3</td><td colspan="3">There is adequate knowledge of the impacts of the fishery on the ecosystem</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>Information is adequate to identify the key elements of the ecosystem (e.g., trophic structure and function, community composition, productivity pattern and biodiversity).</td><td>Information is adequate to broadly understand the key elements of the ecosystem.</td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Knowledge on the structure and function of the North Sea ecosystem has been acquired through more than a century of scientific inquiry, most of it focused on understanding the role of the fish community. Of particular importance have been the long effort in multi-species modelling, supported by large stomach sampling surveys, and continuously updated (ICES 2014). The most important model is the “SMS” statistical model, which is largely used a reference for other models (Lewy and Vinther, 2004), such as the Ecopath model (Mackinson and Daskalov, 2007). New functional groups are continuously being added to the multi-species models, in particular dependent ETP species (mammals, birds and rays). The key elements of the ecosystem are therefore well understood.</td></tr>
<tr><td rowspan="3">b</td><td>Guide post</td><td>Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and have not been investigated in detail.</td><td>Main impacts of the fishery on these key ecosystem elements can be inferred from existing information and some have been investigated in detail.</td><td>Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated in detail.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The impact of fishing on the ecosystem have been investigated in detail, both from empirical analyses (e.g. Daan et al. 2005) and from the multi-species models. The stomach analyses and models have provided credible estimates of the impact of predatory species on the targeted forage fish, as well as shown which species are particularly dependent on the forage fish. Many specific interactions have been investigated in detail. There are, however, two issues that hinders awarding a SG100 for this guidepost:
1) The stomach surveys that support the multi-species models are becoming dated. The incipient recovery of larger species has the potential to instigate larger changes in the trophic structure of the North Sea. There is therefore a need for a reevaluation of interaction coefficients based on new stomach samplings to maintain the credibility of the multi-species models.
2) While the multi-species models show the two-way interaction between species, they do not currently resolve the direct impact of food limitation. This means that effects of food limitation can only be inferred, not directly simulated.</td></tr>
</table>

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
c	Guide post		The main functions of the Components (i.e., target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species are identified and the main functions of these Components in the ecosystem are understood.
	Met?		Y	Y
	Justification	As in 2.5.3a and 2.5.3b. In this guidepost only the main functions are required to be understood, which is generally the case (ICES, 2016), hence SG100 is awarded.		
d	Guide post		Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
	Met?		Y	Y
	Justification	Sufficient information is available to assess the main consequences of fishing on retained species, ETPs and higher trophic level fish species; see 2.3.1a and b.		
e	Guide post		Sufficient data continue to be collected to detect any increase in risk level (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
	Met?		Y	N
	Justification	Data is collected through annual international fish surveys. Further, mammals and birds are continuously monitored for abundance and (for birds) for hatching success. The data are used to update key runs of the multi-species models on a tri-annual basis. The available information is sufficient to support the development of an ecosystem fishing strategy and to manage ecosystem impacts. An update of interaction coefficients based on stomach samples is needed to maintain an acceptable reliability of the multi-species modeling (see also 2.5.3b), thus only a SG80 is awarded.		
References		Daan, N., Gislason, H., Pope, J. G., & Rice, J. C. (2005). Changes in the North Sea fish community: evidence of indirect effects of fishing? *ICES Journal of Marine Science* 62(2), 177-188.		

PI 2.5.3	There is adequate knowledge of the impacts of the fishery on the ecosystem	
	ICES (2014) Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM) ICES CM 2014/SSGSUE:11 Lewy, P. and Vinther, M. (2004). A stochastic age-length-structured multispecies model applied to North Sea stocks. *ICES CM*, *FF:22*, 33.pp Mackinson, S., and G. Daskalov (2007) An ecosystem model of the North Sea to support an ecosystem approach to fisheries management: description and parameterisation. *Cefas Science Series Technical Report* 142, 195 pp. ICES (2016) ICES *Ecosystem Overviews* Greater North Sea Ecoregion.	
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		

Principle 3

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There is an effective national legal system and a framework for cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and organised and effective cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and binding procedures governing cooperation with other parties which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	Y	Y	Y
	Justification	European fisheries are managed through the European Union Common Fisheries Policy (CFP). The CFP has specific precautionary and MSY objectives to reach sustainable fisheries in the context of ecosystem based management, and therefore has management outcomes consistent with MSC principles 1 and 2. In addition, the EU Marine Strategy Directive (Directive 2008/56/EC) commits Members States to further foster the integration of environmental concerns into other relevant policies, such as the CFP, in order to achieve 'good environmental status' in the marine environment, through the development and implementation of national level policies based on an ecosystem approach. Denmark has enacted the CFP in its 1999 Fisheries Act and has set management objectives in line with its principles. Finally, there are also binding international agreements to set fishing opportunities for shared stocks with several third countries.		
b	**Guidepost**	The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.
	Met?	Y	Y	N

<table>
<tr><td colspan="2">PI 3.1.1</td><td colspan="3">The management system exists within an appropriate legal and/or customary framework which ensures that it:
• Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and
• Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and
• Incorporates an appropriate dispute resolution framework.</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Disputes between Member States and the European Commission are resolved in the Council of Ministers, while legal disputes between European Institutions and with EU governments can be taken to the Court of Justice of the European Union. At European level there is also the possibility of appealing to the Ombudsman, which investigates complaints about maladministration in the institutions and bodies of the European Union. There are also a wide range of institutional solutions to dispute resolution – through trade organizations, professional associations, and a range of decision-making bodies (at local, regional and national levels).

Nationally, the resolution of legal disputes is made through the Danish judicial system. In the event of a fisheries infringement, the Agrifish Agency passes the details to the public prosecutor who will then decide the value of the fine. Fishers, or industry representatives, can appeal to the full judicial process.

Both European and national systems have been tested in several cases and have been proven to be effective. For example, infractions procedures have been made is the past by the EC against several MS for quota overshooting or lack to provide required fisheries data. However, at international level, the system has not been proven to be completely effective in resolving disputes, namely in sharing fishing opportunities between interested parties, as evidenced by difficulties and delays in reaching mutually agreeable EU-Norway agreements on fishing, for example, and therefore SG100 is not met.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The EU CFP sets out a formal commitment to the legal and customary rights of people dependent on fishing, through a commitment to relative stability (i.e. Member States are always allocated the same proportion of particular stocks). The share of quota nationally also takes into account local communities dependent on fishing, namely by having special consideration for ITQ share, among other measures.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries</td></tr>
</table>

PI 3.1.1	**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**	
	Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. Denmark 1999 Fisheries Act (Act No. 281 of 1999, consolidated as LBK No. 978 of 26 September 2008). https://ec.europa.eu/fisheries/cfp/international/agreements/norway_en	
OVERALL PERFORMANCE INDICATOR SCORE:		**95**

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
	Met?	Y	Y	Y

<table>
<tr><td colspan="2">PI 3.1.2</td><td colspan="3">The management system has effective consultation processes that are open to interested and affected parties.

The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The main institutions involved in management of the sandeel, sprat, and Norway pout fisheries in the North Sea, Skagerrak and Kattegat are:
• European Commission DG MARE – responsible for drafting European legislation on the management of European fisheries in accordance with the Common Fisheries Policy.
• Ministry of Food, Agriculture and Fisheries responsible for overall management of Danish fisheries.
• Danish Agrifish Agency, responsible for regulating, monitoring, enforcement and inspection of fishing, and providing structural support, e.g. from the European Maritime and Fisheries Fund.
• International Council for the Exploration of the Sea, ICES – provides the forum for consolidation of scientific work undertaken by scientists in participating national institutions (through relevant Expert Groups), and the delivery of advice on how best to manage fish stocks.
• European Commission's Scientific, Technical and Economic Committee for Fisheries, STECF – the fisheries scientific committee of the European Commission providing advice to the Commission on all aspects of fisheries science and economics.
• DTU-Aqua, national fisheries research institute, responsible for fisheries analysis and advice, including stock assessment.
• The Danish Fishermen's Association represents the interests of Danish fishermen national and internationally (ex. Advisory Councils).
• Norwegian fisheries management authorities, responsible for Norwegian fisheries in fishing areas shared with Denmark in European waters.

All of these institutions have well established protocols covering their purpose, roles, operation, representation, consultation, and decision-making process, as well as for communicating policy, plans, decisions, and other information. Their roles are well understood and the interaction between them works effectively. Therefore SG100 is met.</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.</td><td>The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.</td><td>The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.1.2</td><td colspan="3">The management system has effective consultation processes that are open to interested and affected parties.

The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">The newly reformed CFP, is guided by several principles of good governance including (among others) the appropriate involvement of stakeholders, in particular Advisory Councils (created in the previous reform that include industry and NGO representatives). The European Commission, ad specifically DG MARE, when drafting and proposing legislation, consults a wide range of stakeholders from public online consultations to meetings with the ACs, MSs, industry representatives and environmental NGOs.

The Danish Fisheries Development Committee gives advice in matters related to the use of European Maritime and Fisheries Fund (EMFF) structural funds, priorities and mechanisms. Fishermen are represented on this Committee and have substantial input into its policy. The EU Committee (Paragraph 5 in the Danish Fisheries Law) is consulted in all matters related to the CFP and EU fisheries regulations. DFPO members are represented on this Committee. The ‘Paragraph 6’ Committee is also statutory and must be consulted in all matters related to regulation of Danish commercial fisheries. DFPO members are similarly represented here. Consultation with environmental NGOs appears to be more informal and they have no statutory role in the Committees mentioned above.

However, at both the EU level and nationally there is not always a clear explanation provided of how the information received by stakeholders is used and therefore SG100 is not met.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>The consultation process provides opportunity for all interested and affected parties to be involved.</td><td>The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The Danish Fisheries Development Committee gives advice in matters related to the use of EMFF structural funds, priorities and mechanisms. Fishermen are represented on this Committee and have substantial input into its policy. The EU Committee (Paragraph 5 in the Danish Fisheries Law) is consulted in all matters related to the CFP and EU fisheries regulations. DFPO members are represented on this Committee. The ‘Paragraph 6’ Committee is also statutory and must be consulted in all matters related to regulation of Danish commercial fisheries. DFPO members are similarly represented here. Although environmental NGOs and the public have no statutory role in the Committees mentioned above, the DG Mare consultation process does provide opportunity and encouragement for all interested and affected parties to be involved. One example is the website interface for consulting on fishing opportunities: http://ec.europa.eu/dgs/maritimeaffairs_fisheries/consultations/fishing-opportunities-2017/index_en.htm and therefore SG 100 is met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3"></td></tr>
</table>

PI 3.1.2	**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**
OVERALL PERFORMANCE INDICATOR SCORE:	**95**

PI 3.1.3		**The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Long-term objectives to guide decision-making, consistent with the MSC Principles and Criteria and the precautionary approach, are implicit within management policy	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach are explicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.
	Met?	Y	Y	Y

PI 3.1.3		**The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach**
	Justification	As stated above, the CFP has in its Article 2 specific precautionary and MSY objectives to reach sustainable fisheries: "*the CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield (MSY). Furthermore, the CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavour to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment. In particular it shall, among other objectives, gradually eliminate discards; make the best use of unwanted catches; provide for measures to adjust the fishing capacity of the fleets to levels of fishing opportunities; take into account the interests of both consumers and producers; and be coherent with the Union environmental legislation*"; while it states that "*in order to reach the objective of progressively restoring and maintaining populations of fish stocks above biomass levels capable of producing maximum sustainable yield, the maximum sustainable yield exploitation rate shall be achieved by 2015 where possible and, on a progressive, incremental basis at the latest by 2020 for all stocks*". The EU Marine Strategy Directive (Directive 2008/56/EC) also commits Members States to further foster the integration of environmental concerns into other relevant policies, such as the CFP, in order to achieve 'good environmental status' in the marine environment, through the development and implementation of national level policies based on an ecosystem approach, in order to meet the following targets by 2020 : • populations of all commercially exploited fish and shellfish must be within safe biological limits, exhibiting an age and size distribution that is indicative of a healthy stock; • all elements of the marine food web must occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity; • biological diversity must be maintained and the quality and occurrence of habitats, and the distribution and abundance of species, are to be kept in line with prevailing conditions; and • sea floor integrity is maintained at a level that ensures the safeguarding of structure and functions of the ecosystems.
References		REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. COUNCIL REGULATION (EC) No 1198/2006. On the European Fisheries Fund Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora.
OVERALL PERFORMANCE INDICATOR SCORE:		**100**

PI 3.1.4		The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure they do not contribute to unsustainable fishing practices.
	Met?	Y	Y	Partial

PI 3.1.4		**The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing**
	Justification	Since the 2002 review of the CFP, subsidies that contributed in Europe to unsustainable fishing have stopped, and presently there is no support to increase capacity, or to compensate for low catches. The main mechanism for providing incentives via funding to the industry in Denmark is the European Maritime and Fisheries Fund, EMFF. The EMFF was reformed in 2006, after some criticism that it was contributing to overcapacity, and the problems arising from this. Council Regulation EC 1198/2006 on the European Fisheries Fund has tightened funding restrictions to provide targeted support for improving safety and working practices, improving catch handling and quality, to encourage the adoption of low impact fishing methods and for development of shore based infrastructure to complement this. It was reformed again in 2014 (prior to this it was the European Fisheries Fund), but is still largely structured the same way as previously. The EMFF, co-funded by the Danish (and other European) governments, is seeking to support implementation of the CFP (which is consistent with MSC principles 1 & 2) and includes positive incentives (funding) to reduce the fisheries impact on the marine environment, as well as joint stewardship of protected areas and Natura 2000 sites, etc. A preferential tax system is still applied to diesel across all EU primary production sectors, which could be considered a subsidy relative to other economic sectors, but European countries already apply a far higher level of taxation on fuel than many other countries, so in comparison it might not be a significant subsidy. In the reformed CFP, it is expected that the newly introduced Landing Obligation (LO) will be a big incentive to fish more selectively, as the main objective of the LO is to reduce unwanted catch. In the specific case of sprat, the landing obligation is expected to provide a disincentive to slip catches of herring (see P2). However, it is too soon to tell whether the LO will produce the incentives it is expected to, or how and whether management will respond as experience with this new law grows. But the latest CFP reform also considers incentives, including those of an economic nature, such as fishing opportunities, to promote fishing methods that contribute to more selective fishing to fishing with low impact on the marine ecosystem and fishery resources. Finally, European fisheries funds programs are reviewed periodically with the revision of the CFP, to ensure they do not contribute to unsustainable fishing practices and therefore SG 100 is met in this regard. However, past reviews were not sufficient to prevent subsidies used for unsustainable fisheries and as mentioned above, it is too soon to tell the actual effect of the LO with regard to creating incentives for sustainable fishing and how this will be reviewed and modified if needed going forward, therefore SG 100 is only met partially.
References		REGULATION (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund (EMFF). Commission Delegated Regulation (EU) No 1395/2014 of 20 October 2014 establishing a discard plan for certain small pelagic fisheries and fisheries for industrial purposes in the North Sea.

PI 3.1.4	**The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing**	
	COM (2009)163 final. GREEN PAPER. Reform of the Common Fisheries Policy. European Maritime and Fisheries Fund - Operational Programme for Denmark (2014). CCI: 2014DK14MFOP001.version 1.1. 138pp. Accessed at: http://ec.europa.eu/fisheries/cfp/emff/doc/op-denmark_da.pdf	
OVERALL PERFORMANCE INDICATOR SCORE:		**90**

PI 3.2.1		**The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.**		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	**Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system.	**Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.	**Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.
	Met?	Y	Partial	N
	Justifi cation	The EU Common Fishery Policy has general objectives related to maintaining stocks at or above B_{msy} and not exploiting stocks at levels above F_{msy}. However these general objectives have not been translated into adopting any specific reference points for these stocks, nor formal harvest control rules to keep harvests within the general bounds set by the CFP. At an operational level short-term objectives are represented by annual TACs. Achievement against these annual targets is monitored at national level by Denmark for all three target species. The ICES ACFM presents advice on stock management based on its current understanding of the state of stocks. It also advises on what TACs should be set for the coming year for those stocks that it has been requested to advise on – taking into consideration its knowledge of the stocks and any decision-control rules that have been adopted for these stocks. Regarding impact on ecosystem (Principle 2), the management system takes into account ecosystem effects. TAC setting is based on recommendations from stock assessments that already account for predation pressure on key prey species such as these by using Multi-		

<table>
<tr><td colspan="2">PI 3.2.1</td><td colspan="2">The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.</td></tr>
<tr><td></td><td></td><td colspan="2">Species Virtual Population Analysis (MSVPA) estimates of natural mortality (ICES 2015f).

In addition, the CFP has also environmental objectives with specific such as the reduction of unwanted catches with the Landings Obligation (in place since 2015 for pelagic fisheries), the protection of species and habitats through different Directives, but also through the EU Marine Strategy Directive (Directive 2008/56/EC) that commits Members States to further foster the integration of environmental concerns into other relevant policies, such as the CFP, in order to achieve 'good environmental status' in the marine environment.
The short- and long-term management objectives are therefore consistent with achieving the outcomes expressed by MSC's Principle 1 and 2 but due to an absence of explicit long-term management plans for any of the three target species under assessment, the long-term objectives are not entirely explicit in the fisheries management system, and therefore SG80 is only partially met.</td></tr>
<tr><td colspan="2">References</td><td colspan="2">REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>70</td></tr>
<tr><td colspan="3">CONDITION NUMBER (if relevant):

By the 4th annual audit, short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, must be explicit within the fishery-specific management system for sandeel, sprat, and Norway pout.</td><td>9</td></tr>
</table>

PI 3.2.2	The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.			
Scoring Issue		SG 60	SG 80	SG 100
a	Decision-making processes			
	Guide post	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	Y	Y	
	Justification	European fisheries are managed through the CFP. The European Commission, mainly DG MARE, is responsible for drafting European legislation on the management of European fisheries in accordance with the CFP objectives. The draft European legislation is then agreed by Council, composed of all MSs fisheries ministers, or in co-decision with the European Parliament. This decision-making system is applicable to fishery specific management decisions, such as the setting of TACs, technical measures (MLS, mesh size, days-at-sea, closed areas, etc.) and annual plans (including harvest control rules and reference points). In the case of stocks shared with Norway (e.g. Norway pout), effective agreements exist to ensure the stock is not overharvested, although coordination may not always be explicit. Overall, however, these processes are established and result in measures and strategies to achieve the fishery-specific management objectives, thus the SG 80 is met.		
b	Responsiveness of decision-making processes			
	Guide post	Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Y	Y	N
	Justification	The EC by making proposals based on the most updated research, and submitting them to agreement by Council and Parliament, does respond to serious and other important issues. By also drafting and making proposals in consultation with a wide range of stakeholders, (ACs, MSs, industry representatives, environmental NGOs and general public) they respond in a transparent, timely and adaptive manner and take account of the wider implications of decisions regarding the status of exploited stocks and their immediate management needs.		

<table>
<tr><td colspan="2">PI 3.2.2</td><td colspan="3">The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.</td></tr>
<tr><td></td><td></td><td colspan="3">The outcome of meetings of the Council of Ministers clearly demonstrates that all of this information is taken into account, and explains the basis for management actions. This information is formally reported and readily accessible on the EC website (see http://ec.europa.eu/fisheries/meetings_events/council_meetings/archives/council_meetings_2014_en.htm).

Decision-making processes do take into account the wider implications of decisions as evidenced by the year-over-year TAC change restraints imposed even when scientific advice recommends a large decrease or increase in TAC. Another example of this is the stock assessments that lead to agreed TACs taking explicit account of natural mortality from predators via the MSVPN approach particularly relevant to key LTL species such as those under assessment here.

However, it cannot be demonstrated that the decision-making procedures respond to all issues identified in relevant research, monitoring, evaluation and consultation in an adaptive manner, so the SG 100 level is not met for this scoring issue.</td></tr>
<tr><td>c</td><td colspan="4">Use of precautionary approach</td></tr>
<tr><td></td><td>Guide post</td><td></td><td>Decision-making processes use the precautionary approach and are based on best available information.</td><td></td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td></td></tr>
<tr><td></td><td>Justification</td><td colspan="3">EC proposals are always in line with (and guided by) the CFP, which clearly states a commitment to the precautionary approach, but also to MSY. By making use of the considerable expertise within ICES and STECF and their most updated advice, the EC ensures that decisions are based on the best available information. The basis of ICES advice, upon which TAC setting procedures are based for these and other fisheries, is in line with the precautionary approach and MSY objectives, thus, the SG 80 is met for this scoring issue. This is evidenced here particularly in the very precautionary TAC setting in the “data-deficient” sandeel areas 4 and 6. Although it does not affect the score here (the TAC setting itself is what has been evaluated), it is worth noting that in recent years, the catch has exceeded the TAC for sprat in the North Sea, meaning that although decisions on TAC have followed a precautionary approach in this fishery, there has been an implementation problem. This is reflected in scores within P1 and P2.</td></tr>
<tr><td>d</td><td colspan="4">Accountability and transparency of management system and decision-making process</td></tr>
<tr><td></td><td>Guide post</td><td>Some information on the fishery’s performance and management action is generally available on request to stakeholders.</td><td>Information on the fishery’s performance and management action is available on request, and explanations are provided for any</td><td>Formal reporting to all interested stakeholders provides comprehensive information on the fishery’s performance and management</td></tr>
</table>

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.		
			actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	**actions** and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	Y	Y	N
	Justification	The EC is formally obliged to report on the implementation and effectiveness of the CFP, of multi-annual management plans, but also on setting fishing opportunities. The CFP has a formal review every 10 years, while multi-annual plans are reviewed between 3 to 5 years by ICES and/or STECF. The setting of fishing opportunities and status of commercial exploited stocks is reviewed annually by DG MARE and from this year based on STECF analysis, and is readily available to interested stakeholders and the public in general. However, there is little reporting on how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity, and for this reason SG 100 is not reached.		
e	Approach to disputes			
	Guide post	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	Y	Y	N
	Justification	There are a number of mechanisms in the EU and in Denmark that act proactively to avoid legal disputes. The increase in stakeholder involvements with recent CFP reforms, namely through ACs, have reduced the likelihood of management measures to trigger disputes. The EC, and specifically DG MARE, when drafting and proposing legislation, consults a wide range of stakeholders from public online consultations to meetings with the ACs, MSs, industry representatives and environmental NGOs. Additionally in Denmark, the Danish Fisheries Development Committee acts proactively with the industry to discuss management proposals, address industry concerns and inform of up-coming regulations. There are also regular meetings between the industry and the Ministry. However, it has happened in the past that international negotiations, e.g. between EU and Norway on fishing opportunities, could not be completed in a timely way because of (legal) disputes. This has in some years prevented		

<table>
<tr><td colspan="2">PI 3.2.2</td><td colspan="2">The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.</td></tr>
<tr><td></td><td></td><td colspan="2">the EC from setting and communicating quotas and uptake regulations to Member States before the start of the calendar year, and prevented EU fishers from entering Norwegian zone and vice-versa. Therefore SG 100 is not reached.</td></tr>
<tr><td colspan="2">References</td><td colspan="2">EC 2002. Council Regulation No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy. Official Journal of the European Union L 358, 59-80.
REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

Denmark Fisheries Law (1999)</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80</td></tr>
<tr><td colspan="3">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
Scoring Issue		SG 60	SG 80	SG 100
a	MCS implementation			
	Guide post	Monitoring, control and surveillance **mechanisms** exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance **system** has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A **comprehensive** monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	Y	Y	N
	Justification	It is the responsibility of EU member states to enforce rules agreed under the CFP. An EU Community Fisheries Control Agency (CFCA), now called the European Fisheries Control Agency (EFCA), was established in 2007 to strengthen and coordinate controls across all national enforcement authorities to bring about improved uniformity and effectiveness of enforcement. This is further reinforced by the new EU control regulation which came into force on 1st January 2010, and aims to foster a new culture of compliance (1224/2009). In Denmark, the responsible authority is the Agrifish Agency who conduct a risk-based on board and dockside control based on vessel behavior (i.e. instances of past non-compliance with e.g. hailing protocols or reporting would mean a vessel is higher risk and in need of more frequent monitoring), and there is a random selection of vessels for bycatch inspection. The introduction of e-logbooks for purse seiners and trawl vessels has facilitated consistent enforcement and compliance in these fisheries; however, there is a consistent discrepancy between reported catches of non-target species in e-logbooks vs official sampling. In both cases, the quantity of non-target catch reported is very small, and the discrepancy is most likely due to the differences in sampling protocols between the vessels and the officials, which should be resolved in order for the MCS system to be considered to meet the SG100 requirements.		
b	Sanctions			
	Guide post	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, **are consistently applied** and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and **demonstrably** provide effective deterrence.
	Met?	Y	Y	N
	Justification	In Denmark, non-compliance is dealt with through the Danish criminal justice systems, and using agreed and tested procedures. In event of an infringement being detected, details of the infringement are passed to the public prosecutor, who determines the appropriate fine / sanction. This		

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
		process also enables the fisher to prepare a defense against the charge and provides full right of appeal. Within the Danish fisheries organisation, mechanisms exist to apply sanctions to vessels that break quota allowances (requiring additional quota to be sought), The MCS system enforcing national regulations implementing the CFP, along with some self-regulation by the industry are consistently applied and expected to provide effective deterrence. As an example from the sandeel fishery, misreporting of catch between sandeel areas was discovered within the fleet. Meanwhile, sandeel fishermen have requested management measures to increase flexibility to allow them to swap quota between areas. However, since this noncompliance was discovered, management is reluctant to investigate increasing flexibility for the industry until they demonstrate fully compliant behavior. There have since been no incidences of area misreporting. Within the DFPO and DPPO mechanisms exist to apply sanctions to vessels that break their Code of Conduct, including the loss of MSC certification for fish that they land from certified fisheries. In addition to this all DPPO and DFPO member vessels are required to abide by their own code of contact (to be part of the MSC group), covering a wide range of compliance issues, with specific provisions relating to catches of ETP species. However, there is no demonstration available on the effectiveness of this system in deterring noncompliance, therefore the SG100 level is not met for this scoring issue.		
c	Compliance			
	Guide post	Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	**Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
	Met?	Y	Y	N
	Justification	Although the system appears robust and effective, as detailed above, this stops short of being *high confidence* for a number of reasons – particularly the relatively low observer/inspections coverage, and the catch composition disparities between the official statistics and the logbook data from the fleet discussed previously. Discarding of bycatch in the fishery may occur by sorting the catch at sea or though slipping of the entire catch.		

