

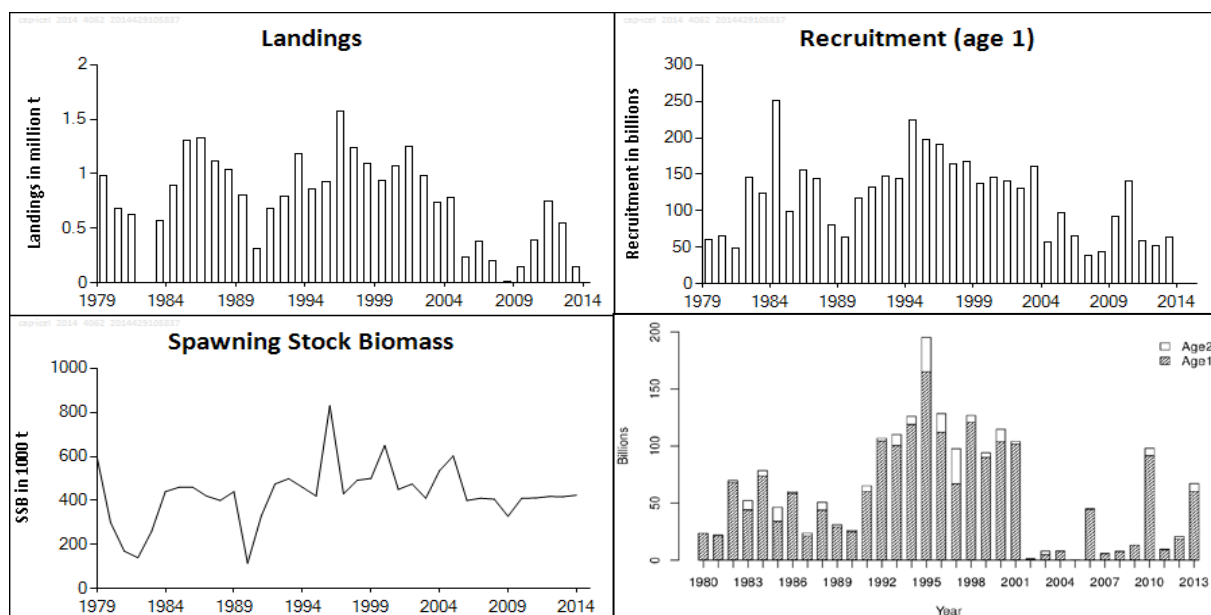
**ECOREGION** Iceland and East Greenland  
**STOCK** Capelin in Subareas V and XIV and Division IIa west of 5°W  
 (Iceland–East Greenland–Jan Mayen area)

**Advice for 2014/2015**

ICES advises on the basis of precautionary considerations that the initial quota be set at 50% of the predicted quota, implying an initial quota of 225 000 t. The final quota should be revised based on in-season survey information in winter 2015. All catches are assumed to be landed.

**State of the stock**

Fishing pressure		
	2011–2013	
MSY ( $F_{MSY}$ )	?	Undefined
Precautionary approach ( $F_{pa}, F_{lim}$ )	?	Undefined
Qualitative evaluation	→	Stable
Stock size		
	2012–2014	
MSY ( $B_{trigger}$ )	?	Undefined
Precautionary approach ( $B_{pa}, B_{lim}$ )	?	Undefined
Qualitative evaluation	→	Stable near average



**Figure 2.3.1.1** Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area). Acoustic index of immature capelin at ages 1 and 2 (numbers in billions) from autumn surveys.

The maturing component of the stock in autumn 2013 was estimated to be 603 000 t by the Icelandic annual acoustic autumn survey that took place in September–October 2013. It is estimated that 424 000 t spawned in March 2014, which is slightly above the 400 000 t escapement threshold. The spawning stock in 2015 will consist of fish from the 2012 year class and the part of the 2011 year class that did not spawn in 2014. The autumn acoustic survey estimate of these year classes is close to the long-term average.

## Management plans

Since 1980 the TAC has been set in accordance with a 400 000 t SSB escapement strategy management plan. In June 1989 Greenland, Iceland, and Norway signed an agreement on the division of the TAC between the parties involved in the fishery. This agreement has been revised several times since then, most recently in 2003.

ICES has not evaluated the management plan.

## Biology

Capelin is a short-lived species that dies after spawning (age 3–4). The SSB is comprised of only one or two age groups and is therefore highly dependent on the recruitment from a single year. Before the spawning migration starts, adult capelin is mostly found in Arctic seawater, north of Iceland, where the temperature is usually lower than 3°C. Juveniles can be found on the Icelandic continental shelf, in Denmark Strait, and along the shelf of East Greenland. Capelin is an important forage species.

