

SHRIMP IN SKAGAFJÖRÐUR – RÆKJA Í SKAGAFIRÐI

Pandalus borealis

THE FISHERY

Shrimp fishing started in Skagafjörður in 1984. The catch increased from 96 tonnes in 1988 to 1570 tonnes in 1996 (Figure 1). Then catches decreased, and no fishing has been allowed since the quota year 1999/2000 due to low biomass indices of shrimp. CPUE increased from 1988 to 1996 when it decreased again.

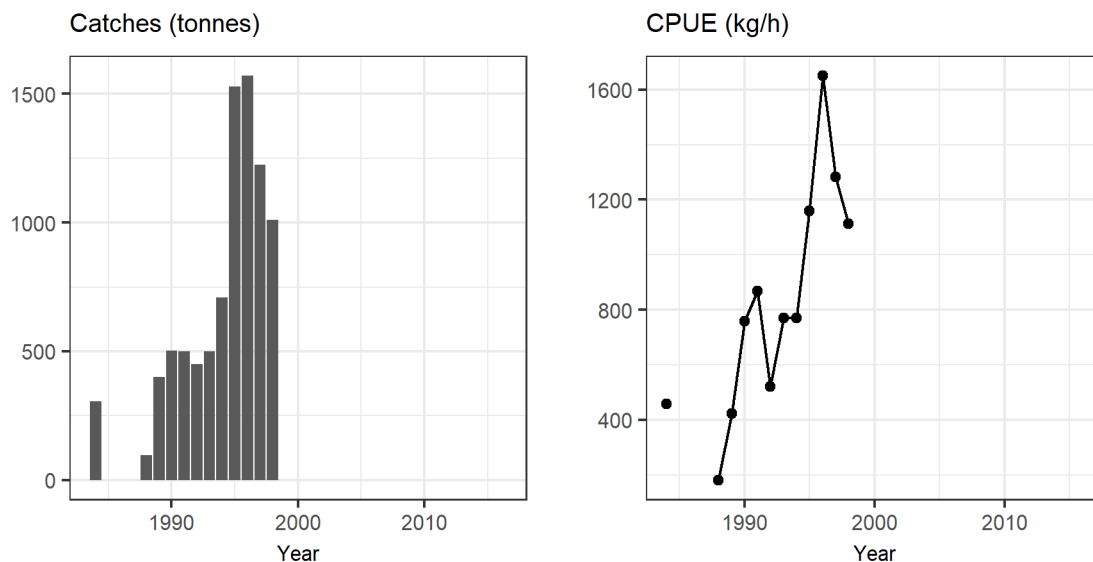


Figure 1. Shrimp in Skagafjörður. Total catch and catch per unit effort.

Mynd 1. Rækja í Skagafirði. Heildaraflí og afli á sóknareiningu.

SURVEY DATA

The annual Icelandic shrimp survey has been conducted since 1989 in Skagafjörður. No survey was conducted in 2004, 2006 or 2017. Until 2004, a total of 18 fixed station were sampled annually but after that 7 fixed stations have been sampled. The 2018 survey was conducted on 20 October and included 7 fixed stations at depths of 64–114 m. Information on sampling procedure can be found in the report 'Northern shrimp research in Icelandic waters, 1988-2015' (Jónsdóttir et al. 2017).

In 1989-1998, shrimp was found in all areas within Skagafjörður. Since then shrimp has been found at the middle and the outer part of the fjord (Figure 2).