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
		The catch is sucked up directly from the nets into the hull. Sorting devices are not allowed on board, and non-compliance is easy to spot. The operations are typically large, so hand-sorting is not an option. Consequently, discarding of a partial catch is not an issue. Slipping an entire catch is the only way to discard an unwanted catch. There is no monitoring by observers, neither now or in the past, so there is no direct information about slipping. The nature of the fishery, which targets the schools of the stocks directly by combining acoustics and habitats (sand banks for sandeel; deep mud for Norway pout), makes it unlikely that the entire schools of non-target species are caught and possibly slipped. These are general observations, but there are special potential issues with bycatch of herring (see below). The fishery has operated under the landing obligation where all fish have to be landed since 1/1-2015. The landing obligation can be considered a strategy, as its explicit objective is to eliminate discard of bycatch. The landing obligation means that there is no direct penalty for landing non-target fish, which reduces the incentive to slip. Therefore, in principle, there will be no incentive to slip an entire catch at sea due to the risk of penalties. The Danish AgriFish agency provides some evidence as to a successful implementation: ‘During inspections conducted in 2015, our inspectors have informed and guided fishermen on the ban on discard in the Baltic Sea as well as for pelagic and industrial species in other areas. There have been no sanctions for noncompliance to the ban on discard in 2015’ (AgriFish, 2016). Herring acts as a choke species in the sprat and Norway pout fisheries, which could create an incentive to slip. Earlier, there was a catch-composition rule that one landing could contain no more than 50% herring in the Norway pout fishery or 20% in the sprat fishery. Therefore, at least in the sprat fishery, discarding (slippage) occurred but was not quantified (ICES 2015b). Now, under the landing obligation, all will have to be landed. Quotas of herring bycatch are not allocated to individual fishers and, because of the landing obligation there is no punishment for landing herring. In the sprat fishery, up to 9% of a catch of herring can be written off on the sprat quota; this is to create a disincentive to slippage. However, the fishery is considering development of internal regulation of the fishery to avoid olympic fishing where the bycatch quota is quickly fished by single vessels (Claus Sparrevorn, DPPO, pers. comm.). Such future internal regulation within the fishery could create incentives to slip a catch at sea, in particular in the Norway pout fishery, and they need to be monitored. Thus the SG80, but not the SG100, is met.		
d	Systematic non-compliance			
	Guide post		There is no evidence of systematic non-compliance.	
	Met?		Y	
	Justification	In Denmark, the enforcement system makes strategic and coordinated use of e-logbooks, sales notes, VMS, designated ports, landing inspections,		

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.	
		advance hailing of landing, reporting tolerance limits, inspections throughout the retail and supply chain (as a result of revised buyers and sellers registration requirements in the reformed CFP). Recent improvements including the new EU IUU and Control regulations and the NEAFC Port State control rules also increase comprehensive nature of the system. This can be considered comprehensive and COM (2008) 670 demonstrates that this is consistently effective, even though occasional instances of noncompliance are uncovered.	
References		COUNCIL REGULATION (EC) No 1224/2009. Establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, amending Regulations (EC) No 847/96, (EC) No 2371/2002, (EC) No 811/2004, (EC) No 768/2005, (EC) No 2115/2005, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007, (EC) No 676/2007, (EC) No 1098/2007, (EC) No 1300/2008, (EC) No 1342/2008. COMMISSION REGULATION (EC) No 1010/2009. Laying down detailed rules for the implementation of Council Regulation (EC) No 1005/2008 establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing COM (2008) 670. COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT. Reports from Member States on behaviours which seriously infringed the rules of the Common Fisheries Policy in 2006	
OVERALL PERFORMANCE INDICATOR SCORE:			**85**
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 3.2.4

PI 3.2.4		The fishery has a research plan that addresses the information needs of management		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
	Met?	Y	Y	N
	Justification	ICES strategically establishes study groups based on information requirements-identified by national delegates, including through industrial representations.-Members of various ICES Working Groups focused on such elements as climate-change, plankton, multi-species		

<table>
<tr><th colspan="2">PI 3.2.4</th><th colspan="3">The fishery has a research plan that addresses the information needs of management</th></tr>
<tr><td></td><td></td><td colspan="3">fisheries (ecosystem), etc. All review research, identify research requirements and undertake appropriate work. There is good-communication between Working Groups (via ACOM), and between researchers-through their specialist interests. Regular benchmark stock assessments and ecosystem modelling are conducted specific to these stocks and their roles within the wider ecosystem.

Research / investigation is undertaken in relation to specific requirements, which-generally come from the recommendations of the Stock Assessment Working Group.-Members of the ICES community keep abreast of developments within the scientific-community of relevance to the fishery under consideration. This ICES community is wider than Europe and includes relevant research elsewhere.

The AgriFish Agency is responsible for-the implementation of the Danish National Programme for the collection of data in-the fisheries sector. This contributes to the EC Data Collection Framework (DCF) which evaluates the fisheries sector, i.e. the collection of economic, biological, and-global variables (fishery statistics) as well as fishery-independent surveys at sea.

Taken in combination it can be concluded there is therefore a strategic approach, which delivers reliable and timely information. However there is no “comprehensive-research plan to provide the management system with a coherent and strategic-approach to research across P1, P2 and P3” and therefore SG100 is not met.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Research results are available to interested parties.</td><td>Research results are disseminated to all interested parties in a timely fashion.</td><td>Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The annual reports of ICES working groups and study groups and all other ICES reports are publically available on the ICES website. In addition they are disseminated to interested parties in a timely fashion.

The EU Framework research programs have their own websites, publish aims, programs, and it is conditional on EC funding that the results are publicly available in a timely manner. In particular they are disseminated to decision-makers, in time for annual fishery allocation negotiations. Thus the SG100 level is met for this PI.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Searchable hub for all ICES expert groups:
http://www.ices.dk/workinggroups/WorkingGroups.aspx

National programme and annual reports for data collection
https://www.havochvatten.se/en/start/environmental-research/-datacollection-framework/national-programes-and-annual-reports.html</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>90</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 3.2.5 – Monitoring and management performance evaluation

PI 3.2.5	**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**		
Scoring Issue	SG 60	SG 80	SG 100

	Guide post	There are mechanisms in place to evaluate **some** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **key** parts of the fishery-specific management system	There are mechanisms in place to evaluate **all** parts of the fishery-specific management system.
	Met?	Y	Y	N
	Justification	There is a comprehensive system of routine monitoring of information relevant for management decision-making and stock assessment purposes. The monitoring program in place principally focuses on landings from the fishery, i.e. quota uptake, and implementation of the Landings Obligation, as well as catch sampling ashore to monitor catch composition. With the systems described in 3.2.3 this monitoring now forms a substantially more accurate reflection of actual fishing mortality. Additional monitoring is also in place to provide sufficient information to support stock-assessment or other precautionary management purposes. Additionally there is a well-established system to of management evaluations. For example, there have been a number of directly relevant evaluations of the management system. These include: • Annual review of survey information and scientific advice (by ICES and STECF) • Review of the CFP (every 10 years) • Annual Reports on Fishing Fleet Capacity in Denmark • Annual report on implementation of the European Fisheries Fund The ICES Working Group also effectively serves as routine evaluations of management performance, by comparing fishery performance to pre-determined targets. Environmental management addressing P2 elements is also subject to evaluation via the delivery of the Natura 2000 network. Catch reporting, including discarding and ETP interactions via observers, also enables the evaluation of P2 elements. However, there is not yet a system for monitoring and evaluating the performance of the new Landings Obligation for this fishery, and although bycatch is low and the incentive for discarding or slipping is also low, as explained in several P2 indicators, a lack of monitoring and evaluation system for the Landings Obligation means the SG100 level is not reached for this Scoring Issue.		

<table>
<tr><td></td><td></td><td colspan="3">In addition, no long-term management plan for any of the stocks under assessment means that evaluations of management performance can currently only be judged against the yearly advice and TAC cycle and its ability to maintain stocks at an acceptable level, rather than against long term objectives.</td></tr>
<tr><td rowspan="4">b</td><td colspan="4">Internal and/or external review</td></tr>
<tr><td>Guide post</td><td>The fishery-specific management system is subject to occasional internal review.</td><td>The fishery-specific management system is subject to regular internal and occasional external review.</td><td>The fishery-specific management system is subject to regular internal and external review.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The majority of the evaluations undertaken are ‘internal’ either within ICES or the EC. ICES work brings together a wide range of national scientists, and in so doing builds external perspectives into the assessments, as well as provide a much greater degree of confidence in the catch and discard figures used in the assessments (note the LO will affect the parameters of these stock assessments going forward). The ICES advice (including stock assessment methodologies) is therefore-regularly internally reviewed. STECF also provides occasional external review of specific fisheries management systems at the request of the Commission, however this has not been done for these fisheries. The sandeel, sprat, and Norway pout fisheries do not have formal mechanisms defined for internal and-external review (as are laid out in Long Term Management Plans for example) and-therefore SG 100 is not met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">STECF review of ICES advice: http://stecf.jrc.ec.europa.eu/reports/review-advice</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Appendix 1.2 Risk Based Framework (RBF) Outputs

Appendix 1.2.1 Consequence Analysis (CA) for Principle 1

Table 1.2.1.a: Principle 1 CA Scoring Template - Target Species

	Scoring element	Consequence subcomponents	Consequence Score
PRINCIPLE ONE: Stock status outcome	**Sandeel in Subarea 4**	**Population size**	100
		Reproductive capacity	
		Age/size/sex structure	
		Geographic range	
Rationale for most vulnerable subcomponent	Sandeel fishing is not selective for size, sex or species, and sandeel life history factors include early maturation, relatively high fecundity, and high natural mortality. Consequently population size is probably only slightly more sensitive to the effects of fishing than the other subcomponents. However, of the four options, population size is the most pragmatic for monitoring and managing. In addition, geographic range, fecundity, age and size structure are expected to show high inter-annual variation from natural causes and thus be less sensitive indicators of fishery impacts.		
Rationale for consequence score	No analytical assessment or short-term forecast is available for this stock. The ICES framework for category 3 stocks was applied based on a combined abundance index for the ages 0 and 1 from the dredge survey of the Firth of Forth (ICES, 2012). This index is estimated to have increased by more than 20% between 2010–2013 (four-year average) and 2014. The exploitation on the stock is considered to be very low; therefore, no additional precautionary buffer was applied (ICES 2015a). There is no commercial TAC for sandeel in Area 4—only a monitoring TAC for the purposes of establishing a sufficient data set for an analytical assessment in the future. In addition, the entire UK coastal zone is closed to sandeel fishing in Area 4. In 2012 and 2014, monitoring TACs of 5000 t were implemented for this stock. Since the monitoring TAC was established, sandeel catches in Area 4 have been below the catch corresponding to ICES advice. ICES emphasizes the importance of obtaining sufficient sampling from the monitoring fishery. Historically, the sandeel catch in area 4 has been as high as 170		

	thousand t (in 1997), and routinely in the range of 30-60 thousand t per year, which is well above the current monitoring TAC of 5,000t. Given that much of the sandeel habitat area in Area 4 is unfished due to closed areas and the small monitoring TAC, the team has judged the fishing impact currently to generate an insignificant change to population size or growth rate, and any change is unlikely to be detectable against natural variability for this population.

PRINCIPLE ONE: **Stock status outcome**	**Scoring element**	**Consequence subcomponents**	**Consequence Score**
	Sandeel in Subarea 6	**Population size**	80
		Reproductive capacity	
		Age/size/sex structure	
		Geographic range	
Rationale for most vulnerable subcomponent	Sandeel fishing is not selective for size, sex or species, and sandeel life history factors include early maturation, relatively high fecundity, and high natural mortality. Consequently population size is probably only slightly more sensitive to the effects of fishing than the other subcomponents. However, of the four options, population size is the most pragmatic for monitoring and managing. In addition, geographic range, fecundity, age and size structure are expected to show high inter-annual variation from natural causes and thus be less sensitive indicators of fishery impacts.		

Rationale for consequence score	Only catch history is known for this substock of sandeel in the Kattegat. In the absence of more information, ICES bases its advice on the average catch of the three previous years, and applies a precautionary buffer of 20% (ICES 2015b). ICES has been providing TAC advice on this basis since 2013, and the catch each year since then has always been below the TAC advice of ICES. This sandeel bank is only fished by smaller Danish trawlers who report no detectible changes in population size or density during fishing activities in recent years. An experienced Danish sandeel fisherman reported the following (Dan Harding Pedersen pers. comm.) • The sandeel caught in the Kattegat are on average large/old (compared to the other areas), except in very few extraordinary years (1986, 1993) where there seemed to be a temporary massive influx of lots of small/young sandeel (presumably from the North Sea) on every single bank in the Kattegat. The 'normal' Kattegat sandeel occur in high abundance on certain banks (two north of Læsø, one west of Anholt etc.) every year, and more erratically on other banks. • For these 'safe' banks, the catch rates have been stable throughout the 40-year period that he has been fishing. There will always be sandeel on the other banks as well – but only some of them, so you have to search. This was possible in former times when the quotas and number of vessels were higher. But with the current low quota (last year fished by just two vessels), there are enough fish on the safe banks – so no one will waste time looking for fish on the others. • He also explained that the low water depth and the fact that it was older/larger fish, meant that no matter how many fish you would see on the sonar when you arrived at a bank, once you had fished on them for a day, the rest would have dispersed so widely that it would take several days for them to come back in large enough densities to make fishing worthwhile – a behavior he felt offered them a kind of natural protection against overfishing. If the fishery at its current scale were depleting the stock some decline in CPUE might be experienced, and this has not generally been the case. Decreases in catches since the 1990s have been due to additional regulations applied to the fisheries both inside UK jurisdiction and in EU jurisdiction. An analysis of actual sandeel fishing in Area 6 versus the sandeel habitat area in this area (see Availability rationale in the PSA tables) shows that there is very little overlap of the fishery with the sandeel habitat in the area. Therefore, although there is no positive evidence that catches are sustainable, due to the low likelihood of adverse impact, a score of 80 was awarded for the Consequence Analysis. This corresponds with a possible detectable change in size/growth rate but minimal impact on population size and none on dynamics.

<table>
<tr><td rowspan="5">PRINCIPLE ONE:
Stock status outcome</td><td>Scoring element</td><td>Consequence subcomponents</td><td>Consequence Score</td></tr>
<tr><td rowspan="4">Other sandeel species; all areas:
Lesser sandeel (Ammodytes tobianus; all areas)
Corbin’s sandeel (Hyperoplus immaculatlus; all areas)
Smooth sandeel (Gymnammodytes semisquamatus; all areas)
Greater sandeel (Hyperoplus lanceolatus)</td><td>Population size</td><td>60</td></tr>
<tr><td>Reproductive capacity</td><td></td></tr>
<tr><td>Age/size/sex structure</td><td></td></tr>
<tr><td>Geographic range</td><td></td></tr>
<tr><td>Rationale for most vulnerable subcomponent</td><td colspan="3">Sandeel fishing is not selective for size, sex or species, and sandeel life history factors include early maturation, relatively high fecundity, and high natural mortality. Consequently population size is probably only slightly more sensitive to the effects of fishing than the other subcomponents. However, of the four options, population size is the most pragmatic for monitoring and managing. In addition, geographic range, fecundity, age and size structure are expected to show high inter-annual variation from natural causes and thus be less sensitive indicators of fishery impacts.</td></tr>
<tr><td>Rationale for consequence score</td><td colspan="3">Without genetic testing or careful taxonomic analysis, Lesser, Corbin’s, greater, and smooth sandeel are all indistinguishable from Ammodytes marinus, the sandeel species targeted by industrial fisheries. In addition, very little is known about these species, although there is some information about general range and broad habitat preferences.

Lesser sandeel is known to inhabit coastal areas from mid-tide level to around 30m depth in inshore waters with clean and sandy bottoms (van Deurs et al 2012). http://www.luontoportti.com/suomi/en/kalat/lesser-sandeel

Corbin’s sandeel is the most local, least studied and most recently recognized sandeel species. Its distribution is throughout the eastern North Atlantic along all coats of the British Isles, North Sea, English Channel and northern Biscay. It is thought to inhabit inshore and offshore sandeel banks, closely associated with other sandeel species although less gregarious, and juveniles appear to only occur close inshore.
http://species-identification.org/species.php?species_group=fnam&id=1756

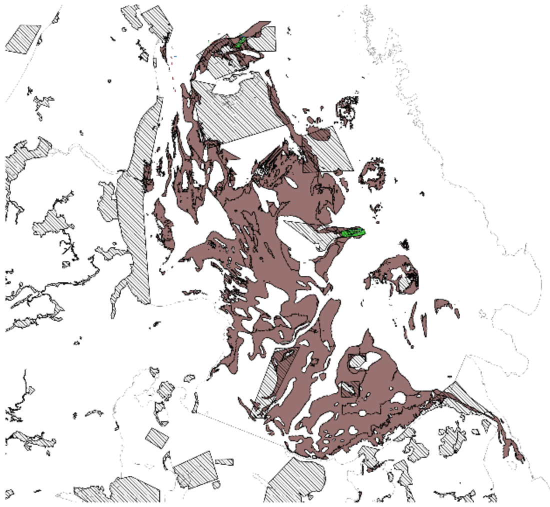
Smooth sandeel (Gymnammodytes semisquamatus) typically occurs offshore over shell-gravel substrates, and also inshore where shell-gravel beaches occur. It feeds on plankton and is a summer batch spawner (Reay</td></tr>
</table>

	1986). Spawning occurs from April until July (Lynam *et al.* 2013). Although it thought to be part of the *A. marinus* fishery bycatch in parts of its range, there is a paucity of information available concerning life history, population trends and harvest levels; however, it is likely that *G. semisquamatus* receives some benefit from fisheries management efforts directed towards *A. marinus* which include the establishment of conservation zones and fishing moratoria. http://www.iucnredlist.org/details/18155963/0 Greater sandeel is very similar in size and appearance to Corbin's sandeel. It is native to the eastern North Atlantic from Murmansk (70°N) and Spitzbergen (75°N) southwards to Portugal (38°N) including Iceland and the Baltic Sea. It has not been recorded from the Mediterranean Sea or the Barents Sea. Its habitat is from the low water mark down to over 100 m, typically over clean and sandy substrates. It is closely associated with other sandeel species, although probably less gregarious. http://species-identification.org/species.php?species_group=fnam&menuentry=soorten&id=1757&tab=beschrijving In summary, very little is known about the life histories and fishing impact on these sandeel species. However, their habitat distribution is different from that of *A. marinus* (e.g. more coastal in the case of lesser sandeel, and juvenile habitat appears to be outside the commercial fishing areas for smooth sandeel), and these species are not targeted by the fishery. In addition, the limited information suggests that productivity characteristics of these species are very similar to *A. marinus* (i.e. highly productive). The scoring uses *A. marinus* population status as a reasonable proxy for the other species, and takes into account that the fishery intends to target on *A. marinus* and those impacts are considered sustainable. Consequently it is likely that the fishery targeting *A. marinus* is not impacting the majority of the populations of these other non-targeted sandeel species, and where it does take them incidentally, there is no cause to consider the impacts would greater than on the targeted species. Thus, taking a precautionary approach a consequence score of 60 is awarded, corresponding to 'full exploitation rate but no detrimental impacts on long-term recruitment dynamics.'

Appendix 1.2.2 Productivity-Susceptibility Analysis (PSA)

Table 1.2.2.a. PSA Rationale Table

PI number	**1.1.1-Sandeel in Area 6**	
A. Productivity		
Scoring element (species)	Sandeel (*A. marinus*) in subarea 6	
Attribute	**Rationale**	**Score**
Average age at maturity.	For both males and females, average age at maturity is approximately 2.5 years (ICES 2015b), resulting in a high productivity score for this attribute.	**1**
Average maximum age	Maximum age reported for all the sandeel stocks in the North Sea assessments of 10 years (ICES 2015b), with at least 95% of the population ago 5 and younger. Thus the maximum reported age is on the edge between high and medium productivity according to the MSC PSA table, and the average maximum age is below 10. Therefore a high productivity score for this species is given. The maximum age and maximum length reported in Fishbase, taken from Muus and Nielsen (1999) are consistent with the ICES figures.	**1**
Fecundity	Reported in Fishbase to be around 25 thousand eggs per year, resulting in a high productivity score for this attribute.	**1**
Average maximum size	Maximum size for North Sea sandeel reported in ICES 2015b is less than 25cm, corresponding to a high productivity score for this attribute.	**1**
Average size at maturity	All the sandeel stocks are reported to commence maturity at around at 11cm (ICES 2015b), and most certainly on average it would be less than 40cm, resulting in a high productivity score for this attribute.	**1**
Reproductive strategy	Several studies (Wright and Bailey, 1996; Proctor et al., 1998; Jensen et al., 2001; Munk et al., 2002; Christensen et al., 2008) and in fishbase (citing Reay 1986), sandeels are open-water broadcast spawners, resulting in a high productivity score for this attribute.	**1**
Trophic level	Trophic level reported in Fishbase based on food items is 2.7, resulting in a high productivity score for this attribute.	**1**
B. Susceptibility		
Fishery only where the scoring element is scored cumulatively	All sandeel fishing vessels operating in Area 6.	
Attribute	**Rationale**	**Score**
Areal Overlap	This species is the target of the fishery in Area 6, however, most of the habitat area is out of reach of the fishery. A simple analysis of the areal overlap of the sandeel fishery in the Kattegat and the sandeel habitat in the Kattegat shows that approx. 3 % of the sandeel habitat is actually impacted by fishing. The area of the fishery is represented by polygons drawn around the VMS signals (from all vessels fishing for sandeel in Kattegat – area 6 in 2012-2014). This is not at all as precise as a swept area calculation based on the tracks, but clearly overestimates the actual area covered by the fishery.	**1**

	The area of sandeel habitat is represented by the substrate 'Sand to muddy sand' in the 'Balance' habitat database (http://balance-eu.org/), cut to the depth interval 10-30 meters (see Figure 9).  **Figure 39. Brown: 'Sand to sandy mud' in the 10-30 m depth range (Sources: www.balance-eu.org (substrate), Danish Geological Survey (depth)). Grey polygons: Sandeel fishing areas 2012-2014. Arrows: VMS pings, Sandeel fishing 2012-2014 (source: Agrifish Agency).** This is the substrate and depth range roughly corresponds to the current fishing. It is a more restrictive definition of sandeel habitat than the one used in Behrens et al. 2009 [3] where the depth range used is 0-50 m. The total area of all 'Sand to muddy sand' within the 10-30 m depth range in the Kattegat is 1117.5 sq.km, the polygons surrounding the fishery 32.6 sq.km. – thus an overlap of 2,92 %. This represents a 'precautionary' overestimate of the overlap, and thus clearly shows how limited the overlap of fishery and distribution is due to the very low quota (note that if the habitat definition of Behrens et al. 2009 leads to an area of 14 609 sq. km – which would correspond to an overlap of 0,22%). A low risk score is given for this attribute.	
Encounterability	This is the target species for the fishery, therefore the vertical overlap of the gear with sandeel distribution is likely to be high, therefore a high risk score is given for this attribute.	**3**
Selectivity of gear type	This is the target species for the fishery, therefore the selectivity of the gear for sandeel is likely to be high, and a high risk score is given for this attribute.	**3**
Post capture mortality	This is the target species for the fishery, therefore PCM is absolute, and a high risk score is given for this attribute.	**3**
Catch (weight) only where the scoring element is scored cumulatively	N/A	**n/a**
Overall PSA Score		**1.93**
MSC equivalent score		**96**

[3] Behrens et al: "Oxygen deficiency impacts on burying habitats for lesser sandeel, Ammodytes tobianus, in the inner Danish waters" Can. J. Fish. Aquat. Sci. 66: 883–895 (2009).