## Environmental influence on the stock

In the years 2002–2005 and 2007–2012 it is likely that the juveniles only partly occupied the usual areas on the Icelandic continental shelf. In this period, the quarterly monitoring of environmental conditions of Icelandic waters shows a rise in sea temperatures north and east of Iceland, which probably also reaches farther north and northwest. A northward shift in the conditions may have affected the productivity of the Icelandic shelf system. The acoustic surveys in autumn 2010, 2012, and 2013 show that the juveniles are more westerly distributed than before. Since 2010, the northern-most boundary of the maturing stock observed was during the autumn survey in 2013.

## The fisheries

The fishery in recent years has largely been confined to the period January–March, which coincides with the last three months of the capelin lifespan. In 2011 a summer fishery took place, for the first time since 2004. No summer capelin fishery took place in either 2012 or 2013. Only a limited autumn fishery took place in 2012 and no autumn fishery took place in 2013.

**Catch distribution** Total catch (winter fishery 2013/14): 142 kt, where 142 kt were estimated landings (85% purse-seine, 15% pelagic trawl). Discards are negligible.

## Effects of the fisheries on the ecosystem

Capelin is an important forage fish and a decline in the stock may be expected to have implications on the productivity of their predators.

## Quality considerations

The acoustic survey in September–October 2013 had a good coverage of the spatial distribution of the capelin stock. The assessment/management plan does not fully take into account the uncertainties in the capelin survey estimate.

The natural mortality used in the projection models is considered to be an underestimate (ICES, 2009). The projection models that have been used until now for the estimation of the stock in relation to the escapement threshold are therefore not considered reliable as basis for a robust estimate of an SSB.

There is no agreed method on estimating SSB almost one and a half years ahead from the autumn acoustic survey. The regression method used since 1992 was rejected by WKSHORT in 2009 (ICES, 2009) and has not yet been replaced by an alternative method. This method estimates the SSB in 2015 to be 850 000 t, if no fishery takes place. Like last year two alternative estimation methods were carried out, estimating SSB in 2015 at 703 000 t or 832 000 t if no fishery takes place. The regression method used since 1992 includes a minimum SSB of 300 000 t (when the index is zero).

In conclusion, the SSB in 2015 is predicted by the acoustic survey to be above the threshold of 400 000 t, but this cannot be reliably estimated. A benchmark is proposed for early 2015.

**Scientific basis**

<b>Stock data category</b>	1 ( <a href="#">ICES, 2014a</a> )
<b>Assessment type</b>	Target escapement strategy used. A model based on acoustic survey and assessment that predicts the spawning biomass one and a half year ahead. The model assumes growth (a linear relationship; Vilhjálmsson, 1994) and uses a fixed $M = 0.035 \text{ month}^{-1}$ .
<b>Input data</b>	Icelandic acoustic surveys, autumn and winter.
<b>Discards and bycatch</b>	Not included, considered negligible.
<b>Indicators</b>	None.
<b>Other information</b>	The assessment was evaluated at WKSHORT 2009 (ICES, 2009). A benchmark is scheduled for early 2015
<b>Working group</b>	North-Western Working Group ( <a href="#">NWWG</a> ; ICES, 2014b).

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**Reference points**

Reference points have not been defined for this stock. An escapement SSB target of 400 000 t has been used since 1979 and is according to the agreed management plan. The target reference point has not been evaluated by ICES.

**Outlook for 2015**

Basis: The short-term prediction is based on indices from an acoustic survey in autumn 2013.

Rationale	Landings (2014/2015)	Basis	SSB (2015)
Zero catch	0	No fishing	850
Management plan	450	B <sub>escapement</sub>	400

Following the management plan agreed by Greenland, Iceland, and Norway the catches in 2014/2015 should be no more than 450 000 t. This is based on the objective that an SSB of 400 000 t remains for spawning in 2015.

ICES advises on an initial quota on the basis of precautionary considerations and that this should be set at 50% of the predicted quota, implying an initial quota of 225 000 t. The final quota should be revised based on in-season survey information in winter 2015. All catches are assumed to be landed.

**Management plan**

Since 1980 the TAC has been set in accordance with a 400 000 t escapement strategy management plan. In June 1989 Greenland, Iceland, and Norway signed an agreement on the division of the TAC between the countries. This agreement has been revised several times since then, most recently in 2003.