PI number	1.1.1-Sandeel in Area 4	
A. Productivity		
Scoring element (species)	Sandeel (*A. marinus*) in subarea 4	
Attribute	**Rationale**	**Score**
Average age at maturity.	For both males and females, average age at maturity is approximately 2.5 years (ICES 2015a), resulting in a high productivity score for this attribute.	**1**
Average maximum age	Maximum age reported for all the sandeel stocks in the North Sea assessments of 10 years (ICES 2015a), with at least 95% of the population ago 5 and younger. Thus the maximum reported age is on the edge between high and medium productivity according to the MSC PSA table, and the average maximum age is below 10. Therefore a high productivity score for this species is given. The maximum age and maximum length reported in Fishbase, taken from Muus and Nielsen (1999) are consistent with the ICES figures.	**1**
Fecundity	Reported in Fishbase to be around 25 thousand eggs per year, resulting in a high productivity score for this attribute.	**1**
Average maximum size	Maximum size for North Sea sandeel reported in ICES 2015a is less than 25cm, corresponding to a high productivity score for this attribute.	**1**
Average size at maturity	All the sandeel stocks are reported to commence maturity at around at 11cm (ICES 2015a), and most certainly on average it would be less than 40cm, resulting in a high productivity score for this attribute.	**1**
Reproductive strategy	Several studies (Wright and Bailey, 1996; Proctor et al., 1998; Jensen et al., 2001; Munk et al., 2002; Christensen et al., 2008) and in Fishbase (citing Reay 1986), sandeels are open-water broadcast spawners, resulting in a high productivity score for this attribute.	**1**
Trophic level	Trophic level reported in Fishbase based on food items is 2.7, resulting in a high productivity score for this attribute.	**1**
B. Susceptibility		
Fishery only where the scoring element is scored cumulatively	These susceptibility scores are given considering all known fishing impacts on the species.	
Attribute	**Rationale**	**Score**
Areal Overlap	There are large parts of Area 4 that are off limits to sandeel fishing (i.e. the entire UK coastal zone). In addition, the area fished in order to take the very small research TAC for this area is likely to be much smaller than the total sandeel habitat in Area 4, based on what is known about fishing behaviour in this fishery. Based on this information, and historically much higher catches when there was a commercial fishery in this area, the assessment team has judged areal overlap in Area 4 to be less than 10% of the sandeel habitat, thus a low risk score was given for this attribute.	**1**
Encounterability	This is the target species for the fishery, therefore the vertical overlap of the gear with sandeel distribution is likely to be high, therefore a high risk score is given for this attribute.	**3**
Selectivity of gear type	This is the target species for the fishery, therefore the selectivity of the gear for sandeel is likely to be high, and a high risk score is given for this attribute.	**3**
Post capture mortality	This is the target species for the fishery, therefore PCM is absolute, and a high risk score is given for this attribute.	**3**

Catch (weight) only where the scoring element is scored cumulatively	N/A	**n/a**
Overall PSA Score		**1.93**
MSC equivalent score		**96**

PI number	**1.1.1-Other sandeel species, all areas**	
A. Productivity		
Scoring element (species)	Other sandeel species: Lesser sandeel (*Ammodytes tobianus*; all areas) Corbin's sandeel (*Hyperoplus immaculatlus*; all areas) Smooth sandeel (*Gymnammodytes semisquamatus*; all areas) Greater sandeel (*Hyperoplus lanceolatus*)	
Attribute	**Rationale**	**Score**
Average age at maturity.	For both males and females, average age at maturity for *A. tobianus* is approximately 2.5 years (Fishbase). This is consistent with the maturity age for *A. marinus*, and thought therefore to be approximately the same for the other two sandeel species, resulting in a high productivity score for this attribute.	**1**
Average maximum age	Maximum age reported in Fishbase of 7 years for *A. tobianus*, therefore a high productivity score for this set of species is given, assuming a similar maximum age for the other sandeel species. Maximum age reported in Fishbase is from Reay (1973)	**1**
Fecundity	Reported in Fishbase to be around 25 thousand eggs per year for *A. marinus*. No information on fecundity is available for the other sandeel species, however it is not expected to be significantly different from *A. marinus*, resulting in a high productivity score for this attribute.	**1**
Average maximum size	Maximum size reported in Fishbase is 20cm for *A. tobianus*. This is less than that reported for *A. marinus*, and thought to be representative of the other indistinguishable sandeels as a whole, corresponding to a high productivity score for this attribute. Maximum length reported in Fishbase is from Bauchot (1987).	**1**
Average size at maturity	Reported for *A. tobianus* in Fishbase to be 11-15cm, resulting in a high productivity score for this attribute.	**1**
Reproductive strategy	Several studies (Wright and Bailey, 1996; Proctor et al., 1998; Jensen et al., 2001; Munk et al., 2002; Christensen et al., 2008) and in fishbase (citing Reay 1986), sandeels are open-water broadcast spawners, resulting in a high productivity score for this attribute	**1**
Trophic level	Trophic level reported in Fishbase based on food items is 2.7, resulting in a high productivity score for this attribute.	**1**
B. Susceptibility		
Fishery only where the scoring element is scored cumulatively	These susceptibility scores are given considering all known fishing impacts on these species.	
Attribute	**Rationale**	**Score**
Areal Overlap	Although none of these sandeel species share the identical habitat to the target *A. marinus* species, because so little is known about the actual proportion of these other sandeel species in the commercial catches, the team has decided to give a medium risk score for this attribute, in order to be precautionary. To increase the specificity of this score	**2**

	would require better information on both the habitat preferences of the minor species and the detailed distribution of fishing effort around habitat types in the area of overlap among the species.	
Encounterability	These are not the target species for the fishery, but, as the target species is also a virtually indistinguishable sandeel, the vertical overlap of the gear with sandeel distribution is likely to be high, therefore a high risk score is given for this attribute.	**3**
Selectivity of gear type	These are not the target species for the fishery, but, as the target species is also a virtually indistinguishable sandeel, the selectivity of the gear for sandeel is likely to be high, and a high risk score is given for this attribute.	**3**
Post capture mortality	These are not the target species for the fishery, however any minor sandeel species that are caught during fishing for *A. marinus* are not released, therefore PCM is absolute, and a high risk score is given for this attribute.	**3**
Catch (weight) only where the scoring element is scored cumulatively	N/A	**n/a**
Overall PSA Score		**2.53**
MSC equivalent score		**83**

Appendix 1.2.3. Combined RBF score

Table 1.2.3.a Final MSC score derived from the CA and PSA scores for each sandeel scoring element.

Species type	Fishery descriptor	MSC PSA-derived score	Risk Category Name	MSC scoring guidepost	Consequence Score (CA)	Final MSC score (per scoring element)
Non-invertebrate	Sandeel area 4	96	Low	≥80	100	98
Non-invertebrate	Sandeel area 6	96	Low	≥80	80	88
Non-invertebrate	sandeel other species	61	Med	60-79	60	61

Appendix 1.3 Conditions

(REQUIRED FOR ALL REPORTS WHERE CONDITIONS ARE NEEDED FOR CERTIFICATION)

Condition 1

Performance Indicator	**1.1.1 (sandeel areas 1-3)** **b. The stock is at or fluctuating around its target reference point.**
Score	70
Rationale	Unit 1 – the SSB has been fluctuating around the B_{lim} for this unit since 2000, with SSB below B_{lim} for eight of the 16 years (ICES 2015a Table 11.2.9 and Figure 11.2.10 – middle panel.). It has only been above B_{pa}, which functions in the scientific advice as if it were a management target, for four of those years. So that although the stock is presently between its B_{lim} and its B_{pa}, it has been fluctuating below its target reference point for most of the past 15 years. Hence SG 80 is not quite met, Unit 2 – The SSB the SSB has been fluctuating between B_{lim} and B_{pa} for this unit since 2000. SSB has been below B_{lim} for only four of the 16 years, but It has only been above B_{pa}, which functions in the scientific advice as if it were a management target, for four of those years as well (ICES 2015a Table 11.3.8 and Figure 11.3.10 – middle panel.). . So that although the stock is presently nearly at its B_{pa}, it has been fluctuating below its target reference point for most of the past 15 years. Hence SG 80 is not quite met. Unit 3 – the SSB has been fluctuating around or below the B_{lim} for this unit since 2000, with SSB below B_{lim} for 11 of the 16 years (ICES 2015a Table 11.4.9 and Figure 11.4.10 – middle panel.). It has only been above B_{pa}, which functions in the scientific advice as if it were a management target, for three of those years. So that although the stock is presently above its B_{pa}, due to recruitment of a very strong year-class, it has been fluctuating well below its target reference point for most of the past 15 years. However, since 2009, SSB has been above B_{pa} for 3 of the 6 years, and below B_{lim} for only two of them. Hence for the more recent period the stock has been fluctuating around B_{pa}. With the addition of an F_{cap} to the de facto harvest strategy (see 1.2.1) and an apparent modest improvement in recruitment in the 2010's, the more recent period may be more indicative of present stock dynamics and population development.
Condition	By the 4th annual audit, the management system must provide evidence that *A. marinus* stocks are at or fluctuating around target reference point for areas 1, 2, and 3.
Milestones	At the first annual surveillance, provide a plan increase abundance of stocks in Areas 1, 2, and 3 , recognizing that environmental factors may be as or more important than fishing effort in driving abundance. At the second annual surveillance, provide evidence that the plan has gone into effect and that fishing effort is consistent with opportunity for increasing stock abundance. At the third annual surveillance, provide evidence that abundance has begun to increase. At the fourth annual surveillance, provide evidence that the stocks are at or fluctuating around the target reference point. At this point, the performance indicator will re-score to at least 80.
Client action plan	The fishery will work towards formulating and implementing Management plans wherein reference points are formulated for all relevant industrial stocks, there among sandeel (see condition 3 for further information).

	It should also be noted that new reference points (Blim, Bescapement and Fcap) have been selected at the 2016 benchmark and the application of these has to be evaluated during the next couple of years <u>Year 1 (see also condition 3).</u> ICES will host a WS on management of small pelagics with special focus on the escapement strategy. The industry will participate in this. <u>Year 2 (see also condition 3.</u> <u>Year 3 (see also condition 3)</u> At the end of year 2 it will be evaluated if there are indication on that the objective of fluctuating or being above Bescapement has been meet. <u>Year 4 (see also condition 3)</u> Evidence the stock is fluctuating around its target reference point will be provided.
Consultation on condition	ICES will hold a WS where reference points and management strategy used will be evaluated. The annual ICES advice provides annual assessment of the state of the stock (traffic lights). The color of these will provide arguments to determine if the new (2016) reference points in combination with the new assessment settings are more appropriate than those used earlier.

Condition 2

Performance Indicator	**1.1.1 (other sandeel species)**		
Score	70		
Rationale	**Fishery only where the scoring element is scored cumulatively**	These susceptibility scores are given considering all known fishing impacts on these species.	
	Attribute	**Rationale**	**Score**
	Areal Overlap	Although none of these sandeel species share the identical habitat to the target *A. marinus* species, because so little is known about the actual proportion of these other sandeel species in the commercial catches, the team has decided to give a high risk score for this attribute, in order to be precautionary. To increase the specificity of this score would require better information on both the habitat preferences of the minor species and the detailed distribution of fishing effort around habitat types in the area of overlap among the species.	**3**
	Encounterability	These are not the target species for the fishery, but, as the target species is also a virtually indistinguishable sandeel, the vertical overlap of the gear with sandeel distribution is likely to be high, therefore a high risk score is given for this attribute.	**3**
	Selectivity of gear type	These are not the target species for the fishery, but, as the target species is also a virtually indistinguishable sandeel, the selectivity of the gear for sandeel is likely to be high, and a high risk score is given for this attribute.	**3**

	Post capture mortality	These are not the target species for the fishery, however any minor sandeel species that are caught during fishing for *A. marinus* are not released, therefore PCM is absolute, and a high risk score is given for this attribute.	**3**
	Catch (weight) only where the scoring element is scored cumulatively	N/A	**n/a**
	As the proportions of other species in the catch are not know, additional information on the proportions may determine that some other species each make up < 2% of the catch, in which case those species could qualify for IPI species. Alternatively, implementing management measures could reduce the susceptibility of other sandeel species enough to raise the RBF-derived score for those species to 80 or higher.		
Condition	By the 4th annual audit, information on 'other sandeel species' must either be sufficient to determine that this fishery is catching only negligible amounts of those species (less than 2% of the total catch) so they may be considered as IPI stocks; or information must be sufficient to determine that, within the RBF framework, susceptibility of other sandeel species to this fishery is low enough to raise the RBF-derived MSC score for these species to greater than 80.		
Milestones	At the first annual surveillance, provide a plan to collect the necessary information on other sandeel species to achieve the condition. At the second annual surveillance, provide evidence that the plan has gone into effect, and has identified steps to determine the proportion of each species in the catch (relative to IPI) and or steps to determine management measure that will adjust fishing activities to increase PSA scores. At the third annual surveillance, report progress on implementation of the plan. At the fourth annual surveillance, provide evidence that the stocks are at or fluctuating around the target reference point, or that the stocks are IPI and do not require status determination. At this point, the performance indicator will re-score to at least 80.		
Client action plan	The challenge is that at present there is no easy way to distinguish between lesser sandeel (Ammodytes marinus) and small sandeel (Ammodytes tobianus). The fishery organisation is together with DTU Aqua involved in genetic projects aiming at developing easy methods to identify sandeel spp. to species. The fishery will tackle this issue on two levels. First, the fished proportion of the habitat of non-target sandeel will be evaluated. Second the fraction of non-Ammodytes marinus species in the catches will be evaluated, however as noted before this is a challenge when it comes to distinguishing *Ammodytes marinus* from *Ammodytes tobianus*. <u>Year 1.</u> The area of each by catch species habitat subject to fishing will be estimated and for Ammodytes tobianus it might be necessary to look at indirect indications of habitat such as depth distribution, temperature preference etc. If the genetic methods is assessed not to be available at the latest for use in year 3, the industry will together with DTU Aqua initiated a project to finalize the development of genetic methods to distinguish between Ammodytes tobianus and Ammodytes marinus.		

	Year 2. For those species that can be easily identified the fraction the bycatch constitute of the total catch will be estimated, directly. For Ammodytes tobianus it might be necessary to develop habitat maps based upon e.g. depth preferences. Year 3 Samples from catches, perhaps as part of a self sampling program, will be evaluated using genetic methods. Year 4. Based upon data collected in year 3, the fraction of Ammodytes tobianus in the catches will be evaluated, and depending on the observed levels it will either be an IPI, or the geographical overlap of the fishery with tobianus habitat will be shown to be low enough to conclude using the RBF methods that the impact of the fishery is consistent with the MSC principles.
Consultation on condition	Since this part is purely biology the work is done and will continue to be done within a close collaboration with DTU Aqua.

Condition 3

Performance Indicator	**1.2.2 (sandeel areas 1-3) a. Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.**
Score	75
Rationale	The harvest strategy that is used by ICES in provision of scientific advice, and is de facto applied by the management authority of the fishery lends itself well to application of specific harvest control rules. ICES has used area-specific values for $B_{escapement}$ for nearly two decades, set at a value that was B_{pa} rather than B_{lim} (ICES 2010). ICES is exploring area-specific values for F_{cap}, now that it has been recommended as part of the harvest strategy. These biomass values serve de facto as management targets (see 1.1.b) for each area. As SSB approaches the $B_{escapement}$ value, advice on harvests already recommends that harvests be reduced, so exploitation rate is reduced even before the target is reached, and advice is to stop harvests once the stock is below the target $B_{escapement}$ (ICES 2014). Management decisions have generally been consistent with the science advice. Nevertheless in all three areas there have been non-zero quotas in some years when SSB was below $B_{escapement}$, and even below B_{lim}. This resulted in F's above 0.1 and even as high or higher than 0.4 on some ages in some years when SSB was below in B_{lim}, and often F's of between 0.15 and 0.4 on some ages when SSB was below $B_{escapement}$. However, if there were a sequence of three or more years of poor recruitment, F's did fall to below 0.05 (ICES 2015, Tables 11.2.7, 11.3.6 and 11.4.5).This pattern indicates that an initial poor recruitment might not be picked up by management in the year that it occurred. However, if poor recruitments came in sequence, then as B_{lim} was reached fisheries were closed. Consequently, in practice the management is reducing exploitation as the limit is approached. This means that SG 60 is reached for all three areas. The harvest control rules are being applied for all three stocks in the science advice and in the management decisions on quotas (ICES 2015). The management authority has not adopted the reference points and harvest strategy in any formal way, nor prepared management plans

	for the fishery that contain the rules. Consequently there is no assurance that in future harvest rate will continue to be reduced as SSB approaches $B_{escapement}$ and reach zero by the time SSB passes B_{lim}. As this control rule has not been adopted by the management authority, it cannot be concluded that "well defined harvest control rules *are in place*". It appears that such rules are being applied in practice, but with no objectives, reference points and harvest control rules formally adopted, at best "generic rules" may be in place. The results of the annual stock assessments (ICES 2014b, 2015), and specifically the estimates of fishing mortality in those assessments (ICES 2015, Tables 11.2.7, 11.3.6 and 11.4.5) factored into the scoring decision for this scoring issue. Those tables clearly show that in the short term the rules are not achieving the exploitation rates required by the de facto harvest control rules. In some years when the stock is below even B_{lim}, and certainly below $B_{escapement}$, (ICES 2015, Tables 11.2.7, 11.3.6 and 11.4.5) fishing mortality on some ages are above zero by amounts too large be overlooked as assessment uncertainty or only small oversights or error in management. Illustrations are available from all three main stock areas, using F from the first half of the year: for example: Area Year SSB $B_{escapement}$ B_{lim} Age F 1 2006 145Kt 215 Kt 160Kt 1 0.436 2 2013 76Kt 100 Kt 70Kt 2 0.119 3 2013 49Kt 195 Kt 100Kt 1 0.301 Examining the time series of F's, performance of management appears to be improving the ability to reduce F when SSB declines below $B_{escapement}$. Hence the SG 80 guidepost is met in terms of technical quality but it does not appear that the management actions have well defined harvest control rules or that the rules are in place. The fishery meets the SG 60, but not the SG80. For areas 4 and 6 the harvest control rule is simply that catches should not exceed a highly precautionary TAC until there is sufficient information to conduct an analytical assessment to establish if a higher catch level is sustainable. Thus the harvest control rule is clearly defined, and although the HCR does not reduce catch as a defined Limit Reference Point is approached, the intent of keeping harvests at a very low level, to protect the stock in times of weak recruitment, is achieved under this HCR.
Condition	By the fourth annual audit, well defined harvest control rules must be in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached for sandeel areas 1-3.
Milestones	At the first annual surveillance, provide a plan to assure that the tools in use are appropriate and effective. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that the tools are appropriate and effective in achieving the exploitation levels required under the harvest control rules. At this point the performance indicator will re-score at least to SG80.

Client action plan	The fishery will work towards formulating and implementing Management plans wherein HCR's are formulated for all relevant industrial stocks, there among sandeel. Such plans can either be developed species by species, for the entire industrial fishery complex or as part of the multi-species management plans for the North Sea, like the plan developed and implemented in the Baltic. Further it should be brought to attention that the reference points have been change at the last sandeel benchmark in 2016. The applicability of these reference points must be evaluated using the latest assessment methods. <u>Year 1.</u> The industry will decide on whether the management plan can be formulated and implemented, species by species, for the entire industrial fishery complex, or if the needed management rules can be embedded in a multispecies management plan covering industrial and pelagic species in the North Sea. <u>Year 2.</u> The plan will be developed and relevant management rules and HCR will be formulated. <u>Year 3</u> The plan will be implemented. <u>Year 4</u> The plan will be evaluated considering the new reference points, and evidence will be provided that the explicit harvest control rules are consistent with the harvest strategy.
Consultation on condition	DG MARE did host a scoping workshop on a possible plan for small pelagic and industrial species in the North Sea the 7 to 8 November 2016, in Brussels. The content of such a plan is not yet formulated but during 2017 it is the ambition that the content of such a plan has been decided on. The industry will actively contribute to this process. The clients are also partners in an EMFF project with DTU Aqua specifically looking at developing a management plan for sandeel and sprat, potentially as a combined plan. The project is scheduled to be completed in the end of 2018 or the beginning of 2019 (before surveillance audit 2). If DG MARE moves ahead with their initiative, it is the ambition to lift the outcome of the EMFF project into that process.

Condition 4

Performance Indicator	**1.2.2 (Norway pout) a. Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached**
Score	75
Rationale	The harvest control rules explored by ICES in the benchmark assessment meetings are well defined (ICES 2012). The scientific advice and management decisions by the management authority are consistent with the application of $B_{escapement}$ as a harvest control rule – that is, ensuring that after harvests and estimated of natural mortality are removed from the stock, remaining spawning biomass is above 150,000 t. However this control rule has not been adopted by the management authority, so it cannot be concluded that "well defined harvest control rules *are in place*". It appears that such rules are being applied in

	practice, but with no objectives, reference points and harvest control rules formally adopted, at best "generic rules" may be in place. Hence the SG 80 guidepost is met in terms of technical quality but it does not appear that the management actions have well defined harvest control rules or that the rules are in place. The fishery meets the SG 60, but not the SG80.
Condition	By the 4th annual audit, there must be well defined harvest control rules in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
Milestones	At the first annual surveillance, provide a plan to assure that well defined harvest control rules are in place. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that well defined harvest control rules are in place. At this point the performance indicator will re-score at least to SG80.
Client action plan	The fishery will work towards formulating and implementing Management plans wherein HCR's are formulated. Such plans can either be developed species by species, for the entire industrial fishery complex or as part of the multi-species management plans for the North Sea, like the plan developed and implemented in the Baltic. Further it should be brought to attention that the reference points have been change at the last Norway pout benchmark in 2016, as has the forecast method (from a deterministic to a stochastic). The applicability of these reference points and the new forecast method must be evaluated using the latest assessment methods. <u>Year 1.</u> The industry will, if possible, participate in the planned Workshop between EU and Norway aiming at developing a common management plan. <u>Year 2.</u> The plan will be developed and relevant management rules and HCR will be formulated. <u>Year 3</u> The plan will be implemented. <u>Year 4</u> The plan will be evaluated, and evidence will be provided that the explicit harvest control rules are consistent with the harvest strategy.
Consultation on condition	DG MARE has already held a scoping workshop on a possible plan for small pelagic and industrial species in the North Sea the 7 to 8 November 2016, in Brussels. The content of such a plan is not yet formulated but during 2017 it is the ambition that the content of such a plan has been decided on. The industry will actively contribute to this process. In addition, because of Norway pout is a shared stock, the EU and Norway have recently agreed on holding consultations and hosting a workshop in spring 2017 aiming at developing and agreeing upon a common management plan for Norway pout (see the Agreed records of the Fisheries Consultations between Norway and the European Union for 2017, item 6.6.4).

Condition 5

Performance Indicator	**1.2.2 (sprat) a. Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.**
Score	75
Rationale	Well-defined harvest control rules were explored by ICES in the MSY benchmark meeting (ICES 2014b). The scientific advice on North Sea sprat is formulated using a harvest control that performed well in the simulations, including a de facto $B_{escapement}$ of 150,000 t and a de facto F_{cap} of 0.7, The control rules set TACs where total fishing removals from July of year X to June of year X+1 do not reduce the SSB below the $B_{escapement}$, and for large SSBs, if TACs produced by application of the escapement rule would result in an F greater than 0.7, then the TAC is no larger than harvest resulting from fishing at F=0.7, Management decisions by the management authority over the past 15 years have been consistent with the application of $B_{escapement}$ as a harvest control rule. The F cap is a new feature in the ICES advice, but has been used in developing the advice on the 2015 TAC, given the exceptionally strong year-class recruiting to the stock (Table 8.9.2 ICES 2015), and the management decision is consistent with the advice. Although this control rule has not been adopted by the management authority, it has been applied in practice for the last several years. Consequently it can be concluded that "well defined harvest control rules are in place", but only at present. Such rules are being applied in practice, but with no objectives, reference points and harvest control rules formally adopted, only "generic rules" are be in place with certainty. Hence the SG 80 guidepost is met in terms of technical quality but it does not appear that the management actions have well defined harvest control rules or that the rules are in place. The fishery meets the SG 60, but not the SG80.
Condition	By the 4th annual audit, there must be well defined harvest control rules in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
Milestones	At the first annual surveillance, provide a plan to assure that well defined harvest control rules are in place. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that well defined harvest control rules are in place. At this point the performance indicator will re-score at least to SG80.
Client action plan	The fishery will work towards formulating and implementing Management plans wherein HCR's are formulated for all relevant industrial stocks, there among sprat. Such plans can either be developed species by species, for the entire industrial fishery complex or as part of the multi-species management plans for the North Sea, like the plan developed and implemented in the Baltic. Year 1. The industry will decide on whether the management plan can be formulated and implemented, species by species, for the entire industrial fishery complex, or if the needed management rules can be embedded in a multispecies management plan covering industrial and pelagic species in the North Sea. Year 2.

	The plan will be developed and relevant management rules and HCR will be formulated. Year 3 The plan will be implemented. Year 4 The plan will be evaluated, and evidence will be provided that the explicit harvest control rules are consistent with the harvest strategy
Consultation on condition	DG MARE has already held a scoping workshop on a possible plan for small pelagic and industrial species in the North Sea the 7 to 8 November 2016, in Brussels. The content of such a plan is not yet formulated but during 2017 it is the ambition that the content of such a plan has been decided on. The industry will actively contribute to this process. The clients are also partners in an EMFF project with DTU aqua specifically looking at developing a management plan for sandeel and sprat, potentially as a combined plan. The project is scheduled to be completed in the end of 2018 or the beginning of 2019 (before surveillance audit 2). If DG MARE moves ahead with their initiative, it is the ambition to lift the outcome of the EMFF project into that process.

Condition 6

Performance Indicator	**2.2.3 (sprat and Norway pout) a. Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery**
Score	75
Rationale	The catch is sucked directly from the nets into the hull. Sorting devices are not allowed on board, and non-compliance is easy to spot. The operations are typically large, so hand-sorting is not an option. Consequently, discarding of a partial catch is not an issue. Slipping an entire catch is the only way to discard an unwanted catch. Herring acts as a choke species in the sprat and Norway pout fisheries, which could create an incentive to slip. Earlier, there was a catch-composition rule that one landing could contain no more than 50% herring in the Norway pout fishery or 20% in the sprat fishery. Therefore, at least in the sprat fishery, discarding (slippage) occurred but was not quantified (ICES 2015b). There is a closely monitored experimental sprat fishery in the German Bight. The fishery is monitored with tests of catch composition for each haul, though there are no onboard observers. The experimental fishery started in 2013 and is still ongoing. Slippage has, however, not been explicitly evaluated in the area (Lotte Worsøe, DTU Aqua, pers. comm.). Quantitative information about slippage in the sprat and Norway pout fisheries is therefore not available.
Condition	By the 4th annual audit there must be qualitative information and some quantitative information available on the amount of main bycatch species (herring) taken by the sprat and Norway pout fisheries.
Milestones	At the first annual surveillance, provide a plan to assure that some quantitative information is available on the amount of main bycatch species taken by the fishery, focussing of slippage of herring. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that quantitative information is available on the amount of main bycatch species taken by the fishery, focussing of slippage of herring. At this point the performance indicator will re-score at least to SG80.

Client action plan	Because of the landing obligation slipping is nowadays prohibited in the industrial and pelagic fishery. Prior to the implementation of the landing obligation, slipping was in certain cases, where the catch-composition rule could not be followed, obligatory. This change is acknowledged by the clients. That slipping is no longer legal implies that monitoring slipping by other means than through information collected by the control agency, must be considered unrealistic. Year 1: The relevant CoC will be amended such that the slipping prohibition is specifically mentioned. In addition the uptake of the herring bycatch % will be analyzed and presented to provide evidence that there are no incentives to slip catches. Year 2-4: The annual control agency report will provide the basis for evaluating to what extend slipping takes place. In addition the uptake of the herring bycatch % will be analyzed and presented to provide evidence that there are no incentives to slip catches.
Consultation on condition	The control agency carries out control of fishing operations.

Condition 7

Performance Indicator	**2.4.1 (Norway pout for bottom gear) a. The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm**
Score	70
Rationale	The gears are bottom-touching otter trawl. The impact of the trawl on the bottom comes from the doors, from the middle-weight (when used), and from the ground rope. The doors and the weight produce trawl tracks on the bottom, while the rope interacts with organisms on the bottom and possibly produce a cloud of mud. The targeted species are fish are living off (not on) the sea bed (sandeel are not targeted by the fishery while they are buried in the sand). The fishery therefore does not need to scrape the fish off the bottom (such as in nephrops fishery) so there is little incentive for the fishery to interact strongly with the bottom, as it will only result in increased fuel costs. Consequently, gear riggings do not use any kind of tickling chains or bobbins on the footrope of the trawl, as is used in e.g. the plaice fishery. *Muddy bottom.* The Norway pout fishery is conducted on the Fladen Ground, a large plain of fine mud, at water depths ranging from 15–200 m or more, designated by OSPAR as “burrowed mud”. This habitat is considered “sensitive” to mechanical disturbance (OSPAR 2010c). Further, there are registered widespread occurrences of sea pens over the entire area. Even though the habitat is sensitive, the impact of the gear is limited, and it is likely that most sea pen species are not seriously impacted. Fishing is also conducted within Central Fladen where the particular sensitive tall sea pens are found. An MPA is being considered for the area. Even though the fishery is unlikely to cause serious harm on the Fladen Ground, there is no direct evidence that this is the case, and the current fishery cannot be said to be “highly unlikely” to cause serious harm. SG60.
Condition	By the 4th annual audit, the client must be able to demonstrate that the fishery is unlikely to cause serious or irreversible harm to sensitive habitats, particularly the muddy Fladen ground habitat.

Milestones	At the first annual surveillance, provide a plan to assure that the fishery is highly unlikely to reduce habitat structure and function with focus on the muddy Fladen Ground. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that the fishery is highly unlikely to reduce habitat structure and function with focus on the muddy Fladen Ground. At this point the performance indicator will re-score at least to SG80.
Client action plan	The DFPO and DPPO are active participants in the spatial management of the North Sea – including MPA designations and the development of management measures within MPAs. We have already contributed specifically to the Central Fladen Ground consultation process through the NSAC. The latest estimate from the Scottish Authorities is that the proposed measures for this area will come into force during 2017. Year 1 The clients will provide evidence that either: - The sensitive parts of Central Fladen Ground (containing the Tall Seapen) have been closed to all bottom trawling, or - The clients have drafted a plan for fishery-specific measures to ensure that the fishery does not impact the sensitive parts of the Fladen Grounds - Year 2 and onwards The clients will provide evidence that either: - The sensitive parts of Central Fladen Ground (containing the Tall Seapen) have been closed to all bottom trawling, or - The fishery-specific plan has entered into force, ensuring that the fishery does not impact the sensitive parts of the Fladen Grounds.
Consultation on condition	Measures to protect the sensitive parts of the Central Fladen Ground are already being moved forward by the Scottish marine authorities.

Condition 8.

Performance Indicator	**2.4.2 b. There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved**
Score	75
Rationale	MPAs will provide refuge for particular sensitive habitats, such as the tall sea pen on the proposed Central Fladen MPA. Further, the MPAs will acts are a recruitment reserve for adjacent areas. The establishment of MPAs are therefore a relevant mitigation measure for trawl impact, both for reduction of direct impact and for recovery of impacted areas. As all fishing operations are registered with VMS, enforcement of MPAs is easy, so there is high incentive for fishers to avoid fishing in MPAs. Even though the MPAs are highly likely to work, they have not been implemented. Until MPA with management measures specifically designed for the protection of the habitats are implemented, there is no objective basis for confidence that the partial strategy will work. Management measures need to be implemented in vulnerable areas, and should include the ability to modify fishing practices in the light of monitoring results, in order to achieve confidence in its effectiveness.
Condition	By the fourth annual surveillance audit, there must be some objective basis for confidence that the partial strategy for achieving the habitat outcome level of 80 or above will work, based on information directly about the fishery and/or habitats involved.

Milestones	At the first annual surveillance, provide a plan to assure that there is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved, with a focus on implementing planned MPAs and evaluating their efficacy. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that there is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved, with a focus on implementing planned MPAs and evaluating their efficacy. At this point the performance indicator will re-score at least to SG80.
Client action plan	The DFPO and DPPO are active participants in the spatial management of the North Sea – including MPA designations and the development of management measures within MPAs. We have already contributed to several proposed MPAs in the North Sea through the NSAC (particularly the joint English/Dutch/German designation on the Dogger Bank). While the some of these MPAs contain specific features (such as boulder reefs or aggregations of tall seapens) sensitive to bottom trawling, others are designated for features such as sandbanks, where it is more difficult to point to any particular parts that would be vulnerable to trawling. <u>Year 1</u> The clients will provide evidence of the process of implementing management measures in designated MPAs in the North Sea and Skagerrak, as well as the continued contribution of the clients to these processes. The clients will present a plan to ensure that the fishery does not impact mapped sensitive areas within the designated MPAs – including fishery specific measures as necessary to compliment/precede official closures. <u>Year 2 and onwards</u> The clients will provide evidence of the process of implementing management measures in designated MPAs in the North Sea and Skagerrak, as well as the continued contribution of the clients to these processes. The clients will present evidence of the implementation of the measures in the fishery-specific plan.
Consultation on condition	Measures to protect sensitive parts of designated Natura2000 sites are already being proposed by Member States (and are mandatory under EU law).

Condition 9

Performance Indicator	**2.4.3 Bottom touching gear. c. Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures)**
Score	75
Rationale	VMS data are continuously collected from the fishery and the distribution of effort can be monitored from this. *Sand and muddy bottoms:* European research into impacts of fishing gear on benthic communities and seabed habitats is ongoing, with greater levels of research associated with the marine protected area designations being considered for the fisheries in question (Dogger bank for sandeel and Central Fladen for the Norway pout fishery). This will be required to continue into the future under the Habitats Directive and under

	commitments to OSPAR. However, the monitoring is not systematic and does not ensure that changes in habitat distributions over time are captured. The fishery report impact with benthic organisms through Code-of-Conduct logging. It is surprising that no impacts with benthic organisms are recorded, in particular for the Norway pout fishery, which occur in an area with recordings of sea pens. The fishery needs to build confidence in the CoC logging and provide information about encounters to increase the detail of knowledge on the distribution of vulnerable habitats. Maps of the fishery based on VMS data have been made available. However, the frequency of disturbance on a given area are unavailable. Thus, it is not possible to estimate the time that a habitat is allowed to recover between trawl impacts from the fishery. Further, not only the impact from the reduction fishery matters for the habitat; the cumulative impacts of all fisheries on the habitats needs to be collated and assessed. These concerns are relevant for both habitat types.
Condition	By the fourth annual surveillance audit sufficient data must continue to be collected to detect any increase in risk to habitat types affected by this fishery.
Milestones	At the first annual surveillance, provide a plan to assure that sufficient data continue to be collected to detect any increase in risk to habitat. At the second and third annual surveillance, provide an update on the progress against the plan. At the fourth annual surveillance, provide evidence that sufficient data exist to detect any increase in risk to habitat. At this point the performance indicator will re-score at least to SG80.
Client action plan	Year 1 and onwards The clients will provide VMS overlays on habitat maps as evidence of continued monitoring of the impact of the fishery on habitat types. In addition, the Codes of Conduct require vessels to register all catches of benthic organisms that could indicate sensitive habitats (such as sponges, sea pens etc.). Records of interaction will be collated and reported at each audit.
Consultation on condition	N/A

Condition 10

Performance Indicator	**3.2.1**
Score	70
Rationale	The EU Common Fishery Policy has general objectives related to maintaining stocks at or above B_{msy} and not exploiting stocks at levels above F_{msy}. However these general objectives have not been translated into adopting any specific reference points for this stock, nor formal harvest control rules to keep harvests within the general bounds set by the CFP. At an operational level short-term objectives are represented by annual TACs. Achievement against these annual targets is monitored at national level by Denmark for all three target species. The ICES ACFM presents advice on stock management based on its current understanding of the state of stocks. It also advises on what TACs should be set for the coming year for those stocks that it has been requested to advise on – taking into consideration its knowledge of the stocks and any decision-control rules that have been adopted for these stocks.

	Regarding impact on ecosystem (Principle 2), the management system takes into account ecosystem effects. TAC setting is based on recommendations from stock assessments that already account for predation pressure on key prey species such as these by using Multi-Species Virtual Population Analysis (MSVPA) estimates of natural mortality (ICES 2015f). In addition, the CFP has also environmental objectives with specific such as the reduction of unwanted catches with the Landings Obligation (in place since 2015 for pelagic fisheries), the protection of species and habitats through different Directives, but also through the EU Marine Strategy Directive (Directive 2008/56/EC) that commits Members States to further foster the integration of environmental concerns into other relevant policies, such as the CFP, in order to achieve 'good environmental status' in the marine environment. The short- and long-term management objectives are therefore consistent with achieving the outcomes expressed by MSC's Principle 1 and 2 but due to an absence of explicit long-term management plans for any of the three target species under assessment, the long-term objectives are not entirely explicit in the fisheries management system, and therefore SG80 is only partially met.
Condition	By the fourth annual audit, short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, must be explicit within the fishery-specific management systems for sandeel, sprat, and Norway pout.
Milestones	At the first annual surveillance, provide a plan to ensure short- and long-term objectives are made explicit within the fishery-specific management systems within the timeframe of the current certification. At the second annual surveillance, provide an update on progress against the plan and present any modifications if needed. At the third annual surveillance, provide another progress update. At the fourth annual surveillance, provide evidence that short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, must be explicit within the fishery-specific management systems for sandeel, sprat, and Norway pout.
Client action plan	See conditions 3, 4 and 5
Consultation on condition	See conditions 3, 4 and 5

Condition 11

Performance Indicator	**2.5.2, SId (sprat)**
Score	75
Rationale	M2s are continuously calculated (on a tri-annual basis) and used in single species management, incl. Fmsy calculations (ICES 2014). For the sandeel and Norway pout fisheries, this constitutes evidence that the measures are being implemented, since TACs have been set following scientific advice. For sprat, however, the situation is not as clear. Since the latest sprat benchmark held in February 2013, the advice year has been changed such that it now runs from 1. July to 31. June the following year. The calendar for the advice-to-TAC cycle has however not been changed. This has meant that the advice comes out the day before the advice year (30. June), but the TAC year has remained the calendar year. For two of

	the years, this has led to in-season revisions of the TAC (as new advice came out with very different results). This meant an increase in the TAC in 2015 and a decrease in 2016. This makes it somewhat difficult to compare advice and TACs directly to see if advice has indeed been heeded, and also difficult to ensure that the TACs are in line with advice for the entire year. In some years since 2013 TAC has ultimately been set above ICES advice because of this mismatch (ICES 2016). Therefore SG80 is not reached for sprat because the M2 strategy for protecting dependant predators relies on adherence to scientific advice for TAC setting (for sandeel and Norway pout TACs are set at or below ICES advice). Therefore for sprat, it is not possible to say that measures are being implemented successfully. However, it is worth noting that from now on, this calendar mismatch issue has been resolved because ICES advice will come out in April from now on, allowing the TAC to be adjusted before the season starts. However it remains to be seen if this alone will resolve the issue.
Condition	By the fourth annual audit, there must be some evidence that measures comprising the partial strategy to ensure the sprat fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function, are being implemented successfully.
Milestones	At the first annual surveillance, provide a plan to provide evidence of successful implementation of a partial strategy as described in the condition, within the timeframe of the current certification. At the second annual surveillance, provide an update on progress against the plan and present any modifications if needed. At the third annual surveillance, provide another progress update. At the fourth annual surveillance, provide some evidence that measures comprising the partial strategy to ensure the sprat fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function, are being implemented successfully. Note, although the action plan below results in a full LTMP, this is not required to fulfill this condition, so concomitant with the action plan laid out above, the adherence to scientific advice in TAC setting for sprat, and adherence to the agreed TAC by the fleet, will be monitored in light of the advice calendar year shift. If there is evidence that TACs are consistently being set in line with advice going forward, this condition may be closed before the LTMP is implemented.
Client action plan	The fishery will work towards formulating and implementing Management plans wherein HCR's are formulated for all relevant industrial stocks, there among sprat. Such plans can either be developed species by species, for the entire industrial fishery complex or as part of the multi-species management plans for the North Sea, like the plan developed and implemented in the Baltic. <u>Year 1.</u> The industry will decide on whether the management plan can be formulated and implemented, species by species, for the entire industrial fishery complex, or if the needed management rules can be embedded in a multispecies management plan covering industrial and pelagic species in the North Sea. <u>Year 2.</u> The plan will be developed and relevant management rules and HCR will be formulated. <u>Year 3</u>

	The plan will be implemented. <u>Year 4</u> The plan will be evaluated, and evidence will be provided that the explicit harvest control rules are consistent with the harvest strategy, which will also provide some evidence that measures comprising the partial strategy to ensure the sprat fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function, are being implemented successfully. As noted by the CAB under 'milestones,' a full LTMP is not required to fulfill this condition, so concomitant with the action plan laid out above, the adherence to scientific advice in TAC setting for sprat, and adherence to the agreed TAC by the fleet, will be monitored in light of the advice calendar year shift. If there is evidence that TACs are consistently being set in line with advice going forward, this condition may be closed before the LTMP is implemented.
Consultation on condition	DG MARE has already held a scoping workshop on a possible plan for small pelagic and industrial species in the North Sea the 7 to 8 November 2016, in Brussels. The content of such a plan is not yet formulated but during 2017 it is the ambition that the content of such a plan has been decided on. The industry will actively contribute to this process. The clients are also partners in an EMFF project with DTU aqua specifically looking at developing a management plan for sandeel and sprat, potentially as a combined plan. The project is scheduled to be completed in the end of 2018 or the beginning of 2019 (before surveillance audit 2). If DG MARE moves ahead with their initiative, it is the ambition to lift the outcome of the EMFF project into that process.

Appendix 2 Peer Review Reports

Peer Review 1

Summary of Peer Reviewer Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**No**	**CAB Response**
Justification: There are three main problems with this assessment report. First, there is too much technical information presented as background to Principle 1 that is superfluous and not used in scoring, which I think has led the Team to make some wrong judgments. These are highlighted below. Second, there is at least one more year of ICES advice available for the three target species, which for both sandeel and sprat changes the perception of stock status and adequacy of management. Third, the definitions of Units of Assessment are not clear, there is one P1 score for 7 sandeel stocks (scored separately and subject to different conditions), and the gears used are not always distinguished in scoring Principle 2, thus not picking up the different impacts on non-target species and habitats. Harmonisation with other MSC assessed fisheries using similar gear in the same sea area would help where evidence is lacking. Despite these shortcomings, the overall Principle level scores might not change too much.		With response to "too much technical detail", the extra technical detail was made necessary by the incompatibility between the ICES new Fmsy framework and the MSC Certification scoring criteria. It was necessary to explain a) where the reference points came from; b) what functions the reference points were intended to serve when ICES made the estimates in the late 1990s and early 1980s, c) what state the stock is relative to those reference points (and its recent trajectory), d) how that relationship of stock status to reference points is being used (or not) in actual management, and e) how b, c , and d related to the MSC scoring guidelines. If the ICES framework were directly compatible with the MSC standards, it would only be necessary to do a, c and a bit of e. b and d and some of e would indeed be unnecessary. But because the two frameworks do NOT map directly onto each other, a lot of technical information is indeed necessary. Reviewer 2 is aware of the discrepancy, did not consider the detail to be superfluous, and indeed conjectured that a couple of P1 scores might possibly be too high. Pertaining to the lack of clarity in Units of Assessment, we have attempted to make this clearer throughout, particularly in Principle 2. What we have done is to use a 'scoring elements' approach for sandeel substocks in P1, and the retained species, ETP species and habitat types in P2. While it would have been possible to separate out the fisheries in P2 by gear type and/or target species, this would have resulted in a lot of duplication and very little difference in the way of results (none of which would have been more conservative—hence our approach was precautionary). There are further details in the responses to the P2 reviewer comments. Regarding currency of stock assessments, when the report was completed the most recent data

	available was used. In the meantime, there have been updated assessments, and the P1 assessor has reviewed these and incorporated the results where they have led to a change in the score (e.g. for sprat in P1 and P2.5), but the additional time needed to fully incorporate them into the report at this stage, with no material change to the outcome, was not available. At the first surveillance audit, the latest stock assessment advice will be reviewed and the surveillance report will reflect this.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe? [Reference: FCR 7.11.1 and sub-clauses]	**Yes (but see C10)**	**CAB Response**
<u>*Justification:*</u> **C1**: requires the management system to provide evidence that *A. marinus* stocks in areas 1, 2, and 3 are fluctuating around their target reference points. ICES 2016 advice shows that this condition should strictly only apply to SA 2, though development of management plans for all three stocks would be of benefit (see C3). **C2**: provide information on 'other sandeel species' sufficient to determine whether these comprise less than 2% of the total catch so they may be considered as IPI stocks; or to determine that susceptibility of other sandeel species to this fishery is low enough to raise the RBF-derived MSC score for these species to greater than 80. **C3**: well defined harvest control rules must be in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached for sandeel areas 1-3. See C1. **C4**: as C3, but for Norway pout. **C5**: as C3 and C4, but for sprat and needed with more urgency. **C 6**: information should be available on the amount of main bycatch species taken by the sprat fishery. Note that this condition should also cover the Norway pout fishery. **C7**: demonstrate that the Norway pout fishery is unlikely to cause serious or irreversible harm to sensitive habitats, particularly the muddy Fladen ground habitat. **C8**: provide a plan focussed on implementing MPAs and evaluating their efficacy. **C9**: Collect sufficient data to detect any increase in risk to habitat types affected by the sandeel and Norway pout fisheries. **C10**: short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, must be explicit within the fishery-specific management systems for sandeel, sprat, and Norway pout. I argue that a review of scoring might show that this condition is not necessary.		Thank you. We have modified C6 to also apply to the Norway pout fishery. A justification for C10 remaining is given in our response to the reviewer's specific comment under 3.2.1.

If included:

<table>
<tr><td>Do you think the client action plan is sufficient to close the conditions raised?
[Reference FCR 7.11.2-7.11.3 and sub-clauses]</td><td>Yes</td><td>CAB Response</td></tr>
<tr><td colspan="2"><u>Justification:</u>
C1: Yes, see above.
C2: Yes, provided that at Year 1 a research plan is available for the DTU Aqua project on Ammodytes species identification and catch sampling that satisfies the condition.
C3: Yes, the client is already involved in an EMFF project with DTU aqua to develop a management plan for sandeel, and DG MARE hosted a relevant workshop in November 2016.
C4: Yes, as C3 but for Norway pout.
C5: Yes, as C3 but for Norway pout.
C6: Yes, probably already dealt with.
C7: Yes, the client is already engaged in the Central Fladen Ground consultation process through the NSAC.
C8: Yes, the client is participating in spatial management plans (MPAs) for the North Sea through the NSAC.
C9: Probably. Though the client will provide VMS overlays on habitat maps, this does not provide evidence of the impact of the fishery on habitat types. Monitoring benthic organisms in trawl catches would help with this.
C10: Not necessary – covered by C3, 4 & 5.</td><td>Regarding Condition 9, the other peer reviewer also pointed out that the action plan does not specifically address the need to quantify encounters with sea pen. It has now been revised accordingly to ensure that the code of conduct requires recording of fishery interaction with sensitive benthic organisms and the assessment team receives an annual report on this.

For C10, see above.</td></tr>
</table>

<u>Performance Indicator Review</u>

Please complete the appropriate table(s) in relation to the CAB's Peer Review Draft Report:

Table 36 For reports using one of the default assessment trees:

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
Sandeel					

1.1.1	Yes?	No	C1 Yes C2 Yes	The explanation under Type of reference point is redundant, having been dealt with in the scoring comments. If SSB for sandeel in Unit 3 has recently been fluctuating around B_{pa} , why does it score 70? The scores for SA4 and SA6 do not tally with those given for the RBF. Note that here and elsewhere it is necessary to explain how the final PI score has been arrived at, presumably using Table C2 in the CR (27.10.7.4).	The reason that a score of 70 has been given for a stock fluctuating around Bpa is that Bpa is not appropriate as a Target Reference Point that is biologically comparable or equivalent to Bmsy (the MSC standard). Bpa is a reference point intended to be used used in Harvest Control Strategies to manage the risk of possibly falling below the biologically based Blim. For each stock its value was determined by the stock-specific values of Blim and the uncertainty in the stock biomass estimates. Any possble correpdence between Bpa and biologically equivalents of Bmsy is completely accidental and would need to be demonstrated on a case by case basis, because Bmsy played no systematic role in the estimation of Bpa. When the original values for Bpa were developed by ICES in the late 1990s, this distinction was clearly understood and

					explained. However, when ICES moved from the "Precautionary Approach basis for advice developed in the late 1990s to the Fmsy target basis for advice in the early 2010s, Bmsy was discounted as a "notional concept", and is not included in ICES advice. A practice of using Bpa as a default target has become widespread, as is the case for these stocks. This has presented major challenges for MSC certification, of which I am aware because I undertook a review of the possible Bpa / Bmsy relationships for a number of ICES stocks in fall of 2016. In the majority of stocks the relationship between the two reference points was either not possible to establish with the information available, of Bpa was well below the neighborhood where Bmsy was likely to lay. Consequently stocks varying around Bpa are likely to be varying below Bmsy, and in fact half

					the time moving into the biomass where the risk of falling below Blim has reached a level where reduction in F should be advised. Consequently the score is considered justified, until an appropriate biomass target for these stocks is identified, and the stocks can be demonstrated to be fluctuating around that value. It may indeed be that Bpa is a reasonable biologically based surrogate for Bmsy, but that needs to be demonstrated with appropriate analyses. (And the justification for some of the narrative suggested as redundant was to provide the basis for the scoring, particularly for readers immersed in the advisory system that mistakenly dismisses Bmsy and allows Bpa to be a default target reference point. This comment suggests not only is the narrative not redundant, but may need to be expanded even further). No change to the score

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
					or rationale has been made.
1.1.2	Yes	Yes	NA	A good explanation is given for this difficult issue ref. sandeels.	

1.1.3	No	No	NA	None of the stocks is currently depleted, and this PI should not be scored. Doing so adds a spurious 100 score to P1.	Figures 10, 11, and 12 all illuatate that the major sand eel stocks have been near and in some cases below their Blim values within the past decade. Notwithstanding that sandeel are a short-lived species with highly variable recruitment, a stock in the neighborhood of Blim is legitimately considered “depleted”, and careful management of the stock when at low biomass did play an important role in stock recovery, even if the positive anomalies in year-class strength contributed importantly to the rapid increases in SSB. No change to the score or rationale has been made.
1.2.1	Yes	Yes	NA	The score is justified. What is the condition that would address the concerns in 1.2.1a/b?	Becaise the scores in 1.2.1a/b are 80, there is no condition necessary. However, the same analyses needed to address C1 could provide the documentation needed

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
					to possibly go from a score of 80 to 100. No change to the score or rationale has been made.
1.2.2	Yes	Yes	C3 Yes	The score is justified.	

1.2.3	Yes	No	NA	It seems unduly harsh to mark down SAs 1, 2 & 3 due to a shortfall in information on fine-scale stock structure. This is largely ignored for many demersal species, and recognizing 7 sandeel MUs that are assessed and managed separately in the North Sea is surely as good as it gets (pragmatically and in practice).	The reviewer is correct that fine-scale stock structure is ignored for many demersal species. However, sandeel (and the other species in this assesmsent) are lower trophic level species with a number of dependent predators that, at least for some seasons and life history stages, display strong spatial foraging patterns. Although the predator-prey relationships are all scored in P2, the spatial aspects of management of the stock are scored here. For these stocks, better information on the spatial aspects of stock unit productivity would allow more confidence in a conlcusion that the spatial management of seven units is both necessary and sufficient to maintain stock productivity on the scales of these units, or if other units would be more appropriate. Again, scores of 80 were awarded for all stock units. However, given the greater importance of spatial scale of

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
					management of these stocks that for most demersal stocks, it is not inapprorpaite to conclude that "comprehensive information on … stock productivity" (1.2.3a) is not yet available.

1.2.4	Yes	No	NA	This PI concerns the stock assessment, not the Harvest Strategy or HCR (dealt with at 1.2.1 and 1.2.2), so scoring should not be influenced by such considerations. Are the major features relevant to the biology of the "other" sandeel species so different that they result in less effective management?	The current justification for the stocks meeting the 80 scoring benchmark but not the 100, state that the 100 benchmark is approached but not met. The reviewer is probably correct that the life history differences among the sand eel species are not different enough to require separate management approaches. However, at the very least, the minor species taken in the area 2 fisheries must have some important life history differences, if only because their distribution is more restricted than the *marinus.* The reason for not awarding a score of 100 is that it seems no one has bothered to investigate the degree to which any of these life history differences really are large enough to matter to assesment and harvesting strategies. No change to the score or rationale has been made.