The fishery is managed according to a two-step management plan which requires a spawning-stock biomass of no less than 400 000 t by the end of the fishing season (mid- to late March). The first step in this plan is to set a preliminary TAC, based on the results of an acoustic survey carried out to evaluate the immature 1-group and immature part of the 2-group in the autumn (October–November), almost a year before the fishing season starts. Under the management plan the initial quota is set at two thirds of the predicted TAC, calculated on the condition that 400 000 t of the SSB should be left for spawning. The second step is based on the results of another survey conducted during the fishing season for the same year classes. This result is used to revise the TAC, still based on the condition that 400 000 t of the SSB should be left for spawning. The intention is that the TAC comprises only mature fish (see *Regulations and their effects* below).

**Precautionary approach**

The assessment and short-term predictions currently used are not accepted methods because the natural mortality applied is considered to be too low. Therefore, until additional survey measurements on the size of the 2012 year class become available the initial quota should be set significantly lower than two thirds of the predicted quota in the management agreement. It is recommended that the initial quota be set at 50% of the predicted quota, implying an initial quota of 225 000 t.

**Additional considerations**

*Management considerations*

Historically, the fishing season for capelin begins in the period from late June to July/August. The availability of plankton is then at its highest and the fishable stock of capelin feeds very actively over large areas north of Iceland, between Iceland and Greenland, and extending north to the area between Greenland and Jan Mayen, increasing rapidly in size, weight, and fatness. The fat content increases during the time of the feeding migration from being around 5% to 20% in the autumn before spawning (Engilbertsson *et al.*, 2013). Immature capelin has a much lower fat content, usually less than 3–4%.

Taking into account the large weight increase in the summer before spawning it is clear that more yield can be obtained if the fishery starts late autumn instead of summer. This is also supported by information for the Barents Sea capelin, where it has been shown that fishing during autumn would maximize the yield, but from the ecosystem point of view a winter fishery is preferable (Gjøsæter *et al.*, 2002). As the biology of these two capelin stocks is similar and also their effect on the ecosystem, this is considered to be valid for the Icelandic capelin as well.

Results from the summer and autumn surveys often show a mixing of juveniles and adult capelin. In Icelandic waters, only purse-seine is allowed in areas where such conditions are likely to protect juveniles (see *Regulations and their effects*). The pelagic trawls used in the capelin fishery are very large and filter enormous volumes of seawater during normal operation. Einarsson *et al.* (2007) shows that these trawls only retain between 20% and 40% of the capelin passing through the opening of the trawl. At present it is not known what effect this filtering of the schools has on mortality but it seems reasonable to assume it is considerable, especially if the same schools are filtered (passed through) repeatedly. Therefore, as a precautionary measure to protect the juveniles, all fishing with pelagic trawl has been banned in the Icelandic waters where juveniles are generally found, either separately or mixed with the adults. This measure should also be considered in other areas where juvenile capelin occur.

#### *Regulations and their effects*

It is permissible to transfer catches from the purse-seine of one vessel to another vessel, in order to avoid slippage. Thus, if the catches are beyond the carrying capacity of the vessel and no other vessel is nearby, slippage is allowed. In recent years, reporting of such slippage has not been frequent. Observers are frequently on board vessels during autumn fisheries in areas where juveniles are likely to occur and they have not reported discards. Industrial trawlers do not have the permission to slip capelin in order to harmonize catches to the processing. Catch sensors are installed at the codend to avoid too large catches.

In Icelandic waters, capelin is fished mainly with purse-seine. To protect capelin juveniles pelagic trawls are only allowed in limited areas along the northeast Icelandic coast (fishing in January).

A regulation calling for immediate, temporary area closures when a high abundance of juveniles is measured in the catch (i.e. more than 20% of the catch is composed of fish less than 14 cm) is enforced in Icelandic waters, using on-board observers. Areas with high abundances of juvenile age 1 and 2 capelin (in the shelf region off northwest, north, and northeast Iceland) have usually been closed to the summer and autumn fishery.

Since the capelin fishery began in the mid-1960s it has been closed during April until late June. The season has started in July/August or later, depending on the state of the stock.

#### *Information from the fishing industry*

Based on the magnitude of the echo signals received when using pelagic trawl, fishers have found that catches are often poorer than expected in areas where juveniles are mixed with adults, compared to areas with only adult capelin. This may indicate that the escapement of juveniles through meshes is greater than the escapement of adults.