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
Norway Pout					

1.1.1	Yes	No	NA	If the 2014 estimate of SSB is 274,000 t and B_{pa} is 150,000 t, then the stock is well above the biomass below which recruitment might be impaired, irrespective of the occasional poor year class produced at high SSBs in the time series. I suggest that SG 100 is met. Similarly, if the stock has been above the $MSYB_{escapement}$ value in the last 8 years, SG 100 is met. See comments above on type of reference point.	This is a different situation than for sandeel. In this case the MSYBescapement has been explored in Benchmark assesmsents and was considered to be an appropriate surrogate for Bmsy. However, the target has not been adopted explicitly by any management authority, so it can be viewed as merely a feature of the assessment body, with no expliict standing in managmeent. Moreover the Blim value is noted in the original estimate of Blim values are very poorly defined by the stock recruit data. I cannot propose a more appropriate value to use as Blim, given the available information. However, I cannot conclude that its use in assessments and implicit role in management ensure a low probablliy of recruitment overfishing. So for both the target and limit, current practice is certanly enough to warrant an 80 score, but

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
					more could be done even with existing information to both solidify the basis for the limit and the role of the target in management. So a score of 100 was not considered to have been met (noting also that the MSC requirement for a 100 score is a likelihood greater than or equal to 95%). No change to the score or rationale has been made.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
1.1.2	Yes	Yes	NA	I don't see the relevance to this PI of the note on management objectives and harvest control rules adopted (or not) by the EU and Norway, nor the objectives of the CFP (these come under PI 1.2, where they are repeated). 1.1.2b. the SG 100 Guidepost requires the limit reference point to be set above the level at which there is an "appreciable risk of impairing reproductive capacity following consideration of precautionary issues", not that there is high confidence that SSB ensures high stock productivity under all environmental conditions.	The relevance of the note on management of the stock is to document tha the reference points are technically still only a construct used in assessment of the stock. No mangement authority has explicitly recognized them as a medium-term guide for management of the stock. . The 1.2.x performance indicators evaluate this concern more directly, but it is relevant to mention here, in terms of bounding how the reference points can be interpreted. The last paragraph of the justification in 1.1.2b has been revised to make the reason for not awarding 100 more apprpriate.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.1.3	Not scored	NA	NA		

1.2.1	Yes	No	NA	1.2.1a & 1.2.1b. there is no explanatiom why SG100 is not met. 1.2.1c. If there is no agreement on management objectives and HCR for Norway pout between the EU and Norway, and the general MSY-based objectives in the CFP have not been translated into adopting any specific reference points or formal HCR for this stock, how can it satisfy SG100? Clearly, the harvest strategy is periodically reviewed but not improved as necessary (see 1.2.2a).	Scores for 1.2.1a and 1.2.1b have been raised to 100, as suggested by the reviewer. For 1.2.1c,, *within the scientific framework of the assessment and advice*, the harvest control rule is "improved as necessary".in each benchmark assessment. If 1.2.1a and 1.2.1b are to be scored based on what the science basis for the reference points is, then the structure of the harvest control rule should be as well, so SG 100 would also be met. With that reasoning, the fact that the EU and Norway have not explicitly adopted the reference points and HCR is relevant to score in 1.2.2, and not 1.2.1, In 1.2.2a it is concluded that the SG 80 is not met, and a Condition is given. This takes care of the legitimate concern of the reviewer on this point, and a more appropriate place in the certification assessment.
1.2.2	Yes	Yes	C4 Yes	The score is justified.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.3	Yes	Yes	NA	The score is justified	
1.2.4	Yes	Yes	NA	The score is justified	
Sprat					
1.1.1	Yes	No	NA	1.1.1b. SG100. Though the reference points estimated by ICES may not have been adopted by management, there is still a high degree of certainly that the stock has recently been above its target reference point against which advice on management is given. See comments above on type of reference point.	Response ot the concern is the same as for Sandeel and Norway pout. Until greater attention is given to "precautionary considerations" and the relationship of the reference points as developed in the Precautionary Approach framework to the more recent Fmsy framework is fully documented, an SG 100 score is not appropriates. No change to the score or rationale has been made.

1.1.2	Yes	Yes	NA	1.1.2a. The discussion on the way management should use these reference points is more relevant against 1.1.2c, if at all. There, you argue that there cannot be a high degree of certainly that, if the target is used, outcomes consistent with MSY management can be expected. But at 1.1.2d you state that ICES considers the B_{pa} target reference point for sprat is a proxy MSY-based reference point, so why does it does not satisfy SG100?	It is true that ICES states that it considers the Bpa target reference point a proxy for an MSY referene point. However, this is done using "proxy" very loosely. As established in th work for the MSC that is referenced in sandeel 1.1.2, the equivalance of Bpa and Bmsy has been explored for a large number of ICES stocks, and was only found for very few of them. In the large majority of stocks, the risk management tool of Bpa produces values well below the likely value of Bmsy (which ICES does not consider meaningful as a management tool, contrary to MSC standards). Thus a stock that is fluctuating around Bpa is likely to be fluctuating *below* and not *around* Bmsy, and a score of 100 is not justified. No change to the score or rationale has been made.
1.1.3	Not scored	NA	NA		

1.2.1	Yes	No	NA	1.2.1a. You state that there are no objectives set for the stock, so the SG 100 is not met. However, ICES provides advice following the MSY approach, with an Fcap, and the CFP requires all fisheries to be managed against an MSY objective. The SC100 score at 1.2.1d suggest that the harvest strategy is improved as necessary, but that is not what you imply previously (as it is used in practice).	The reviewer is correct that ICES advice follows an Fmsy approach, but explicitly rejects Bmsy as a meaningful reference point for use in management. Since stock productivity depends on SSB (and environmental conditions) but *not* on F (and environmental conditions) even the ICES framework is not fully consistent with the MSC standards. This is an unfortunate conundrum, and requires attention, which the MSC is giving to the situation. But for the time being it is a reality and prevents a score of 100 from being awarded, until analytical work is tabled that may (or may not) demonstrate that the vicinity of the "notional concept" of Bmsy is in the close neighborhood of Bpa. No change to the score or rationale has been made.
1.2.2	No	No	C5 Yes, but may need to be more	You state that the use of $B_{escapement}$ as a HCR has been applied in practice for the last several years, that F cap was used in	The reviewer was in possession of information not available

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
			urgent.	the advice on the 2015 TAC, and the management decision is consistent with the advice. However, your have some doubts about the continuing use of this HCR, which could be resolved by examining the 2016 ICES advice for 2017 as evidence whether the SG 80 guidepost is met. This shows that landings in 2015 exceeded the set TAC, and the TAC set for 2016 was way above the ICES advice. F has increased above 0.7 in the last two years. It appears that 1.2.2.c SG80 is not met, and an overal PI score of 75 is too high.	at the time the initial assesmsent was done. The new infomration is added to the assessment in this case, and the score adjusted appropropriately.
1.2.3	Yes	Yes	NA	The score is justified	
1.2.4	Yes	Yes	NA	The score is justified	

2.1.1	No	No	NA	It is necessary to provide the evidence here for the catch composition of non-target species, by fishery (sandeel, Norway pout, sprat) and gear (demersal trawl, mid-water trawl and purse seine), but see comments against 2.1.3a. This would allow the reader to understand why the main and minor species have been selected, and whether there are differences between UoAs – which should be scored separately. 2.1.1d. is sufficient known about the status of dab and flounder? It is necessary to explain how the final PI score has been arrived at using Table C2 in the CR (27.10.7.4).	Evidence for the catch composition is provided in the main text in tables 28-30. Explicited references to these tables have been added to the scoring tables. The evidence does not need to be broken down between gears because there is a one-to-one correspondence between gears and species (sprat is caught by pelagic gear; sandeel and Norway pout with demersal gear; see 3.4.6.1). This has been clarified in the scoring table. The scoring of minor species is a bit tricky for these performance indicators. If the team completely ignores minor species, the PI can score no higher than 80 (so long as the main species score at least 80). The team interpret the converse of this to mean that if minor species are considered, they must only be considered at the SG100 level, therefore SId is irrelevant because

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
					it only has a statement at the SG60 level. What we have done is consider all retained species, including the five minor retained species and concluded that of the minor species, only blue whiting reaches the 100 level for SIa, and blue whiting and whiting reach 100 for Sib. We have added an explicit statement using the language in table C2 for how the overall score was arrived at for all relevant P2 PIs.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.1.2	No	No	NA	2.1.2c. the evidence required at 2.1.1.a would demonstrate whether the strategy (gear operation, sorting grids, pout box etc) is being implemented successfully.	More explicit reference to the maintanence of retained species at sustainable levels has been made here to futher support the given score.
2.1.3	Yes	No	NA	NB No species is "managed" by ICES: ICES gives scientific advice on management. 2.1.3dc. Given the discrepencies between logbooks and official landings data, and that dab and flounder are data limited stocks, how is there sufficient detail to assess ongoing mortalities of these two species?	Noted, the same commnet was received by the other reviewer and this has been reformulated throughout the document. See response to the same comment by Peer Reviewer 2. The scores for these species have been reduced.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.2.1	Yes	No	NA	Herring is dealt with under retained species at PI 2.1 (though it may not be taken in the sandeel fishery), and therefore should not appear here (it does have relevance to 2.2.2).	The reviewer is correct. Herring may be caught and retained or it may be caught and slipped. In the first case it is assessed in 2.1, in latter case it is considered a bycatch for the information and management PIs only and we have removed it from explicit consideration in 2.2.1. This has no impact on the given score for 2.2.1.
2.2.2	Yes	Yes	NA	The score is justified	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.2.3	Yes	No	C6 (sprat and Norway pout only) Yes	2.2.3a. The monitored experimental sprat fishery in the German Bight has no on-board observers, just tests of catch composition for each haul. What we are looking for here is information on slipping.	Indeed, and therefore no quantitative information is available. We mention the experimental fishery because it could indeed be used to evaulate slipping. No change to the score or rationale has been made.
2.3.1	No	?? (need to check list of ETP species)	NA	The team needs to ensure that ETP species are in line with the current MSC definition. Is there any evidence that any ray/skate species is taken by these fisheries (slipping or catch composition monitoring), thus not meeting SG100? See comments against 2.3.2b	Added two species: common skate and starry ray. There is no evidence that these are taken. Explict evidence is added in the text.

2.3.2	No	No	NA	Surely one part of the strategy to manage the fisheries' impact on ETP species is the constraint oFn biomass harvesting to ensure sufficient prey availability for predators – see comments against 2.3.3b. The evidence for the success of closed foraging areas for sea birds is not strong.	We have mentioned this as a further support to the partial strategy against indirect negative effects on ETPs, scored in 2.3.1 SIc. Closing an area cannot alone facilitate a recovery of a bird population, if also other factors are involved in their decline. This is also mentioned in the example with the closure at the Firth of Forth. The absence of recovery of Kittiwakes does not mean that the measure is unsuccesful, and SG80 is still justified. Note also that in v1.3 of the MSC requirements, it is the marginal impact of the UoC alone that is under evaluation, so recovery does not need to occur for the measure(s) to be successful. No change to the score or rationale has been made.
2.3.3	Yes	Yes	NA	The score is justified	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.4.1	Yes	No	C7 (Norway pout) Yes	Good to see that you have described the gear used in each fishery (demersal trawl, mid-water trawl and purse seine) and the way they might impact on habitats. All the UoAs should be scored separately, which would support Condition 7 only applying to the Norway Pout fishery. What about mid-water trawls used for sprat?	We have clarified how the UoAs are scored (sandy bottom = sandeel; mud = Norway pout). It has been clarified that C7 only applies to the Norway pout fishery We have clarified that the second part of 2.4.1 (for the sprat fishery) coves all pelagic gears; purse seines and mid-water trawl.

2.4.2	No	No	C8 (demersal gears) Yes	All the UoAs should be scored separately, and harmonisation with existing assessments used to provide information on the severity of likely impacts (which you say is lacking for these UoAs). MPAs are not the only strategy that can be used: gear rigging and operation can minimise impacts to the level that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm. For purse seines in particular the scoring seems too low.	The decisions on how to score Principle 2 (i.e. aggregating the UoAs and using the Scoring Elements approach) has been explained on page 293. In addition, comparison with other MSC certified fisheries is given on page 95. It is not covered under a special "harmonization" section because harmonization is not strictly applicable here (according to the MSC harmonization requirements). We have now mentioned gear riggings and the experiments with mid-water doors in the sandeel fishery. Regarding the low-seeming scoring for purse seines, we have explained within the scoring table itself for 2.4.2 pelagic gear why the 100SG is not met for three of the scoring issues.
2.4.3	Yes	Yes	C9 (demersal gears) Yes	The score is justified.	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.5.1	Yes	No	NA	This PI should be scored by the three target species fisheries (at least). No reason is given why is SG100 not met	Again, a 'scoring elements' approach was used here where appropriate. As the three target species largely share one ecosystem, there were some places within 2.5 where it was appropriate to treat them all the same, but also there was occasion to separate, where the single species management intersects with ecosystem impacts (e.g. with M2s and TAC setting). Added a justification.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.5.2	Yes	No	No condition set, but might be needed for sprat	2.5.2d. I think that you need to examine how well the ICES advice is being followed in TAC setting, and whether catches reflect this. For sprat, at least, this has not been the case in 2015 and 2016, and it seems that SG80 in not met; i.e. the measures are **not** being implemented.	This is correct for sprat, and the score and rationale for SId have been adjusted accordingly. For sandeel and Norway pout TACs are set according to ICES advice.
2.5.3	Yes	Yes	NA	The score is justified	
3.1.1	Yes	Yes	NA	The score is justified	
3.1.2	Yes	No	NA	3.1.2c. Consultation with environmental NGOs is now more formal and, though they have no statutory role, they **are** effectively engaged in the decision-making process (though it may not go as they wish). This suggests that SG 100 is met.	The reviewer is correct—the score and justification has been modified in light of evidence of the current more formalized consultation with the public on DG Mare decisions, such as fishing opportunities.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.1.3	Yes	Yes	NA	The score is justified	
3.1.4	Yes	Yes	NA	The score is justified	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.1	Yes	No	C10 Not required	You say that the EU CFP has general MSY objectives, but these have not been translated into adopting any specific reference points for this stock (sic), nor HCRs to keep harvests within the general bounds set by the CFP. For all three target species, ICES has estimated reference points and provides advice based on the ICES approach to MSY-based management for short-lived species, which is an escapement strategy that takes into account ecosystem effects. Whether these are translated into effective HCRs or management plans is dealt with under 1.2.2.	The assessment team respectfully disagrees with the reviewer on the interpretation of the SG80 scoring guidepost for this Performance Indicator. Pertaining to the fishery-specific management system (rather than overall governance and policy covered in component 3.1), we have interpreted a lack of long-term management plan, or indeed any formalized management plan for any of these three fisheries to mean that short and long-term objectives are not explicit within the fishery-specific management system, therefore an 80 score cannot be reached for this PI. No change has been made.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.2	Yes	No	NA	Some comment is required here concerning whether TACs are set in line with ICES' advice and F is kept within acceptable limits (which was not the case for sprat in 2016).	A comment has been added, although no change to the score has resulted. However, changes to scores in P1 and P2 as a result of this issue have been referenced here.

3.2.3	Yes	No	NA	3.2.3a. The SG100 requirement is a consistent ability to enforce relevant management measures, strategies and/or rules. How does the discrepancy in the very small quantity of non-target catch reported through e-logbooks vs official sampling detrementally affect this?	At the 100 level, SIa requires that a comprehensive MCS system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies, and/or rules. We have judged the fishery to have fallen short of the SG100 because e-logbooks are heavily relied upon as part of fishery monitoriing, and within the relatively small amount of official sampling that does occur, there are large discrepancies in reported catch composiiton. This is probably easily explained as mentioned in the rationale, but nonetheless it calls into some question the effectiveness of this as a monitoring measure. No change to the score or rationale has been made.
3.2.4	Yes	Yes	NA	The score is justified	

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.5	Yes	Yes	NA	The score is justified	

Table 37 For reports using the Risk-Based Framework:

Performance Indicator	Does the report clearly explain how the process (es) applied to determine risk using the RBF has led to the stated outcome? Yes/No	Are the RBF risk scores well-referenced? Yes/No	Justification: Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response:
1.1.1	SAs 4, 6 and other sandeel species: No	Yes	It is not clear whether the assessment team did consult with stakeholders or just examined the relevant ICES reports. However, the scores are justified, **but not replicated** in the scoring table at 1.1.1.	The RBF process was a bit altered for this assessment, as approved through a variation granted from MSC. We have explained this at the bottom of page 108 under subheading 4.4.3 "evaluation techniques" and have now added a link to the RBF notice on the MSC website. We have double checked the scores reported for the RBF given in PI 1.1.1, calculated using the MSC's process for determining P1 RBF scores, and found them to be consistent. For clarity we have added the actual scoring worksheet to the bottom of Appendix 1.2.
2.1.1				
2.2.1				

2.3.1				
2.4.1				
2.5.1				

Optional: General Comments on the Peer Review Draft Report (including comments on the adequacy of the background information if necessary) can be added below and on additional pages

Title page, and through Executive Summary: Missing "North Sea" from "DFPO and DPPO Skagerrak and Kattegat Sandeel, Norway pout, and Sprat fisheries" Only at Description of the Fishery, Unit(s) of Assessment (UoA) and Scope of Certification Sought, does North Sea appear as assessed stock units. Is this a typo associated with the concurrent assessment of the DFPO and DPPO Skagerrak, Kattegat and Western Baltic herring fisheries? A general scan should reveal one or two unwanted "herring" legacies in this report.

RESPONSE: Thank you, these issues have been tidied up in the report.

What is the UoC area?

RESPONSE: The UoC area differs depending on the target species and range of each individual stock. We have added an explicit statement that the UoA encompasses all Danish vessels fishing on the named stocks.

A **Glossary** would be useful

Executive summary
Principle 1; Strengths: how can there be "Good stock assessments and supporting information for all three species, and precautionary harvests in data deficient situations? There are no assessments of sandeel in SA4 and SA6.

RESPONSE: This strength has been clarified to state that where there are stock assessments, they are good, and where there are not, there are precautionary (very small) harvests instead.

Description of the UoAs: given the unique complexity of "stock" definitions (essentially separate management units within the North Sea) for sandeel, it would be useful here to explicitly describe the situation and the sea area occupied by each sandeel SA; or bring Fig. 1 forward. Additionally, at Impact of the reduction fishery on sensitive habitats, you state that the fishery is conducted with otter bottom trawl, otter mid-water trawl, paired bottom trawl and paired mid-water trawl, as well as purse seines in the sprat fishery and that, depending on the targeted species, different habitats are fished. These various trawl gears are likely to have different catch compositions and habitat impacts and should therefore be identified as such in the description of the UoAs, and scored separately (at least demersal and mid-water trawls).

RESPONSE: This issue is specifically addressed earlier under the initial comments as well as P2-specific comments. Some clarifying changes have been made to the text.

Presumably the TAC of sandeels is for the whole UoC area.

RESPONSE: Correct. We have now made that explicit.

Overview of the fishery: annual landings from the Danish fisheries for all three species; sandeel, sprat and Norway pout are now well below the historic peaks, at an aggregate of around half a million t compared to over 2 million t. An explanation for this would be useful here (e.g. a more restrictive regulatory approach to managing harvests, and decrease in effort as TACs were reduced in line with recruitment to the stocks).

RESPONSE: Thank you, an explanation of this has been added to the fishery overview/history section.

Sandeel: why does evidence suggest dispersal of sandeel is limited if banks at scales up to 300 km apart can be connected by the annual dispersal and advection of larvae? The North Sea is not **that** big. Nevertheless, be careful not to confuse sandeel management units with units of certification in this MSC assessment. I suggest using management unit (or SA1, SA2 etc) throughout.

RESPONSE: Thank you, we have gone through and ensured consistency throughout the document in referring to sandeel management units. With regard to the dispersal issue, the observation that "dispersal is limited" comes from both publications and the ICES assessment narrative. A minor modification to the text has been made that it is "post-settlement dispersal" and not every single aspects of "dispersal." I am sure it is true that currents and other transport processes can spread eggs and early-stage larvae widely. However, once the initial settlement occurs, it is unlikely that there is complete mixing even on scales of assessment or management units, let alone for the whole North Sea. Since the processes causing the variation in year-class strength are very poorly known (even though the variation is large) treating the populations as fully mixed just because eggs and early larvae are vulnerable to transport is a very un-precautionary approach to managing a set of species where there are spatially dependent predators.

Principle 2. In terms of the potential for top-down control of sandeel production, ICES concluded that there is no evidence for depletion of sandeels by seabirds or marine mammals, even locally at major breeding colonies (ICES 2010). What about effects of fishery on sandeels and thus birds etc?

RESPONSE: The potential for the fishery to deplete fish stocks to a level where there is limitation of food for birds, marine mammals, and predatory fish species is dealt with extensively in the relevant sections: 2.3.1c for birds and mammals and in 2.5.1 for fish. See also section 3.4.4 in the main text, and the comment on the Lenfest report (page 96).

You state on page 15 that sandeel eggs are demersal, then on page 23 that eggs are released largely in the water column at depths less than 100 m from the surface. Do they sink and then remain on the sea bed?

RESPONSE: The eggs are deposited on the seabed. The larvae hatch after several weeks, and drift in the currents for one to three months, after which they settle on the sandy seabed. This information has been clarified in the report.

Table 3 shows predation mortality estimates by each management unit for all MUs. What does this mean?

RESPONSE: The reviewer is correct that this table does not serve to clarify the reasoning of the assessor and it has been removed, although reference to the source in the ICES documentation has remained.

Norway Pout: is the information on size and maturity at age (Figs 18-21) of any consequence for this MSC assessment? If not (you note that these small annual variations in productivity parameters support the use of recent average values for these parameters in assessments and management of the stock), I suggest that you delete such superfluous information <u>for all three species</u> to make the report more accessible for non-technical readers (those interested can always look up the ICES reports).

RESPONSE: In the past, reviewers have been critical of references to figures in ICES documents that are not also duplicated in the MSC assessment reports, especially when they are used to support reasoning that leads to justification of scores. These are complicated stock assessment models and the MSC P1 assessor has to be confident that the input parameters used in the models which are ultimately chosen as the basis for advice are appropriate. While it may be more than is necessary to include in the reports themselves, we feel it is better to overexplain than underexplain. If the less-technical reviewer is not compelled to read it all in detail that is also fine.

Sprat: You note that by age 2 over 80% of sprat were mature, the percentage mature at age increases through the calendar year (so, of what value is Figure 27, from the Q1 IBTS?), and ICES uses maturity of 0.9 for age 2 in assessments. And what are we meant to make of Table 38. Frequency of occurrence of estimates of natural mortality by age 1990-2014**?** This just serves to confuse.

RESPONSE: The point of Table 19 is to demonstrate how high natural mortality is for all ages of sprat, and the large role of predators. This is important because as a key low-trophic-level species, we must be confident that this natural mortality is being appropriately accounted for in allocating fishing opportunities.

Under key data sets, you present tables for quarterly commercial landings-at-age, abundance indices from the North Sea IBTS trawl surveys and acoustic survey, and then summarise the results of the three fishery-independent surveys in Figure 28, pointing out that the variance among them contributes to the overall uncertainty in the assessment estimates of population parameters. Do we really need to see Tables 20 – 23 to understand this very obvious point? Much more valuable would be a table giving the reference points for sprat, which is missing.

Noting that the audit visit was held in June 2015 (is the additional RBF stakeholder consultation period the reason that this assessment has taken so long?), I strongly suggest that the assessment team updates (and simplifies) the P1 assessment information for the PCDR. This will pick up some important changes in sprat (especially).

RESPONSE: We agree that recent changes in assessment and management information for North Sea sprat warranted consideration at this stage in the assessment, and relevant scores and rationales in P1 and P2 have been adjusted as a result. Please see specific responses for more details.

Impacts of fishing on the fish community: an explanation of M2s as predation mortalities is required earlier.

RESPONSE: Noted, we have moved this information up in the report.

Ecosystem modeling to support management of North Sea fish stocks and other dependent species: though M2s are updated regularly, and future recovery of top predators and resulting decreases in the catch of forage fish that can be taken will be accounted for, this only ensures that fishing does not impede productivity or recovery of predatory species if management implements appropriate controls. Does it?

RESPONSE: Mostly. We have addressed the reviewer's specific concerns related to this general point throughout particularly P1 and P2. The sprat fishery has recently been exceeding TAC which has also been exceeding scientific advice, which demonstrates a breakdown in management implementation of appropriate controls, as described by the reviewer. We have revised the score for 2.5.3 accordingly and generated a new condition. Generally, however, the EU management and assessment framework, accounting for predation mortality in setting TACs, is functional.

ETP species: You may need to reconsider the definition of ETP species. During 2015 MSC indicated that species listed as "prohibited" in the annual EU TAC Regulation should be regarded as ETP species. EU Regulation 72/2016 contains a list of "prohibited" species in Article 13. This Regulation will be amended for 2017. I will use the list presented for this peer review, but note that other CABs the now consider the following elasmobranchs to be ETP specie in the North Sea: starry ray (*Amblyraja radiata*), basking shark (*Cethorhinus maximus*), common skate (*Dipturus batis*) complex, tope shark (*Galeorhinus galeus*) and porbeagle shark (*Lamna nasus*).

RESPONSE: We have added common skate and starry ray to the list of ETP species.

You state that trawl and purse seines are generally known to have negligible by catch of birds or marine mammals. This has not been the case globally and historically for fisheries using these gears, and you should qualify this comment by reference to the North Sea.

RESPONSE: The statement is qualified with two references, both with specific relevance to the North Sea. The observer program for herring is indeed the North Sea herring fishery – this has been clarified in the text.

Harbour porpoise: are any of the UoAs allowed to fish in the 26 designate SACs and, if so, what limitations are applied to minimize porpoise by catch?

RESPONSE: They are indeed allowed to fish in the SACs. The limitations are the use of pingers in the gillnet fishery, which does not apply to the reduction fisheries. This is now noted in the text and tables.

Kittiwake: the 5000 t/yr of sandeel in Firth of Forth is actually a monitoring fishery, not a “small scientific fishery”

RESPONSE: Correct. This has been fixed.

Habitats: you state that the sandeel fishery has developed “floating” trawl doors: are they really positively buoyant, or just doors that can more easily be fished in midwater, without bottom contact?

RESPONSE: The main effect is that they can be fished without bottom contact. The text has been updated to reflect that.

As I had hoped, there is good use of harmonisation here, but it is not used in the scoring table where evidence for the UoAs is lacking.

RESPONSE: We think all scores given within the tables are sufficienty justified, and don’t see where they could be reinforced by repeating harmonization-related information from the main body of the text.

Eligibility of IPI stocks to Enter Further Chains of Custody: it would be useful here to explain that all species of sandeel that are not A. marinus are considered under Principle 1 as a “scoring element” using the RBF because they are indistinguishable in the catch from the target sandeel and caught in unknown quantities, and why this makes them ineligible as IPI stocks (ref. Condition 2). Incidentally, which stakeholders were consulted for the RBF exercise, and when?

RESPONSE: Thank you, this information has been added as suggested. The answer to the question on RBF consultation is given previously under the specific RBF comment/response.

Peer Review 2

Summary of Peer Reviewer Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No** **Yes**	**CAB Response**
Justification: The report is lacking (updated) information to support the scoring of many SIs. There are several aspects that need improvement (see below for details), namely: update on the Norway pout assessment and ETP species. There are a few SI where the information provided is insufficient to support the conclusion and are several cases where the information is unclear or perhaps incorrect (see below for more information). As the scoring of many PIs is dependent on updated and additional information and argumentation, it is likely that the present conclusion of the assessment team is not reached.		Thank you. This is a general statement and all of the specific comments relating to it are given below, which is also where the specific responses by the team are given.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe? [Reference: FCR 7.11.1 and sub-clauses]	**Yes/No** **Yes?**	**CAB Response**
Justification: The conditions raised are generally appropriate and are well justified. However, condition 6 needs to specify qualitative and quantitative data in a shorter timeframe. In addition, as several PIs may be rescored to do updated or additional information, new conditions may arise.		Thank you. There are related detailed answers to this under responses to PR 1. Notabley, the action plan for condition 9 has been revised.

If included:

Do you think the client action plan is sufficient to close the conditions raised? [Reference FCR 7.11.2-7.11.3 and sub-clauses]	**Yes/No** **No**	**CAB Response**
Justification: On conditions 3 to 5 - the client action plan states on year 2 that the management plan will be developed *and* implemented which is time wise unrealistic. Furthermore, there are references to a research project and management processes but no timelines are provided, which does not allow for an assessment if the action plan will close the condition raised within the necessary timeframe. ICES commitment to carry out a workshop should also be confirmed. Condition 6 should be closed through the implementation of a monitoring at-sea programme, and not by relying on the fisheries control agency annual report. Condition 9 - the client action plan only states that VMS data will be mapped, but there is a specific request for information on benthic organism (sea pens) encounters by the Norway pout fishery.		Thank you. The action plan for conditions 3-5 have been revised to a more realistic timeline for implementation and evaluation and to provide the necessary deadline and timeline details. Condition 9 has also been revised to include specific provision of information on interactions with sensitive benthic organisms. Regarding the implementation of an at-sea monitoring program in response to condition 6, we have determined that demanding a separate on-board observer program would be unjustifiably onerous for this condition under these circumstances. Such a program would need a very high observer rate to have any statistical validity because slipping even before it was banned was a rare event. All this for a mortality of herring which cannot be anything but very minor compared to the total fishing mortality since the herring TAC is 3 times the sprat TAC, and the herring bycatch is being closely monitored to avoid that it becomes a choke species. However, the clients have added to the action plan for C6 that they will analyse the update of the herring bycatch % annually to provide evidence that there are no incentives to slip catches.

<u>Performance Indicator Review</u>

Please complete the appropriate table(s) in relation to the CAB's Peer Review Draft Report:

- For reports using one of the default assessment trees (general, salmon or enhanced bivalves), please enter the details on the assessment outcome using Table 36.

Table 39 For reports using one of the default assessment trees:

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
1.1.1 sandeel	Yes	Yes	Yes Condition 1, 2		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.1.2 sandeel	Yes	Yes	NA	SIc The statement "if Bescapement values were set at a level that maintained a low likelihood that the SSB would fall below a biologically based Blim, then Bescapement would be a suitable surrogate for Bmsy" is incorrect. I think ICES is refering to their MSYBtrigger wich they use as a proxy for Bmsy, but it is recognised at a lower level than Bmsy. Sid If ICES is considering a lower value for Bmsy, then one may question if the Bescapment is indeed precautionary taking into account the ecological role of the stock.	This discrepancy between Bescapement and Bmsy is discussed at length in response to the other peer review, in which the reviewer argued tha the scoring initially awarded was posisbly too harsh. After consideration of how best to handle this situation the CAB here concluded that it is most appropriate to take this point into consideration in 1.1.2c, which is specifically about the target reference points. It is scored as not meeting SG 100, which is where the "precautionary concerns" are explicit, but does meet SG 80, because there is a target reference point with "a similar intent" – even of the intent may not be realized. This should be consistent with the reviewer's concern here.

1.1.3 sandeel	No	No	NA	SIa – “All those measures were implemented, including application of an Fcap in scientific advice.” There is no explanation or detail on “those measures”, while the aplication of an Fcap in scientifc advice is only effective if the controls rule are set following that advice. Sib. “stock rebuilt within one generation, as soon as an average or near-average year class recruited to the stock” is true, but disregards the fact that the inexistance of an average recruitment may be (also) due to high fishing mortality, and the stock can be without an average recuritment more than one generation. SG100 is not met.Sic no actual evidence is provided. The reference to annual assessments as evidence that rebulding startegies are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe is clearly insuficient.	The absence of harvest control rules that *implement* the reference points in management decision-making is scored in 1.2.2, which is scored as SG 80 not being met. that seems the appropriate place in the framework to score the degree to which the control rules are actually applied. 1.1.2 is considered to be evaluating how soundly the reference points and control rules are based in scientific evidence. If that distinction is appropriate, then the basis for the reference points and control rules is sound enough for SG80. With regard to 1.1.1b, the reviewer seems to require that stock rebuilding *always* take place within one generation, regardless of a species' life history. For short-lived species with variable recruitment, this standard would be impossible to meet even if all fisheries were closed evey time a stock fell below Blim, and certificaton would be impossible for such stocks. We interpreted the standard as requiring that the reference points and harvest control rules worked together to prevent the fishery from extending the recovery time longer than would ne required by the biology of the stock and

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
					environmental conditions of its environment. The simulatons presented in the references given for this scoring item demonstrate that is the case here, so the scoring is considered appropriate.

1.2.1 sandeel	Yes	No	NA	Sia. There is an aparent confusion between a harvest startegy and its elements and a harvest control rule. The two elements of the harvest startegy presented, Bescapement and Fcap, are elements of a HCR if the TACs follow advice, and not of the harvest strategy. Elements of a harvest startegy are “control rules and tools in place, the information base and monitoring; the assessment method.” Furthermore, the harvest strategy is enshrined in the CFP and has been adopted by all MS. However as stated a managmenet plan is needed to ensure that TACs follow scientific advice. Justification needs to be reviewed. Sib and d. Again a harvest strategy is more than an ICES HCR. Note that a recent ICES benchmark workshop on sandeel (http://www.ices.dk/community/groups/Pages/WKSAND-2016.aspx) concluded that the different sandeel populations are clearly separate between EU and Norwegian waters, and thus sandeel should no longer be considered as a shared stock between the EU and Norway (page 6, https://ec.europa.eu/fisheries/sites/fisheries/files/docs/pages/2017-agreed-record-eu-norway-north-sea-12-2016.pdf)	The scoring does take account of exactly the distinction highlighted by the reviewer. All the *components* of the harvest strategy individually are well explored by simulations and included appropriately in the advice. The phrase “in place” is found in 1.2.2 and NOT in 1.2.1. In 1.2.1 the scoring subcriteria are about the design and testing of the components of the harvest strategy and the design of the control rule that applies the strategy. In all those pieces, the elements meet the SG 80 standard, and usually exceed it, even if there is room for further work (not meeting SG100). The consideraton of how well the strategy is implemented is scored and found to fail to meet the SG 80 score in th appropriate place in 1.2.2. The new benchmark information was not available at the time of this assessment and was not considerded. Moreover the reponse of the management authorities to the benchmark findings will not be known until the 2017 management plans at the earliest, and would be inappropriate to take into account in the assessment, but would be relevant to future surviellance audits.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.2 sandeel	Yes	Yes	Yes Condition 3	SIa and c Please see above for a discussion on harvest startegy vs HCR.	Noted
1.2.3 sandeel	Yes	Yes	NA		

1.2.4 sandeel	Yes	No	NA	SIe I disagree that ICES ACOM procedure qualifies as “external” reviewing, because the experts are usually not external to ICES. I consider it to be part of the internal review and thus SG100 is not met.	Having served many years on ACOM and still occasionally invited to be on advice drafting gorups, I know well the lengths that ICES goes to ensure that there are three levels of engagement of experts in each assessment. At the working gorup level a small team actually does the computations in the assessment and presents the results to a larger group of experts at the working group level. This larger group is expected to thoroughly critique all details of the analyses and review the conclusions tentatiely draw from them. Then the WG report section is drafted by the initial group of experts, and tabled and reviewed by the WG. Only when the WG report is accepted by all members is a separate advice drafting group struck to take the WG report, review it and draft advice from the report. That advice is then reviewed by ACOM, stressing the engagement of experts not involved in any of the previous steps. So there are three levels of scrutiny of the work done by the core assessment team – the WG reviewing the assessment team’s work, the advice drafting group reviewing the WG results, and ACOM reviewing the

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
					product of the advice drafting group. The fact that ICES provides and umbrella for the whole process is an administrative reality, but does not compromise the independence of the levels of review.
1.1.1 Norway pout	No	Yes	NA	Norway pout assessment used is of 2014, yet the reference for ICES is of 2015, which in turn does not match the reference given (back to 2014). **The 2015 assessment should be used, or even the 2016 as it has been released already**.	The 2015 assessment did not include all the figures and tables in the 2014 assessment, so the assessment drew on information from both years. The 2015 reference has been added, and the SSB estimate updated. These changes have no effect on the scoring. As for the 2016 assessment, it was not available when this assessment and scoring was done, but can be the basis for the first surviellance audit.

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
1.1.2 Norway pout	Yes	Yes	NA	SIc There is doubt that when ICES refers that "the Bescapement target was a reasonable surrogate for Bmsy" they were not refering to MSYBtrigger instead, which is a lower value than Bmsy. Sid If ICES is considering a lower value for Bmsy, then one may question if the Bescapment is indeed precautionary taking into account the ecological role of the stock.	This consideration is fully explained in the response to the other reviewer (and is the rationale for not awading the scores of 100 that the other reviewer considered appropriate). Care was taken to score this discrepancy between the ICES Fmsy-based reference points and the MSC standards only in the subcriteria where it was most relevant, rather the rescoring it multiple times.
1.1.3 Norway pout	NA	NA	NA		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.1 Norway pout	Yes	No	NA	SIa. Note that Norway pout is, as stated, a shared stock although not yet jointly managed between the EU and Norway. For P1 purpose the management autority is at stock level and not at fishery level, and thus Norway and the EU both need to be considered. Sia and b. There have also been closures of the fishery in the past that have been adopted following scientific advice. Sid. A harvest strategy is more than an ICES HCR so the review here refers to the review of the CFP and EU/Norway agreement and not necessarely to the review of ICES HCR.	All the concerns of the reviewer about coordination of managmenet authorities and the role of the components of the harvest strategy and HCR as estimated by ICES and the actions of the management authorities are addressed in the assessment, but in the places most appropriate for consideration of the specific concerns, After extensive discussion within the CAB, between the CAB amd the MSC , and between one of the assessors and the MSC, it was decided that the scores in 1.2.1x are evaluating the designed the estimation of the components. It is 1.2.2, particularly 1,2,2,c, where what is actually IN PLACE by the management authorities (individually and jointly) is scored. In that place the SG 80 is indeed considered to not be met.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.2 Norway pout	Yes	Yes	Yes Condition 4	SIa and c Please see above for a discussion on harvest startegy vs HCR. Note that in the most recent EU/Norway agreement the parties agreed to develop a long term management plan for Norway pout. Page 7 (https://ec.europa.eu/fisheries/sites/fisheries/files/docs/pages/2017-agreed-record-eu-norway-north-sea-12-2016.pdf)	The recent agreement between Norway and the EU will be relevant for the surviellance audit, but not for this assessment. The other concerns are addressed as explained for sandeel, which the same point was made.
1.2.3 Norway pout	Yes	Yes	NA		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.4 Norway pout	Yes	No	NA	SId SG100 is met or not? the robustness of the assessment does not depend on the management decisions made based on it, but on its uncertainty. In line with sprat where the scoring for this SI did not reached 100. However, this assessmnet is less robust than the sprat one. SIe I disagree that ICES ACOM procedure qualifies as "external" reviewing, because the experts are usually not external to ICES. I consider it to be part of the internal review and thus SG100 is not met.	The SG 100 was considered to be met. The benchmark assessments for Norway pout have fufilled all the requirements of the scoring guidline. They have explored alternative formulations and hypotheses, and they have established the robustness of the assessment. They have not resulted in an assessment that is accurate and precise, because of the short life history and variable recruitment dynamics of the stock. But the SG 100 does not require accurancy and precision – just robustness and rigour. The issue of "external review" was fully discussed in regard to sandeel assessments.
1.1.1 sprat	Yes	Yes	NA		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.1.2 sprat	Yes	Yes	NA	SId There is doubt that when ICES refers that "the Bpa target reference point for sprat is considered a surrogate (proxy) for an MSY-based reference point for sprat" they were not refering to MSYBtrigger instead, which is a lower value than Bmsy. If ICES is considering a lower value for Bmsy, then one may question if the Bescapment is indeed precautionary taking into account the ecological role of the stock.	Fully discussed relative to Norway pout and the treatment in the scoring is considered appropriate.
1.1.3 sprat	NA	NA	NA		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.1 sprat	Yes	No	NA	SIa. There is an aparent confusion between a harvest startegy and its elements and a harvest control rule. The two elements of the harvest startegy presented, Bescapement and Fcap, are elements of a HCR if the TACs follow advice, and not of the harvest strategy. Elements of a harvest startegy are "control rules and tools in place, the information base and monitoring; the assessment method." Furthermore, the harvest strategy is enshrined in the CFP and has been adopted by all MS. However as stated a managmenet plan is needed to ensure that TACs follow scientific advice. Justification needs to be reviewed. SIb and d. Again a harvest strategy is more than an ICES HCR. Furthermore, in SId the review here refers to the review of the CFP and not necessarely to the review of ICES HCR	Fully discussed with regard to sandeel and Norway pout. The scoring for implementation is most relevant in 1.2.2 and the guidance is clear that each assessment consideration should be addressed in the most appropriate place in the scoring criteria, and a fishery not be repeatedly penalized in multiple places for the same shortcoming. This assessment goes to great lenghts to follow that guidance for all stocks.
1.2.2 sprat	Yes	Yes	Yes Condition 5	SIa and c Please see above for a discussion on harvest startegy vs HCR.	See above
1.2.3 sprat	Yes	Yes	NA		

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
1.2.4 sprat	Yes	No	NA	Sid SG100 is met or not? the robustness of the assessment does not depend on the management decisions made based on it, but on its uncertainty. In line with Norway pout where the scoring for this SI reached 100. However, this assessmnet is more robust than Norway pout. SIe I disagree that ICES ACOM procedure qualifies as "external" reviewing, because the experts are usually not external to ICES. I consider it to be part of the internal ICES review and thus SG100 is not met.	The reviewer is correct that the justifications of 1.2.4d for Norway pout and Sprat as very similar, but different scores were awarded. This discrepancy is corrected by raising the Sprat score to 100 for 1.2.4d, to correspond to Norway pout. The two benchamrk assessments were rigourly done, demonstrate the robustness of the assessment, and explore a variety of hypothses and formulations, Thus the SG 100 standard is met, even if the assessments are still somewhat uncertain. The issue of "external review" was fully discussed in regard to sandeel assessments.
2.1.1	Yes	Yes	NA	SIa. ICES is not a management organisation, is a scientific institution. Stocks are managed by the EU and Norway. Flounder SG needs to be corrected to 80	Correct. Reformulated.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.1.2	Yes	No	NA	SIb and c. Evidence is provided for Norway pout fishery but not for sprat. If no evidence then SG80 is not reached for the sprat fishery.	The fishery of Norway pout and sprat are indeed terminated when the bycatch quota of herring is used. The evidence is that the bycatch quota is not exceeded, while the TAC is not fully taken. This has been clarified in the scoring table.

2.1.3	Yes	No	NA	Sib. Being an ICES category 1 stock is not suficient to be considered “estimate outcome status with a high degree of certainty”. That depends on the quality of the assessment. So either more information is provided on the quality of each assessment or SG needs to be rescored to SG80. Sic “The species managed with analytical assessments (blue whiting, whiting and haddock) have sufficient information to support a strategy.” This is not necessarely true and is too simplictic to justify the scoring. While having an analytical assessment may indicate for example there is catch information to enable an assessment, one may not have data for example on discarding practices, which is a strong component of the management startegy. Sid. The monitoring of retained catches is not suficient to determine levels of mortality at least for dab and flounder, and there is discrepencies between logbooks and landings data on retained species catch, and there is no monitoring at-sea programme. SG 100 is not reached.	We agree with the reviewer’s assessment here. The rationales and scores for Sib, c, and d have been revised accordingly and the PI score as a whole reduced to 85.
2.2.1	Yes	Yes	NA		
2.2.2	Yes	Yes	NA	SIa. I agree with the scoring but several statements should be rephrased. “*the use of trawl and purse seines to avoid bycatch of birds and mammals*” is not a partial management strategy. These are the	We agree with the reviewer and have rewritten 2.2.2. a and c accordingly, however please see response under 2.4.1. pertaining to the MSC defiinition

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
				gears that catch the starget species, they are not chosen specifically because they avoid catching birds or mammals. Also, stating that "*because of the landing obligation there are no punishment for landing herring*" is also incorrect because the catch needs to be acounted for in quota. As stated before I disagree that "*The landing obligation means that there is no direct penalty for landing non-target fish, which reduces the incentive to slip. Therefore, in principle, there will be no incentive to slip an entire catch at sea due to the risk of penalties*." Because it depends on availability of quota and price. The risk of slippage is still present with the LO and this is recognised by the assessment team in the same text. Sic I do not disagree with scoring but again the statement "*There have been no sanctions for noncompliance to the ban on discard in 2015*'" is irelevant since no sanctions were possible.	of "partial strategy" and why the use of particular gears can be included as part of one. No change to the score has been made.

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
2.2.3	No	No	Yes modified Condition 6	Sib More information is needed on the herring assessment to show that the stock status is estimated with a high degree of certainty. Sic If there is questioning on the amount of slipagge that is going on, and that is the main startegy to manage bycatch of herring then one cannot say that the information is sufficient to support the strategy, let alone with a high degree of certainty. SG is maximum 80. Condition 9. The LO and monitoring is compulsory since 2015. Qualitative evidence should be available by the 1st annual audit, while quantitative should be available by the 3rd, instead of showing only on the "4th annual audit of positive evidence that slipping is not occurring in the sprat and Norway pout fisheries".	See response to peer reviewer 1 for a discussion of how herring is handled between the retained and bycatch species components. Additionally, the rationale for SI b has been updated to reflect the concern of the reviewer here. For condition 9, please see the response above to the PR comments on the action plan for this PI.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.3.1	No	No	?	Starry ray and common skate are missing as ETP species (see general comments). SIa. "Independent estimates of absence of bycatch could make this reach SG100" has no reference. Please provide one. Sic On thornback rays and their dependence of sandeel, the reference is old (2010) and the situation could have changed since then, therefore SG80 may not be reached.	These have been added. This comment has been removed Since the populations of both ray species is increasing food limitation is still unlikely. We have added a comment on this and added references to recent abundance estimates from ICES (2015).

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.3.2	No	No	?	Starry ray and common skate are missing as ETP species (see general comments).	See response under 2.4.1. regarding the definition of partial strategy in the MSC context and why gear configuation can be considered as part of this. We have remarked that this measure indeed has been mainly directed at bird populations in the past.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.3.3	No	No	?	Starry ray and common skate are missing as ETP species (see general comments). SIa There is no high degree of certainty on the evaluation of rays populations, not only due to insuficient data but also due to (past) miss indentification issues. SG100 is not reached. Please see latest ICES advice ex http://ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/rjc-347d.pdf SIc If there is no accurate information on mortalities and injuries on all ETP species and SIb only reaches (correctly) SG80 how can there be suficient information to support a harvest strategy and evaluate it with a high degree of certainty? SG100 is not reached.	Starry ray and common skate have been added. This is correct, and the score has been updated to SG80 for skates and rays and the overall score reduced. This is correct. The scoring has been updated to SG80, and the overall score reduced.
2.4.1 bottom touching gear	Yes	Yes	Yes Condition 7		

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
2.4.2 bottom touching gear	Yes	No	No (needs reformulation to a different SI) Condition 8	Although I agree with the argumentation I would score this PI differently: Sib SG80 is reached because there is evidence that if the fishery closes, habitats will recover, while the argument that the MPAs have not beeing implemented is aplicable to Sic (in accordance to the scoring for purse seines – see below) so that SG80 is not reached.	This is a reasonable argument. We have "reversed" the scorings of the two guideposts.
2.4.3 bottom touching gear	Yes	Yes	Yes Condition 9	SIa The information on bottom habitats in the north sea is comprehemsive and there is data from 2012-2014 so the argument of dated data is not suficient to justify only a SG80 score, and a higher score is warranted.	Agreed, SIa has been adjusted to a 100 score and the rationale modified accordingly, however there is no impact on the overall score since the SG80 is not reached for Sic anyway.
2.4.1 purse seine	Yes	Yes	NA		

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
2.4.1 purse seine	Yes	No	NA	SI a and c. The use of pelagic gear is not a partial strategy as the gear is chosen in relation to its target species and not its impact on bycatch. Sic SG 80 may be reached because the impact of purse seine is low due to is minimum contact with seabed.	According to MSC, for a "partial strategy," specific measures may not have been designed to manage the impact on that component specifically, but if such a measure/measures are effective in assistin gthe UoA to achive the SG80 level outcom ePI then this could be considered as a management measure… Therefore, even though the choice of pelagic gear was not specifically designed to protect bottom habitat, it can still be considered as part of a partial strategy. However, there is no 'full strategy' therefore the SG100 is not met, and no change to the score is made.
2.4.1 purse seine	Yes	Yes	NA		

Performance Indicator	**Has all available relevant information been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	**CAB Response**
2.5.1	No	Yes	NA	ICES ecosystem overview is an important piece of information to give a global view of the impact of fisheries and dependence of forage species http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Greater_North_Sea_Ecoregion-Ecosystem_overview.pdf	It is indeed a good overview, that well supports the primary documents used elsewhere in the assessment. We have now referered to the document in the main text.
2.5.2	Yes	No	NA	Sib, c and d The integration of ecosystem models in scientific advice for fishing opportunites does not constitute ecosystem management. Only if the advice is taken to set management measures, such as TACs for example, is the ecosystem advice be possibly considered as ecosystem management. Argumentation needs to be reformulated.	The models provide M2s, which are used to update references points in the fisheries in the North Sea. As the M2s and the reference points are main guides for setting TACs, the models are indeed used as ecosystem mangement. We have now noted this explicitly in 2.5.1a

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
2.5.3	No	Yes	NA	ICES ecosystem overview is an important piece of information to give a global view of the impact of fisheries and dependence of forage species http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Greater_North_Sea_Ecoregion-Ecosystem_overview.pdf	This is indeed a good overview, that well supports the primary documents used elsewhere in the assessment. We have now referered to the document in the main text and in 2.5.3a.
3.1.1	Yes	Yes	NA	Sib Although I agree with the scoring I do not think the mackerel and herring are apropriate examples. This is because the examples given involve several parties while there is only one shared stock (Norway pout, while sandeel is now in question) and the disputes involves (at the moment) 2 parties. However, I agree with the scoring because negotiations between EU and Norway are not easy and in the past there has been no agreement reached before the start of the year (stated in 3.2.2 SIe). Aditionally, in the near future, with the UK likely to join negotiations, the tendency is to get more dificult.	Thank you. Although this PI is generally about EU fisheries policy and governance, we agree that it would be more appropriate to use the example EU-Norway agreements in reference to dispute resolution in scoring issue b and the rationale has been amended accordingly.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.1.2	Yes	Yes	NA		
3.1.3	Yes	Yes	NA	.	
3.1.4	No	Yes	NA	The references to the EFF are outdated as it was reformed and it is now the EMFF. Also disagree that in the sprat fishery the LO will disincentive slippage because there might be a lack of available quota to land discards.	References to EFF have been changed to EMFF and the description of the operational structure of the fund has been updated (as well as the references to enacting legislation). Regarding the discussion of the Landings Obligation, the idea of how it could work as an incentive is described, however it is already noted that it is not possible yet to know whether it actually does act as a positive incentive for sustainable fishing or not. We agree with the reviewer that it may not, but does have the potential to.
3.2.1	Yes	Yes	Yes Condition 9	Reference to several stocks needed (first paragraph)	Corrected, thank you.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.2	Yes	Yes	NA	SIa. Update the example for Norway pout as sandeel may not be shared with Norway in the future.	Done, thank you.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.3	Yes	No	NA	SIa - Also with the introduction of LO there is no comprehensive monitoring control and surveillance system to detect infractions on the LO. Sib Agree that SG 100 is not met, need to update table heading for N and total PI score needs to be revised to 80. Sic. "*The landing obligation means that there is no direct penalty for landing non-target fish, which reduces the incentive to slip. Therefore, in principle, there will be no incentive to slip an entire catch at sea due to the risk of penalties.*" Is incorrect, because the vessel still needs to have quota for the landing of non-targetd fish, which may not be available or can be costly. Either way there is a strong incentive to continue slip. Note also that LO related sanctions were delayed to 1/1/2017 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0812&from=EN so the statement from AgriFish that "*There have been no sanctions for noncompliance to the ban on discard in 2015*" is irrelevant.	Thank you for noting the discrepancy between the score and the rationale for Sib; this has now been corrected and the overall score for the PI revised to 80. The issue of incentives to slip relative to the LO have been covered in PI 3.1.4. The issue of likelihood that a haul would contain primarily non-target fish is discussed under SId, but we agree that the quota for herring bycatch in particular could be an issue and this is also discussed already.

Performance Indicator	Has all available relevant information been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response
3.2.4	Yes	Yes	NA		
3.2.5	Yes	Yes	NA		

Table 40 For reports using the Risk-Based Framework:

Performance Indicator	Does the report clearly explain how the process(es) applied to determine risk using the RBF has led to the stated outcome? Yes/No	Are the RBF risk scores well-referenced? Yes/No	**Justification:** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary. Note: Justification to support your answers is only required where answers given are 'No'.	CAB Response:
1.1.1 Sandeel 4/Sandeel 6	Yes/Yes	Yes/Yes		
2.1.1				

2.2.1				
2.3.1				
2.4.1				
2.5.1				

Optional: General Comments on the Peer Review Draft Report (including comments on the adequacy of the background information if necessary) can be added below and on additional pages

The report needs to be reviewed for consistency between references to the CFP and its related mechanisms. For example, in the report Regional Advisory Council's (RACs) are referred to, but in the scoring tables the new designation of Advisory Councils is stated. The same for European Fisheries Fund which is now called European Maritime and Fisheries Fund, but where the old version is quoted in the scoring tables.

RESPONSE: Thank you for picking up these inconsistencies, they have been corrected throughout the report and updated references have been added.

Regarding the Norway pout P1 scoring, the stock assessment and advice used is of 2014 (e.g. Figure 16, Table 11) which is an old assessment, and the 2015, which was available on the 14 October 2015 should have been used. Although the SI scoring may not change significantly it is crucial to use the most updated advice available. In addition, the references to ICES advice are unclear, as 2014 values are presented but ICES 2015 reference is given (e.g. Figure 16, Table 11). So in summary, at least the 2015 ICES stock assessment and advice should be used to rescore P1 for Norway pout, but at this point the 2016 November advice is also a possibility.