#### *Comparison of the basis of previous assessment and advice*

The basis for the assessment and the advice has not changed from last year.

#### **Sources**

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- Engilbertsson, V., Óskarsson, G. J., and Marteinsdóttir, G. 2013. Interannual variation in fat content of the Icelandic capelin. ICES CM 2013/N:26.
- Gjøsæter, H., Bogstad, B., and Tjelmeland, S. 2002. Assessment methodology for Barents Sea capelin, *Mallotus villosus* (Muller). ICES Journal of Marine Science, 59: 1086–1095.
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**Table 2.3.1.1**

Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area).  
ICES advice, management, and landings.

Year	ICES Advice	Predicted catch <sup>1</sup> corresp. to advice	Agreed <sup>2</sup> TAC	ICES landings <sup>3</sup>
1986	TAC	1100	1290	1333
1987	TAC <sup>1</sup>	500	1115	1116
1988	TAC <sup>1</sup>	900	1065	1036
1989	TAC <sup>1</sup>	900	*	808
1990	TAC <sup>1</sup>	600	250	314
1991	No fishery pending survey results <sup>1</sup>	0	740	677
1992	Precautionary TAC <sup>1</sup>	500	900	788
1993	TAC <sup>1</sup>	900	1250	1179
1994	Apply the harvest control rule	950	850	864
1995	Apply the harvest control rule	800	1390	930
1996	Apply the harvest control rule	1100	1600	1571
1997	Apply the harvest control rule	850	1265	1245
1998	Apply the harvest control rule	950	1200	1100
1999	Apply the harvest control rule	866	1000	934
2000	Apply the harvest control rule	650	1090	1071
2001	Apply the harvest control rule	700	1300	1250
2002	Apply the harvest control rule	690	1000	988
2003	Apply the harvest control rule	555	900	741
2004	Apply the harvest control rule	*335	985	784
2005	Apply the harvest control rule	*No fishery	235	238
2006/07	Apply the harvest control rule	*No fishery	385	377
2007/08	Apply the harvest control rule	*207	207	202
2008/09	Apply the harvest control rule	*No fishery		15**
2009/10	Apply the harvest control rule	*No fishery	150	151
2010/11	Apply the harvest control rule	*No fishery	390	391
2011/12	Set the TAC at 50% of the initial quota in the HCR	366	765	747
2012/13	Precautionary approach	*No fishery	570	551
2013/14	Precautionary approach	*No fishery	160	142
2014/15	Set the initial TAC at 50% of the predicted quota in the HCR	225		

Weights in thousand tonnes.

<sup>1</sup>TAC advised for the July–December part of the season.

<sup>2</sup>Final TAC recommended by national scientists for the whole season.

<sup>3</sup>July–March of following year.

\*Preliminary TAC set according to the results of a preliminary assessment.

\*\* Only scouting quota was allocated in the latter half of February 2009.

**Table 2.3.1.2**

Capelin in Subareas V and XIV and Division IIa west of 5°W (Iceland–East Greenland–Jan Mayen area). Summary of assessment results (a fishing season, e.g. 1978/79, starts in summer 1978 and ends in March 1979). Recruitment of 1-year-old fish (in billions at 1 August); spawning-stock biomass (thousand tonnes at spawning time in March the following year, at the end of a fishing season); landings (thousand tonnes) are the sum of the total landings in the season that starts in the summer/autumn of the year indicated and ends in March of the following year.

Season (Summer/winter)	Recruitment	Landings	Spawning-stock biomass
1978/79	164	1195	600
1979/80	60	980	300
1980/81	66	684	170
1981/82	49	626	140
1982/83	146	0	260
1983/84	124	573	440
1984/85	251	897	460
1985/86	99	1312	460
1986/87	156	1333	420
1987/88	144	1116	400
1988/89	81	1037	440
1989/90	64	808	115
1990/91	118	314	330
1991/92	133	677	475
1992/93	148	788	499
1993/94	144	1179	460
1994/95	224	864	420
1995/96	197	929	830
1996/97	191	1571	430
1997/98	165	1245	492
1998/99	168	1100	500
1999/00	138	933	650
2000/01	146	1071	450
2001/02	140	1249	475
2002/03	130	988	410
2003/04	160	741	535
2004/05	57	783	602
2005/06	97	238	400
2006/07	66	377	410
2007/08	39	202	406
2008/09	44	15	328
2009/10	92	151	410
2010/11	140	391	411
2011/12	58	747	418
2012/13	52*	551	417
2013/14	64*	142	424

\* Preliminary.