RESPONSE: See response to the other reviewer on this point as well. When the report was completed the most recent data available was used. In the meantime, there have been updated assessments, and the P1 assessor has reviewed these and incorporated the results where they have led to a change in the score (e.g. for sprat in P1 and P2.5), but the additional time needed to fully incorporate them into the report at this stage, with no material change to the outcome, was not available. At the first surveillance audit, the latest stock assessment advice will be reviewed and the surveillance report will reflect this.

On the P2 analysis, the information and justification provided in many scoring tables is often not sufficient to justify the scoring given. The ETP species list considered is incomplete as it does not include the EU prohibited species list under art 12 of TAC and quota regulations (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0104&qid=1396448139289&from=EN) which includes starry ray and common skate that are both in a depleted state (ex http://ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/rjr-234.pdf). The status of ETP species should also refer to the most updated scientific assessment, namely by ICES. Finally, the statement "the stock is managed by ICES" is repeated in many SIs. ICES is a scientific institution. Stocks are managed by management authorities, in this case the EU and Norway.

RESPONSE: See specific responses in the PI table where these points are raised. Two species have been added to the ETP category, and references to ICES "management" have been corrected.

Smaller comments:

- Table 33 – Only North Sea sprat stock is under assessment (not Skagerrak)
- Some text editing needed as there are several typing mistakes and unclear references (e.g. ICES, 2015).

RESPONSE: Thank you, the report has been tidied up for accuracy and consistency.

Appendix 3 Stakeholder submissions

Written submissions were received during the PCDR comment period from Birdlife International, Whale and Dolphin Conservation and the MSC Fisheries team (as Technical Oversight comments). In addition, the Peer Review Draft report was reviewed by Accredtation Services International (ASI) as part of their annual audit activities required to monitor our accreditation to carry out MSC assessments. Although technically not public comment, as some of ASI's review has resulted in changes to the assessment report, we decided to include it here with our responses for transparency. Our responses to the comments received are interspersed with the comments where relevant in most cases in ***green bold italic*** text.

RSPB/BirdLife International Response to the DFPO and DPPO North Sea, Skagerrak and Kattegat Sand Eel (*Ammodytes* spp), Sprat (*Sprattus sprattus*) and Norway Pout (*Trisopterus esmarkii*) Fisheries MSC Public Comment Draft Report

Broad comments regarding ETP species

Categorisation of Endangered, Threatened and Protected Species
Firstly, as the fishery is being assessed against v2.0 of MSC's Certification Requirements, it is important to include all species listed as threatened (Vulnerable, Endangered or Critically Endangered) on the IUCN Red List. For seabirds, this includes Atlantic Puffin (Vulnerable globally; Endangered in Europe [ref: http://www.birdlife.org/sites/default/files/attachments/RedList%20-%20BirdLife%20publication%20WEB.pdf] – a seabird highly dependent on sandeels during the summer (see Harris & Wanless 2011) and Northern Fulmar (Vulnerable in Europe and another sandeel predator, see Phillips et al, 1999: https://www.researchgate.net/publication/225742569_Diet_of_the_northern_fulmar_Fulmarus_glacialis_Reliance_on_commercial_fisheries) in addition to kittiwake. Evidence has also recently emerged of predation on sandeels by Atlantic puffins wintering in the Faroes (Harris *et al.* 2015) so a certain level of consumption throughout the year in the North Sea cannot be discounted. Therefore, although many of the points made throughout this response are focussed on Black-legged Kittiwake- (as a surface-feeding, sandeel-dependent seabird with limited foraging 'flexibility' (Furness and Tasker 2000), it is one of the best species for examining response to changing prey populations), similar arguments can be extended to the other species listed above, particularly the Atlantic Puffin. Black-legged Kittiwake is hereafter referred to as kittiwake.

Although they are not currently listed as ETP species, it is of concern to us that other sandeel-dependent seabirds (Razorbill, Common Guillemot, Arctic and Common Terns, Arctic skua) are not taken into account anywhere in the assessment, in spite of the globally important populations found around the North Sea. We query how the CAB (or MSC, if the issue lies in the certification requirements) is able to truly assess impacts when relevant, potentially-impacted species are not factored in.

This assessment was undertaken using the default assessment tree contained within v1.3 of the MSC Certification Requirements. Version 2.0 was only used for the process requirements, per MSC's timeline for transitional arrangements from v1.3 to v2.0. Therefore ETP species are classified as such if they are included in national or

regional legislation as protected or endangered, or if they are listed in Appendix I of the Convention on International Trade of Endangered Species (CITES). The stakeholders are correct that if this assessment had been done under v2.0, any 'out of scope' species (such as seabirds) that are IUCN red-listed would be considered under the ETP component (per MSC FCR SA3.1.5). If this fishery undergoes reassessment in the future, then these requirements (or newer ones) will apply.

In the present assessment, the food needs of sea birds in general (i.e. not ETP species) is covered in Ecosystem Impacts 2.5. They are accounted for in the setting of escapements in the TACs. Because they are not bycatch or retained species in the fishery and also not ETP species, the only place to assess indirect impacts such as competition for prey is in component 2.5 and we are confident that this has been done appropriately and thoroughly. No change to the score or rationale has been made.

Kittiwake foraging distance
It is stated (2.3.1c, p. 87) that "*Even though Dogger bank is at the edge of the commonly accepted foraging range for Kittiwakes (50 km), tagging data show that some individuals go that far, likely to forage (Birdlife 2015).*" In our view, this statement does not accurately capture the state of knowledge around kittiwake foraging ranges or the importance of the area to birds from eastern England, and for the following reasons:

Estimates published by Thaxter *et al*. (2012) suggest a maximum foraging range of 120 km, and a mean maximum (the mean of the maxima reported from a number of colonies) of 60.0 ± 23.3 km. Hence, the 50 km range quoted by the PCDR significantly underestimates both of these metrics.

Further, data acquired by the RSPB (UK Partner of BirdLife International) from GPS tracking of kittiwakes from colonies at Filey Brigg and Flamborough Head, both of which are close to the Dogger Bank, show a maximum range of 226.9 km, a mean maximum range across birds of 94.7 ± 55.9 km, and a mean range across trips of 46.6 ± 53.9 km (estimates calculated from 487 trips recorded from 154 birds, tracked during 2010 – 2015 breeding seasons; data supplied by Ellie Owen, RSPB). This suggests that even the estimates of Thaxter *et al*. may underestimate the true foraging range of kittiwakes.

Using the same RSPB data, home ranges (95% kernel density estimate) show considerable overlap with the fishery (Fig. 1). The western and southwestern edges of the Dogger Bank provide some of the most important commercial sandeel fishing grounds in the area (e.g. ICES, 2007; Jensen *et al*., 2011). Although we do not have access to VMS data to show overlap directly, this indicates that birds from eastern England face substantial overlap with the western Dogger Bank and its key commercial sandeel fishing grounds.

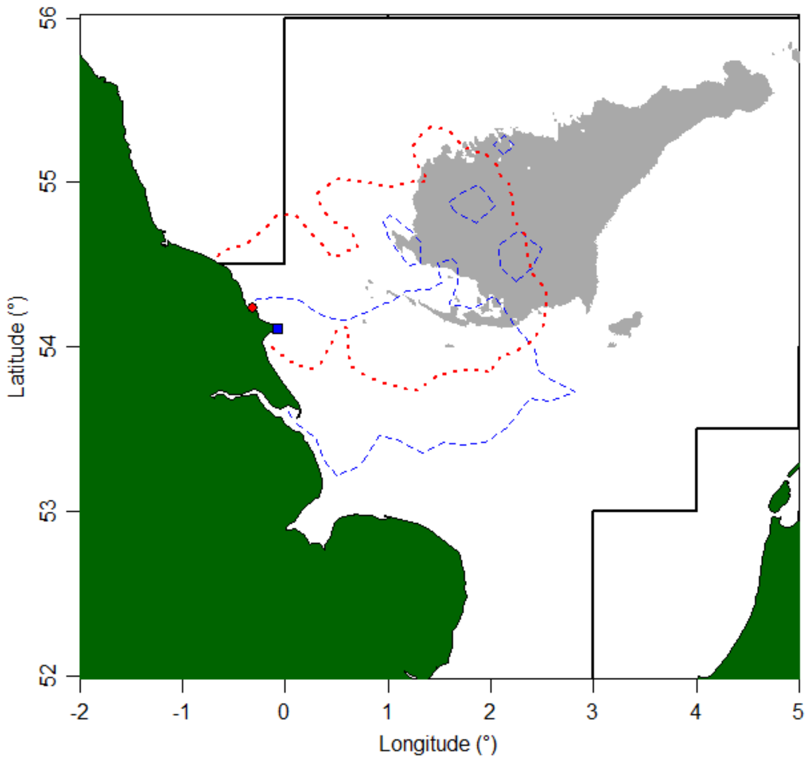


Figure 1. Home range (95% kernel density) estimates for kittiwakes tracked from Filey Brigg (red, dotted line; circle to indicate colony) and Flamborough Head (blue, thin dashed line; square to indicate colony), in the 2010 to 2015 breeding seasons. Thick black line indicates ICES sandeel assessment area SA1. Grey area indicates location of Dogger Bank (derived from GEBCO gridded bathymetric data, www.gebco.net). Figure updated from Carroll et al. (in review).

In the initial (June 2015) BirdLife submission for the DFPO and DPPO North Sea reduction fisheries, kernel density estimates from individual years of tracking from Flamborough Head were provided. These show that the use of these areas is not confined to a single year, but is a regular feature of the foraging behaviour of kittiwakes from these colonies.

Hence, the 50-km kittiwake foraging range stated in the PCDR (p. 87) as "commonly accepted" is an underestimate of known kittiwake foraging ranges, and the assessment does not take into account the evidence that, based on GPS tracking across multiple years and multiple individuals, the Dogger Bank area is used by kittiwakes from eastern England, thus confirming overlap with key commercial sandeel fishing grounds.

We acknowledge that the previous statement of a 50 km foraging range was inaccurate and lacked explicit references to documentation. In particular, the statement did not reflect the ability of kittiwakes to forage much further. The statement also failed to acknowledge that kittiwakes' mean foraging radius is much smaller. We have clarified that statement:

"Kittiwakes have the ability to forage far from their colony, with mean maximum foraging ranges reported between 60 (Thaxter et al. 2012) and 104 km (Soanes et al 2016). However, the average foraging range is much shorter, with a mean between 11 km (Soane et al 2016) and 25 km (Thaxter et al 2012). While the Dogger bank is inside the possible foraging range, they are mostly relying on the coastal sand eel banks closer to shore."

Refs:

Soanes, L. M., et al. "Defining marine important bird areas: Testing the foraging radius approach." Biological Conservation 196 (2016): 69-79.

Thaxter CB, Lascelles B, Sugar K, Cook ASCP, Roos S, Bolton M, Langston RHW, Burton NHK (2012) Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156:53-61.

Seabird predation of sprats
In PI 2.3.1, 2.3.2 and 2.3.3, there appears to be no consideration given to the role of the sprat fishery in ETP impacts. This may be because sprats are considered unimportant for ETPs in the area; this supposition arises because page 94 states "*For sprat and Norway pout, spatial constrained predators is [sic] not an issue.*" The meaning of this sentence is unclear, and no evidence is cited to support it. We must therefore assume that the assessment considers sprats to be unimportant to ETPs.

If this is the implication intended, it is inaccurate. There are limited datasets to establish the importance of sprats to North Sea predators, but two studies of kittiwake diet in eastern Scotland indicate that sprats are commonly taken. Lewis *et al*. (2001) show clupeids were present in 10-20% of kittiwake regurgitates collected on the Isle of May between 1997 and 2000. Bull *et al*. (2004) show that at Inchkeith and Inchcolm, clupeids were present in 67 – 94% of regurgitates. In both studies, it is acknowledged that clupeid species could not all be identified, but the authors note that they were "almost entirely sprats" or "probably mostly small Sprats." Equivalent datasets are unavailable from elsewhere in the North Sea, but in the Irish Sea, sprats constitute the main component of kittiwake diets (Chivers *et al*., 2012). Consequently, sprats can and do constitute an important dietary component to seabirds; the impact of the fishery on ETPs should be considered.

Kittiwake feeding on sprat has indeed not been mentioned in the assessment report. We have corrected this omission on page 88 of the Final Report and Determination:

"Sprat are also likely present in their diet (Lewis et al, 2001M; Bull et al, 2004; Chivers et al 2012). The sprat fishery is concentrated on the coast of Jutland, with only a minor effort on Dogger bank, so there is no conflict between the sprat fishery and kittiwake foraging."

<u>Concerns over scoring under Performance Indicator 2.3.1 (Pp 203-209)</u>

Scoring issues (a & c): For kittiwake, the fishery is considered by the CAB to meet SG80 – i.e. '*That the effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species*'. We agree that the major concern for kittiwakes (and other sandeel-dependent seabirds) is indirect impacts through prey depletion rather than direct impacts. However, we do not agree that the effects of the fishery are 'highly likely' to be within the limits required; the species is listed as 'Vulnerable' on the European Red List owing to major declines - a 44% reduction in the UK from 1998-2002 to 2015 (JNCC, 2016).

While climate change-related impacts are thought to have been a key driver of seabird declines around the UK, sufficient sandeel biomass and fishing mortality of sandeels have also been shown to influence kittiwake breeding success in numerous cases: Daunt *et al.* (2008) demonstrated the effect strongly for the Isle of May; Frederiksen *et al*. (2006) show positive relationships between an index of sandeel biomass and kittiwake breeding success in eastern Scotland; Furness (2007) shows kittiwake breeding success on Foula increasing non-linearly with estimates of sandeel biomass. While management of the fishery has improved in recent years, recent work (Cook *et al*., 2014) clearly shows that between 1986 and 2010, there were several years - including as recently as 2009 - in which less than 1/3 of long-term sandeel biomass was left remaining for top predators (the ‘one third for the birds’ rule, as proposed in Cury *et al*., 2011; which has subsequently been suggested as not precautionary enough, as per the Lenfest work referenced in the PCDR (Pikitch *et al*., 2012)).

Cook *et al*. (2014) note that “*the breeding failure indicators and kittiwake breeding success indicator showed consistent negative relationships with fisheries pressure, represented by the interaction between sandeel population size and the proportion of the population harvested*”. This paper was referenced in the initial BirdLife submission (June 2015), but is conspicuously absent in the PCDR. These peer-reviewed examples (1) provide evidence that kittiwake breeding success in the North Sea is related to sandeel biomass (which the PCDR does not appropriately acknowledge); and 2) demonstrate that the fishery can, under certain circumstances, take a sufficient proportion of biomass that there are negative impacts on kittiwakes. These considerations, in turn, cast doubt on the justification for reaching SG80 for these two scoring issues.

The paper by Cook et al (2014) is indeed not referenced in the assessment. This was because we did not find correspondence between the conclusions in the text and the data presented in the paper. Further, it is unclear from the paper which data of abundance and fishing mortality was used for the sandeel – the paper refer to the entire North Sea, but the relevant part of the stock in this context would be the Dogger bank. Nevertheless, let’s assume that the status of the entire North Sea stock is indicative of the Dogger bank stock. The paper show a small correlation between sandeel population size and breeding success indicators, which is not significantly different from zero. It shows a significant negative correlation between fishing mortality and breeding success. The R^2 of both correlations is between 0.12 and 0.18, which is very small. As it is the population density which matters for feeding by Kittiwakes, the analysis could be used as evidence for the absence of a relation between sandeel density and Kittiwake breeding success. However, given the uncertainty over the relevance of the sandeel data for Dogger bank and the low R^2 of the relation meant that we did not find it a strong evidence to put forward.

The importance of sandeel for kittiwakes is acknowledged in the statement: “Kittiwakes are well known to depend on forage fish, in particular sandeel, and their breeding success may be affected if sandeel populations are depleted (ICES 2013).” We have now added some further specific references: Frederiksen et al 2006 and Furness, 2007).

In addition to this peer-reviewed evidence of impact, in June 2015 BirdLife provided preliminary work (now submitted for publication (Carroll *et al*. in review)) to the CAB in the stakeholder consultation phase. While the assessment acknowledges that we have raised concerns, the CAB has misrepresented our submission by selecting portions of text, with context removed, to support a >80 score under scoring issue (a) and (c). Our original text stated:

Why there is such a strong signal from fishing mortality with a two year lag is unclear. We would assume that the relationship acts in some way through spawning stock biomass, although the relationship between breeding success and SSB is relatively weak (Kittiwake breeding success increases with SSB but the relationship is strongly influenced by one year of high SSB, and when the trends over time in SSB and breeding success are removed, the relationship is no longer significant: Matthew Carroll, RSPB).

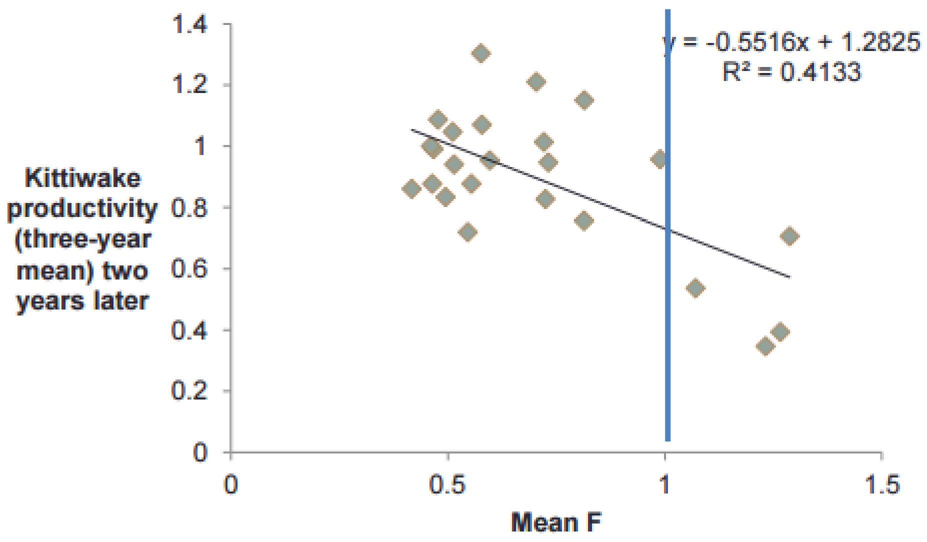
The PCDR (p.87) has paraphrased this as:

The reason for the two-years lagged response is unclear, and indicates that breeding success is not directly affected by the impact of fishing on the biomass of sandeel on Dogger bank. This absence of a direct effect is also confirmed in the report: "the relationship between breeding success and SSB is relatively weak … and not significant".

The PCDR crucially misrepresents BirdLife's original text by removing our caveat *'Kittiwake breeding success increases with SSB but the relationship is strongly influenced by one year of high SSB, and when the trends over time in SSB and breeding success are removed...'* This caveat is important: the detrending approach used could avoid spurious correlations, but could also eliminate real signals in complex ecological datasets such as this (see, e.g., Votier *et al*. (2008) and Wynn *et al*. (2008)). Hence, whilst we must be cautious about interpreting the SSB result due to the lack of significance *after detrending*, this resolutely does not confirm the absence of a relationship altogether. Moreover, the PCDR under-emphasises the key result from our report: there is a **statistically robust relationship between fishing mortality and seabird breeding success, that is present even after detrending**. Taken alongside the Cook *et al*. (2014) paper, a robust negative relationship between fishing pressure and kittiwake breeding success is demonstrated, which does not support the >80 scores awarded for 2.3.1(a) and (c), both of which should receive sub-80 scores.

Given the correlative nature of the work we presented, we were appropriately cautious about the mechanism underpinning this relationship. However, even if the exact mechanism underpinning the relationship remains uncertain (due in large part to the absence of sufficient fine-scale sandeel data from the focal area), the statistically robust relationship with fishing mortality, taken together with the relationship shown by Cook *et al*., suggests that **there are not sufficient grounds to claim that the fishery is "highly unlikely" to create unacceptable impacts to ETP species** (scoring issue (2.3.1 (c)) or 'highly likely to be within national or international limits for protection of ETP species' (scoring issue (2.3.1 (a)). Indeed, the weak logic of the CAB's case for these scores is highlighted in the oxymoronic rationale for 2.3.1(c) - 'The effects of sandeel fishing is (*sic*) therefore **highly unlikely to create an unacceptable impact**, **but it cannot be stated that there are no significant detrimental effects with a high confidence** before the effect is fully documented. SG80' (our emphasis). If there is not high confidence, it cannot be said that it is 'highly unlikely' or even 'unlikely' that the fishery is creating unacceptable impacts. Indeed, the available evidence suggests it is possible that the converse is true.

The key evidence presented by the BirdLife report is the correlation between lagged productivity and sandeel fishing mortality. It is reproduced below:



Clearly, in the years where the stock is overfished and F>1 (blue line) there is a negative impact. These points correspond to the years before 2004. Indeed, had the MSC assessment been performed in that period, the scoring would have been very different. However, in the recent decade F < 0.7. For those exploitation rates the evidence presented by BirdLife shows no relation between fishing mortality and kittiwake productivity. However the uncertainty about the evidence has to be acknowledged, which is why an SG80 is appropriate rather than 100. To avoid the misrepresentation of the BirdLife report we have removed the following citation from the report text and scoring table altogether.

The conclusion in 2.3.1c is indeed bizarre when read out of context. The statement is simply a repetition of the MSC criteria for the guidepost as given in the headings of the table, and meant to distinguish between the certainty required at the SG80 (highly unlikely) vs SG100 level (high degree of confidence). No changes to the scoring have been made.

So while it is right for the CAB to note that fishing mortality has dropped below 0.66 in recent years, it is apparent from the evidence presented in the PCDR that **this is not the consequence of the needs of seabirds and marine mammals being considered in TAC setting**;

The motivation of a management action is not important, what matters is the outcome for PI 2.3.1. (although in 2.3.2 the purposefulness of management measures is part of defining measures vs partial strategy vs strategy). The management of the sandeel stock according to MSY results in low fishing mortalities. This benefits the fisheries yield as well as the dependent predators. Should future management not respect MSY, this will be monitored and would prompt reevaluation of the fishery during surveillance audits and reassessment with respect to impact on the sustainability of the stock and impact on dependant pretators. No change to the score or rationale has been made.

from Section 3.4.4 of the report, on ICES' multi-species model: "*The modelling procedure and incorporation of M2s into single-species fish stock assessments is likely to ensure that* *depleted dependent fish predators are allowed sufficient food to not impede recovery.* ***For other dependent species, such as birds and mammals, such calculations are not performed***" (our emphasis). This highlights that rather than actively lowered fishing mortality in response to seabird declines, the TAC has been coincidentally low in recent years, and provides no guarantee that fishing mortality will not rise to problematic levels again, as seabird and marine mammal depredation of the stock are not considered. This issue is discussed greater detail under our response to the 2.3.2 scores.

In the report the highlighted statement is followed by: "The assessment team has dealt with this by also examining the population status of dependent predator species and the likelihood of fishery impeding recovery of threatened species.", which explains how other dependent species are assessed. Nevertheless, the highlighted statement is inaccurate. The consumption of non-fish predators are actually incorporated in the M2 calculations. We have therefore corrected the sentences to: "For other dependent species, such as ETP birds and mammals, the assessment team has additionally examined the population status and the likelihood of fishery impeding the recovery of depleted species." No changes to scoring have been made.

Concerns over scoring under Performance Indicator 2.3.2 (Pp. 209-211)

Guidepost 2.3.2a (and related text on p.80)

It is stated in the Justification (p. 209) that '*The measures to avoid indirect impacts is* [sic] *a closure of the fishery if negative impacts are documented, e.g. failure of breeding success due to lack of food from forage fish. An example is the closure of the sandeel fishery at the Firth of Forth. This measure applies mainly to the bird species (no closed areas have been proposed to protect skates and rays)*.' We contest the implication here of a systematic, responsive ETP-based strategy for closure of a fishery when negative impacts on seabird breeding success are documented. In the case of the Firth of Forth closure, this was enforced after prolonged advocacy in the 1990s linking the sandeel fishery offshore of that area to the chronic decline in breeding success and numbers of kittiwakes on the coast. In 1999, ICES accordingly recommended closure of ca 20,000km2 of the North Sea off the East coast of Scotland (south to Northumberland) as a precautionary measure. Breeding success criteria to trigger opening and closing of the area were proposed by ICES but never formally adopted. However ICES' closure recommendation was proposed by the European Commission's to the Council of Ministers in Dec 1999, was approved, implemented in 2000, and has remained in place since.

The view of the team is that the issue here is not the way the closure came into place and remained in place. The fact is, the closure did indeed happen, based on a rationale specific to bird species, and it has set a precedent for future management actions.

The related text on p. 80 states that '*The assessment team has deal* [sic] *with this by also examining the population status of dependent predator species and the likelihood of fishery impeding recovery of threatened species.'* No detailed explanation is given of what this statement means. What evidence has been sourced to examine the population status of dependent predators to a potential fishery impact?

The statement is a sweeping reference to the assessment of all ETP predators in 2.3 and other dependent predators in 2.5. The references and details are provided in those sections.A statement to this effect has been added to the text (now page 83).

In this regard we would point out that, notwithstanding JNCC's Seabird Monitoring Programme (SMP), there has been no comprehensive national census of the UK's breeding seabirds, including on the North Sea coast relevant to this fishery assessment, since 1998-2002.

This is indeed a relevant point that we have overlooked. Breeding abundance is continuously monitored and publicly available as part of the SMP. This information clearly indicates that many ETP bird species are declining in abundance. Currently, this information is sufficient and we have not changed the scoring. Nevertheless, it is important that the censuses are also updated on a regular basis. We have added a recommendation to this end, similar to how we recommend an update of the stomach data information for the multi-species modelling.

On p. 209, we find at best over-simplistic, at worst misleading the statement: *'A further measure is the setting on* [sic] *limits on harvest rates informed by the food requirements of dependent predators, including ETPs, informed by multi-species modelling.'* We acknowledge that the estimate of the quantity of sandeels consumed by dependent predators is used to estimate M2s, in turn to estimate sandeel stocks. However, this does not involve any assessment of the **actual food requirements** of dependent predators: seabirds need a much larger biomass of sandeels in the sea than the amount they actually eat - they can't be expected to find every sandeel in the sea, rather they need a certain threshold density to permit energetically viable foraging (Furness (2007): "minimum densities of food required … are orders of magnitude more than the consumption by seabird populations"). Hence, as the estimation of M in the assessment model does not correspond to the actual sandeel stocks required by dependent predators, predator needs are not used in setting sandeel harvest.

It is indeed correct that the pertinent issue is the population density of sandeel, and not the mortality that kittiwakes inflict. Further, the needed population densities is not explicitly accounted for in the procedure used in the calculation of escapements. We have reformulated the sentence to: "A further measure is the harvest limits, which are determined on the basis of the food consumption by dependent predators, including ETPs." No change to the score has resulted.

The annual consumption of sandeel by all birds species is 100-200 kT, while the consumption by other dependent predators is at least an order of magnitude larger. The escapements are therefore at least an order of magnitude higher than what would account for the consumption by birds alone. However, for a specific colony of e.g. kittiwakes, it is the local and not the average density of prey which matters. As per the answers above we do not find it substantiated that the population density of sandeel and the fishery on Dogger bank negatively affects the coastal colonies of kittiwakes, when the sandeel is harvested according to MSY. No change to the score has been made.

Our concern that the sandeel harvest may not be sufficiently precautionary in terms of escapement levels for seabirds is heightened by the 2016 ICES benchmark assessment (Bergen, 31 Oct – 4 Nov). The relevant part of an advanced draft of the executive summary of the ICES Benchmark Report (publication imminent) is as follows:

"It was agreed that the SMS model should be used for stocks in areas SA1, SA2, SA3 and SA4 but that data were inadequate for an analytical assessment for areas 5, 6 or 7. However, the External Experts identified a problem with the SMS model that needs to be addressed: the model is not designed to provide reliable estimates of variance, and the variance estimate derived from the model is a critical component of the escapement strategy TAC setting process. Much variance in the real world is not included in the SMS model (an obvious example being uncertainty in sandeel consumption by predators, and hence the variance around the estimate of M) and so variance is underestimated by

the model, which results in the TAC being set at a higher level than should be the case to achieve the desired metric of less than a 0.05 risk of SSB falling below the reference point threshold.
It was agreed that the SESAM model seems to be valuable as an exploratory tool. It is possible that SESAM may provide a way to estimate variance with a more comprehensive coverage of input parameter variability and uncertainty.
In view of evidence derived from analysis of kittiwake breeding success, it was agreed that assessments in SA1 and SA4 should at least take note of total stock biomass thresholds recommended by recent published reviews to avoid depletion of the stock below levels likely to have adverse effects on dependent predators.
A number of recommendations and further research needs were listed for consideration."

We are quoting this because it draws strong attention to the external expert views and are assured it is unlikely to change substantially from the final benchmark report. It highlights that some inputs (such as the estimate of M) in the model are treated as if exactly known despite being highly uncertain. By underestimating variance and so tending to underestimate Bpa, the model allows a larger TAC. We note that this probably contributes to the observed fact that SSB has fallen below Bpa more often than should be the case on the basis of the assessment (which should keep biomass above Bpa in 95% of years).

The benchmark assessment is particularly important for SA1 where the greatest sandeel fishing effort is currently concentrated. In addition, SA1 does not benefit from any potential advantage accruing from the fishery closure in SA4 (notwithstanding limited transfer of larvae from eastern Scotland (Christensen *et al.*, 2008)). Given that, as correctly stated (p. 210), the population of kittiwakes in the Firth of Forth colonies continues to decline in spite of the closure (which is not to disabuse the need for it), this places an even greater onus on the need to set sufficiently precautionary annual TAC levels elsewhere in SA1 (and in other management areas) to ensure an adequate escapement level for seabirds and other dependent predators. In this regard, we strongly invoke the MSC standard which calls for low-trophic level fisheries to maintain stocks at default 75% of the unfished biomass compared to default 40% in non LTL fisheries (copied below from the Certification Requirements):

"MSC defines the default precautionary reference points for management of key LTL species as either a biomass that is 75% of the unexploited level in the system, or a target exploitation rate of 0.5FMSY or 0.5M (natural mortality of the species). In fisheries where there is sufficient understanding of the system, these default reference points can be adjusted to specific levels appropriate to the fishery, which are shown not to have adverse ecosystem effects through the use of credible ecosystem models (as defined in SA2.2.13)."

The CAB does not reference this requirement or the underpinning science commissioned by MSC (Smith *et al.*, 2011). The CAB's justification for this appears to be that, although ICES does not calculate an unfished biomass (so we are unable to examine if the stock is at 75% of this or not), the '*biomass fished in most cases are (sic) less than the biomass removed by natural causes…and in most cases much less*'. Given the gaps in assessing non-fish predator requirements in ICES' model, as identified at the recent benchmark assessment, we do not accept that the ecosystem model can be defined as 'credible'.

Taking all these factors into account , we dispute the assignment of >80 scores to 2.3.2a and 2.3.2b and consider the score should be lower in both cases.

We did not have the draft 2016 benchmark assessment available at the time we were evaluating this fishery. In addition, it is generally not good practice in MSC assessments to draw conclusions from draft documents. This benchmark assessment will be accounted for in the first surveillance

audit for this fishery. Nevertheless, it is the view of the assessment team that the analysis in the draft report confirms the status and credibility of the multispecies modelling approach rather than discrediting it. First, the concern is about the variances, a second-order measure, and not about the means. The focus on variances implies that the mean values of the predictions are accepted as credible. Second, the text documents that there is indeed focus on obtaining the best possible estimates of predation mortality to incorporate proper escapements in the TACs. The multispecies calculations are not just a show but are considered and are continuously evaluated and refined as an integral part of the advice and management procedure.

The team therefore maintains that there is sufficient understanding of the multispecies aspects of the North Sea ecosystem and that the ecosystem models are sufficiently credible to be used for setting reference points and escapements. This is consistent with MSC requirements for setting reference points for key low-trophic-level species (although they apply in PI 1.1.2 rather than in Principle 2) because CB2.3.20 and subclauses are met (MSC CR v1.3 Page C153). No change to the scoring has been made.

Regarding 2.3.2c, we take issue with the Justification statement: '*There is concern about the possible indirect impact on kittiwakes from the fishery on Dogger Bank. They are not recovering, which could argue for a closure for the fishery on Dogger Bank. The evidence for the detrimental effect however shows that current fishing practice is not likely to blame (see 2.3.1a).'*

We make two points:

1) BirdLife is not necessarily arguing for a closure of the fishery. In our evidence (June 2015) we called for: (*a) a more precautionary approach to sandeel fishing effort, and (b) the need for seabird (and especially Kittiwake) productivity in nearby colonies to be used systematically as an indicator to inform future management of the fishery.* **In order to allow the fishery to meet SG80, a condition should be raised to ensure a more precautionary approach to fishing effort in the short-term, while the needs of seabirds and other dependent predators are built into the TAC-setting process.**

2) We cannot support the statement that *'The evidence for the detrimental effect however shows that current fishing practice is not likely to blame'.* We acknowledge that the lowest productivity of kittiwakes is associated with the high peak in fishing mortality in the late 1990s to early 2000s, and that in recent years fishing mortality has been lower. However, in 2006, 2009 and 2011, fishing mortality was around or greater than 0.6; this is close to the level at which the breeding success-mortality relationship indicates kittiwake breeding success would fall below the long-term mean (which itself is likely to be depressed by the occurrence of years with very low productivity). Moreover, if the long-term reduction in sandeel SSB, and lack of subsequent recovery, is linked to fishing practices, the lack of recovery in seabird breeding success may indeed have been influenced by fishery practices (see above). Hence, whilst we welcome reduced fishing mortality in recent years, whether this is sufficiently low to accommodate the needs of dependent predators is not clear and requires further exploration (i.e. as per the condition we suggest in (1) above).

The needs of dependent predators are already accounted for as part of the TAC setting process which has been described in great detail throughout the report. That procedure is constantly being refined. Clearly, kittiwake breeding success suffers when sandeel populations are overfished and depleted. However, the assessment team do not find that sufficient evidence has been presented to link kittiwake

breeding success (or another indicator of population size and health) to sandeel abundance on Dogger bank or fishing mortality when sandeel is sustainably harvested. Therefore incorporating kittiwakes directly as an indicator under the current management regime is not justified. There has been no change to any score given.

Regarding 2.3.2d (p. 211), we note the statement '*Kittiwakes and Roseate terns are declining, however, not due to direct impacts of the fishery.'* In the context of the PCDR, the issue is not whether the fishery is *directly* impacting on the kittiwake productivity and population numbers but whether it is an aggravating factor which calls for further mitigatory regulation.

We assume the stakeholders are referring to the MSC CR, rather than the PCDR here, and the requirement for the evaluation of indirect impacts to ETP species (in 2.3.1d). The term 'direct impacts' as used by the team in 2.3.2d is indeed confusing because it's not meant in the way that direct vs indirect impacts are distinguished within the MSC requirements. We have rephrased this for clarity.

As per previous answers, we do not find that sufficient new information has been presented to substantiate that the current level of sandeel or sprat fishing is an aggravating factor on kittiwake populations. No change to the score has resulted.

Concerns over scoring Performance Indicator 2.3.3 (pp. 212 – 214)

Regarding 2.3.3b, we take issue with the Justification statement: '*The indirect effects of fishing through food competition are quantitatively estimated through correlations between SSB of fish stocks and breeding success (birds), and by estimations of predation mortality of ETPs on the fished stocks (all ETP species). This is sufficient to determine whether the fishery is a threat to protection of ETP species (SG80).'* Here, we repeat our observation (above) of the text on p. 80 which states that '*The assessment team has deal* [sic] *with this by also examining the population status of dependent predator species and the likelihood of fishery impeding recovery of threatened species.'* No detailed explanation is given of what this statement means. What evidence has been sourced to examine the population status of dependent predators to a potential fishery impact? In this regard we would point out that, notwithstanding JNCC's Seabird Monitoring Programme (SMP), there has been no comprehensive, national census of the UK's breeding seabirds, including on the North Sea coast relevant to this fishery assessment, since 1998-2002.

We acknowledge the lack of sourcing of information. We have added references to suitable examples in the text: "The indirect effects of fishing through food competition are quantitatively estimated through correlations between SSB of fish stocks and breeding success (birds, e.g. Frederiksen et al 2006; Furness, 2007; Cook et al 2014),". No changes to scores have been made.

Further, we are not aware of any systematic, current estimation (at least of any great robustness) of the '*predation mortality of ETPs on the fished stocks'.* Accordingly, we recommend a guidepost score <80 for both 2.3.3b and 2.3.3c.

The predation mortalities by ETPs are assessed on a tri-annual basis by the SMS key runs. As argued above, the assessment team finds that this procedure is robust and no change to the score has been made.

Contact
Euan Dunn, Principal Policy Officer
Royal Society for the Protection of Birds

The Lodge, Potton Road, Sandy, Bedfordshire, SG19 2DL
Euan.dunn@rspb.org.uk

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Whale and Dolphin Conservation Comments:

WDC Scottish Dolphin Centre, Spey Bay, Moray, IV32 7PJ, UK
T +44 (0) 791 869 3023 F +44 (0)1343 829 065 E fiona.read@whales.org W whales.org

Amanda Stern-Pirlot
MRAG Americas, Inc.
1631 15th Ave W
Seattle
WA 98119
USA

certification@mragamericas.com
amanda.stern-pirlot@mragamericas.com

10th February 2017

Dear Amanda Stern-Pirlot,

WDC comments on the Public Comment Draft Report for the DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, Norway pout, and sprat Fisheries Assessment

Thank you for the opportunity for WDC to provide comments on this fisheries assessment. Given our area of interest, we have only focused on the marine mammal sections.

We understand that the assessment has identified these fisheries as having the potential for marine mammal bycatch but that there has been no indication of bycatch. However, to the best of our knowledge, bycatch monitoring has not been dedicated in these fisheries although sandeels, sprat and Norway pout are all important prey species for several marine mammal species (particularly sandeels). We would therefore strongly recommend that the fisheries independently monitor marine mammal bycatch, and other direct and indirect interactions.

It is not correct to state that '*Seals are mainly coastal and therefore not expected to interact directly with the fishery.*' Grey and harbour seals haul out on land, but they are well documented to forage offshore. Grey seals tagged off the east coast of England travelled regularly travelled 230km out to sea from their haul-out site whilst harbour seals in regularly travelled 165km out to sea (e.g., Russell and McConnell, 2014 and references therein).

Overall, should the fisheries be awarded MSC certification, it should be on the condition that the fisheries will adequately monitor bycatch to robustly provide assurance that there is no marine mammal bycatch. MSC should ensure that marine mammal bycatch monitoring is reported to the relevant authorities (e.g., member state governments) annually.

We hope you find these comments useful and would be happy to discuss these comments further.

WHALE AND DOLPHIN CONSERVATION
WDC

A world where every whale and dolphin is safe and free

WDC Scottish Dolphin Centre, Spey Bay, Moray, IV32 7PJ, UK
T +44 (0) 791 869 3023 F +44 (0)1343 829 065 E fiona.read@whales.org W whales.org

Yours Sincerely,

Fiona Read

Policy Officer – End Bycatch

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Response: With regard to references to seals being mainly coastal, the stakeholder is correct to point out the long ranging foraging behaviour and therefore potential to compete with these offshore fisheries for prey. However, since the populations of these seals are increasing throughout the area, we still conclude that the fishery is not having significant negative effects on population sizes due to competition for prey. We have changed the text in two places as follows, but no scoring changes have resulted:

- ***On page 87: "Harbour and grey seals are associated with coastal areas (Søgaard et al 2015), but they can forage far from the coast, for example tagging data show how harbour seals regularly use the Dogger Bank as a feeding area (Debbie and MacConnell)."***

- ***In the 2.3.1 scoring issue B table (page 208): "Seals forage sufficiently far from shore to compete with the fishery, however they not found to be significant predators on sandeel, sprat or Norway pout by Mackinson and Daskalov (2007). Further, since populations are increasing there are no significant negative effects of the fishery."***

Regarding monitoring of interactions with other marine mammals, we have described in the Principle 2 background section how these fisheries monitor interactions, both direct and indirect. Though direct intractions are negligible (see full explanation on page 86), the Danish vessels signed up to DFPO all keep voluntary logs of marine mammal and other endangered species interactions. This is not fishery independendent, but this, combined with the other data available on these fisheries with regard to mammal interactions, means that they pass the MSC standard without conditions. The monitoring and management of potential indirect effects is also described on page 86. Although the fishery does pass these PIs unconditionally in relation to indirect effects as well, we did provide a recommendation that stomach contents data be updated in order to better inform the multi-species statistical models

and natural mortality estimates. Overall, since the fisheries meet the ETP requirements regarding mammals without need for conditions, it is outside the ability of this process to mandate other forms of monitoring as described by WDC or any other additional measure. No changes have been made to scoring or rationales.

MSC Technical Oversight comments:

MainID	21114
SubID	25876
PageReference	13, 80, 81, 82, 83, 107, 108
Grade	Minor
RequirementVersion	FCR_7.12.1.3 v2.0
OversightDescription	Section 3.4.5.1 on Retained Species demonstrates that several non-target species are harvested. Section 5.3 on IPI only mentions sandeel species. The report is not clear on how the non-target species (bycatch) that is retained (pages 81-82) relate to the potential risk of mixing certied and non-certified catch and whether traceability needs to be considered for any catch being sold onward as certified. Therefore, greater clarification is required in Table 33 on this and how it relates to non-certified species, and whether they are/need to be separated from those in the UoC. It is understood that as a reduction fishery, it may well be that the entire haul is placed in the hold and landed, and it is not viable to separate the retained species from target (UoC) species. This raises the question of whether such retained species (with exception of all species of sandeel that are not A. marinus) - should be considered as IPI (as per FCR v2.0 7.4.13.1)?
Pi	
CABComment	This point was also initially raised by ASI during their audit of the peer reivew draft report but subsequently withdrawn after we better explained the nature of the fishery and pointed out that herring, comprising the majority of the small amount of non-target catch, is already MSC certified thus does not qualify for IPI. The following paragraph has been added to the traceability section of the report in order to be clear that this issue has been activiely considered: *This is a reduction fishery and as such, the majority of the contents from the net are pumped on board vessels into the hold then again onto shore for processing. This means there is a risk of non-target species ending up in the final product. However as shown in Principle 2, the only significant amount of non target catch in these fisheries is of herring, and these herring stocks are already MSC certified, thus do not need to be assessed as IPI. Of other potential retained catch, the quantities are extremely negligible. There are sorting grates in the pout fishery that prevent the*

	small quantity of non-target fish from mixing with pout, and in all fisheries, the pumping mechanism limits the size of fish that can be processed, therefore most of the non-target catch is mechanistically excluded through this means.

Relevant findings and responses from Accreditation Services International (ASI) review of Peer Review Draft Report

While ASI findings are considered confidential between ASI, the CAB, and MSC, in this case, we requested to include them here under stakeholder comments, as they have led to changes to the report, and we wanted to be transparent about the genesis of these changes.

Finding No.	44564	Date detected	18/1/2017
Status	Open	Date closed	
Grade	Minor Nonconformity	Deadline for implementation	17/1/2018
Subject	Process Requirements / Scoring the fishery		
Detected by	Antonio Hervas	Closed by	
Normative Reference and Requirement			
MSC-FCR-V2.0-7.10.7.4 7.10.7.4 Table 4 shall be used to determine the overall score for the PI from the scores of the different scoring elements.			
Description			
In one instance the CAB did not use Table 4 correctly to determine the overall score for one Performance Indicator.			
Evidence observed			
PI 1.1.1 "Stock Status" was assessed using the element approach; Six (6) different stocks of sandeel were treated as six (6) different elements and one (1) overall score was applied to sandeel using the combined element score. Each element scored as follow: 70, 70, 70, 98, 88 and 61. All elements met SG60, a few achieved higher performance, at or exceeding SG80, but most did not meet SG80. Therefore following Table 4 of there Fisheries Certification Requirements v2.0, the core shall be 65. However the CAB awarded a score of 70 was given. This finding is graded as a minor non conformity as it was not systematic and did not have an effect on the outcome of the assessment (i.e. the overall score at Principle level remained above 80).			

Response: Upon review of this table and the subsequent clauses in the MSC Certification Requirements, the overall score given for PI 1.1.1. for sandeel has been changed to 65. This change has been reflected in all relevant tables and the overall Principle level scores for sandeel. In addition, we have requested clarification from MSC on how to use the clauses pertaining to modification of the scores arrived at through the scoring elements combination table, because these are not clear.

Finding No.	44565	Date detected	18/1/2017
Status	Open	Date closed	
Grade	Minor Nonconformity	Deadline for implementation	17/4/2017
Subject	Process Requirements / Confirmation of scope		
Detected by	Antonio Hervas	Closed by	
Normative Reference and Requirement			
MSC-FCR-V2.0-7.4.13 7.4.13 The CAB shall identify if there are catches of non-target (P2) stock(s) that are inseparable or practicably inseparable (IPI) from target (P1) stock(s).			
Description			
They CAB did not identified caches of non-target (P2) stocks that are inseparable or practicably inseparable (IPI) from the P1 species as IPI			
Evidence observed			
Ammodytes marinus is the sandeel species included in the Unit of Assessments as P1 (target) species. The CAB states in the certification report:"... sandeel in the North Sea actually comprise a mixture of at least five species. At least 75% of the sandeel are Ammodytes marinus, with the larger greater sandeel (Hyperoplus lanceolatus) the majority of remainder of the biomass. However, the unquantified balance of the sandeel biomass is comprised of three other species (A. tobianus, Hyperoplus immaculatus, and Gymnammodytes semisquamatus) that cannot be morphologically distinguished from A. marinus without expert knowledge and microscopy or genetic tools. Although A. marinus comprise the large majority of harvests, particularly in the first half of the year when most of the catch is usually taken, fisheries in the eastern North Sea have some potential to take the minor sandeel species in mixed catches..." Therefore, other sandeel species (Hyperoplus lanceolatus, A. tobianus, Hyperoplus immaculatus, and Gymnammodytes semisquamatus) are P2 species. In addition there are a number of other species assessed under the retained species component of Principle 2, which include; herring, blue whiting, dab, whiting, flounder and haddock. Other sandeel species and other species assessed under the retained species component of principle 2 are Inseparable or practicably inseparable (IPI) stocks as: 1.The non-target catch of other sandeel species is practicably indistinguishable during normal fishing operations (certification requirement 7.4.13.1a) The finding is raised as a minor NC as it is considered that the CAB did not fail completely to conform to an accreditation requirement; The CAB addressed the IPI certification requirement. However, as assessed y ASI, incorrectly. A timeframe of three (3) months has been set to provide a CA, PA and RCA, due to the need of providing a correction before the certification decision is made.			

Response: The team considered the state of information with regard to other sandeel species during the site visit when we learned of their existence. Because there is no information on their abundance in the catch relative to that of A. marinus, we were not able to classify them as IPI (MSC requierments are such that IPI species must comprise less than 15% of the catch and we do not have enough information to determine this). Our solution to this problem was to assess other sandeel species under Principle 1, using the Risk-Based Framework after receiving a variation from MSC to use a modified RBF process as described in the RBF section of this report. What we failed to do was to include 'other sandeel species' in the list of Units of Assessment. We have since added an 'other sandeel species' sub-unit of assessment to the fishery after receiving a variation from MSC to do so, and have made this clear in the report as well as through issuance of a special stakeholder notification.

Finding No.	44566	Date detected	18/1/2017
Status	Open	Date closed	
Grade	Major Nonconformity	Deadline for implementation	17/4/2017
Subject	Process Requirements / Scoring the fishery		
Detected by	Antonio Hervas	Closed by	
Normative Reference and Requirement			
MSC-FCR-V2.0-7.10.6.1 7.10.6.1 A rationale shall be presented to support the team's conclusion.			
Description			
A rationale was not provided to support the team conclusion for Principle 1 (Sandeel Unit of Assessment).			
Evidence observed			
The indistinguishable sandeel species that could potentially be caught alongside the target species (A.marinus) were scored using the RBF under Principle 1. (Note that by definition other sandeel species are principle 2 species as they are not included in the Unit of Assessment as target specie). If other sandeel species are treated as P1 species, then each of the Performance Indicators of Principle 1 should explicitly refer to this "element" of the assessment. However, the element "other sandeel species" only was scored for PI 1.1.1 (and the PIs for which the default score is 80 due to the use of RBF under PI 1.1.1). No score for the element "other sandeel species" was provided for PI 1.2.1, PI 1.2.2 and PI 1.2.3. This finding is graded as a major NC as in a repetitive manner the element "other sandeel species" was not considered in Principle 1´s PIs. This poses a risk to the overall outcome of the assessment.			

Response: It is clear that 'other sandeel species' were evaluated under Principle 1, rather than being considered under P2 as IPI. However, ASI is correct in pointing out that the scores and rationale for the other sandeel species are not explicitly given for PIs 1.2.1, 1.2.2 and 1.2.3. They have been added to the relevant scoring tables, but no change to any scores has resulted because other sandeel species are not explicitly considered in the management of sandeel, so the management of the target A. marinus applies to the other species as well, with the impacts to the other species likely only to be lower than for A. marinus.

Finding No.	44567	Date detected	18/1/2017
Status	Open	Date closed	
Grade	Opportunity for Improvement	Deadline for implementation	17/1/2018
Subject	Process Requirements / Confirmation of scope		
Detected by	Antonio Hervas	Closed by	
Normative Reference and Requirement			
MSC-FCR-V2.0-7.4.7.1 The CAB shall confirm the proposed unit of assessment (UoA) (i.e., what is to be assessed) to include: 7.4.7.1 The target stock(s),			
Description			
it is not clear how many Unit of Assessments were defined for their assessment.			
Evidence observed			
The CAB defined eight (8) Units of Assessment, six (6) of which were defined for six 6) different sandeel stocks. However the CAB only produced one (1) score for Sandeel under Principle 1 using the element approach to scoring different sandeel stocks. It is therefore not clear whether the CAB defined one UoA for each sandeel stock (as defined under section 3.1.1) or one UoA for all six sandeel stocks (as suggested by using the element approach to scoring P1 for sandeel). This finding is graded as a observation as the two approaches of defining the UoA(s) area permitted. However it is recommended to pay careful attention to defining the UoA consistently with the approach taken to scoring the fishery.			

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Response: ASI is correct in pointing out the inconsistency between the number of Units of Assessment listed vs the eventual 'scoring elements' approach used for sandeel management areas and other sandeel species. We have subsequently decided to stick with the scoring elements approach, and identified the sandeel units of assessment as 'sub-units' or 'scoring elements.' This has been explained in the Units of Assessment section at the beginning of the report and treatment is consistent throughout the report.

Appendix 4 Surveillance Frequency

Table 4.1 : Surveillance level rationale

Year	Surveillance activity	Number of auditors	Rationale
1	*On-site audit*	*3*	*Default level 5 surveillance, may be revisited as the assessment is carried out and conditions are closed and progress is made.*
2	*On-site audit*	*3*	*Default level 5 surveillance, may be revisited as the assessment is carried out and conditions are closed and progress is made.*
3	*On-site audit*	*3*	*Default level 5 surveillance, may be revisited as the assessment is carried out and conditions are closed and progress is made.*
4	*On-site audit and reassessment*	*3*	*Default level 5 surveillance, may be revisited as the assessment is carried out and conditions are closed and progress is made.*

Table 4.2: Timing of surveillance audit

Year	Anniversary date of certificate	Proposed date of surveillance audit	Rationale
1	*March 2018*	*March 2018*	*Near the anniversary of the certification date.*
2	*March 2019*	*March 2019*	*Near the anniversary of the certification date.*
3	*March 2020*	*March 2020*	*Near the anniversary of the certification date.*
4	*March 2021*	*March 2021*	*Near the anniversary of the certification date.*

Table 4.3: Fishery Surveillance Program

Surveillance Level	Year 1	Year 2	Year 3	Year 4
Level 5	*On-site surveillance audit*	*On-site surveillance audit*	*On-site surveillance audit*	*On-site surveillance audit & re-certification site visit*

Appendix 5 Objections Process

(REQUIRED FOR THE PCR IN ASSESSMENTS WHERE AN OBJECTION WAS RAISED AND ACCEPTED BY AN INDEPENDENT ADJUDICATOR)

The report shall include all written decisions arising from an objection.

(Reference: FCR 7.19.1)