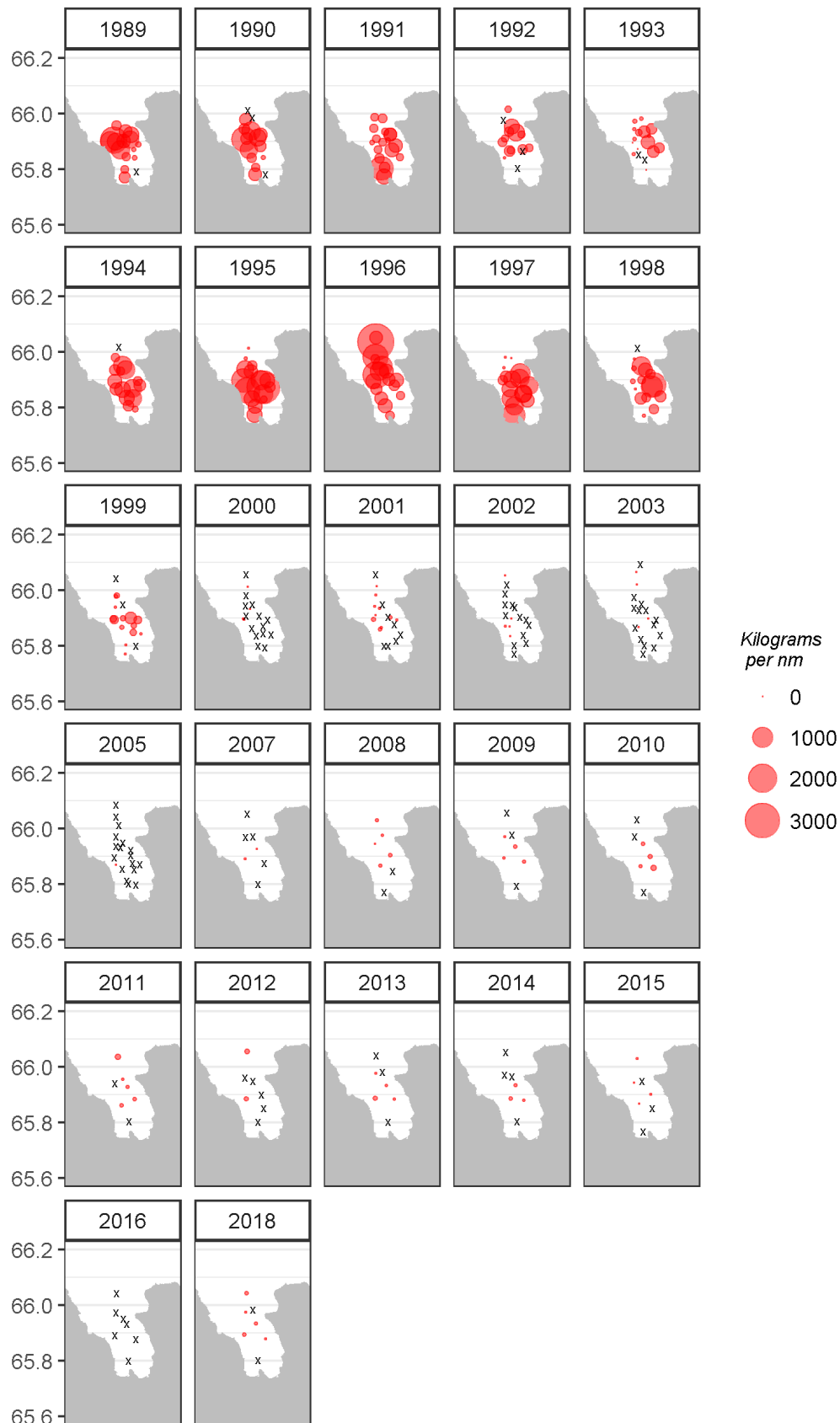


Figure 2. Shrimp in Skagafjörður. Distribution and abundance of shrimp in the annual shrimp survey. X denotes stations where no northern shrimp was found.

Mynd 2. Rækja í Skagafirði. Útbreiðsla og magn rækju í stofnmælingu. x sýnir stöðvar þar sem engin rækja fékkst.

INDICES

Four indices are used to assess the state of the stock; total biomass, fishable biomass, female biomass and juvenile biomass. Juveniles include all individuals equal to and below 13 mm carapace length while the fishable biomass index includes all individuals equal to and above 15.5 mm carapace length. Individuals between 13 and 15.5 mm carapace length are divided between the juvenile and fishable biomass indices. The female biomass includes all females.

All the indices decreased between 1989 and 1993 (Figure 3). They increased and reached a maximum in 1996. After that the indices decreased sharply and reached historically low levels in 2000. The indices have remained at low levels since then and the fishable biomass has remained below the reference level where the state of the stock is considered critical.

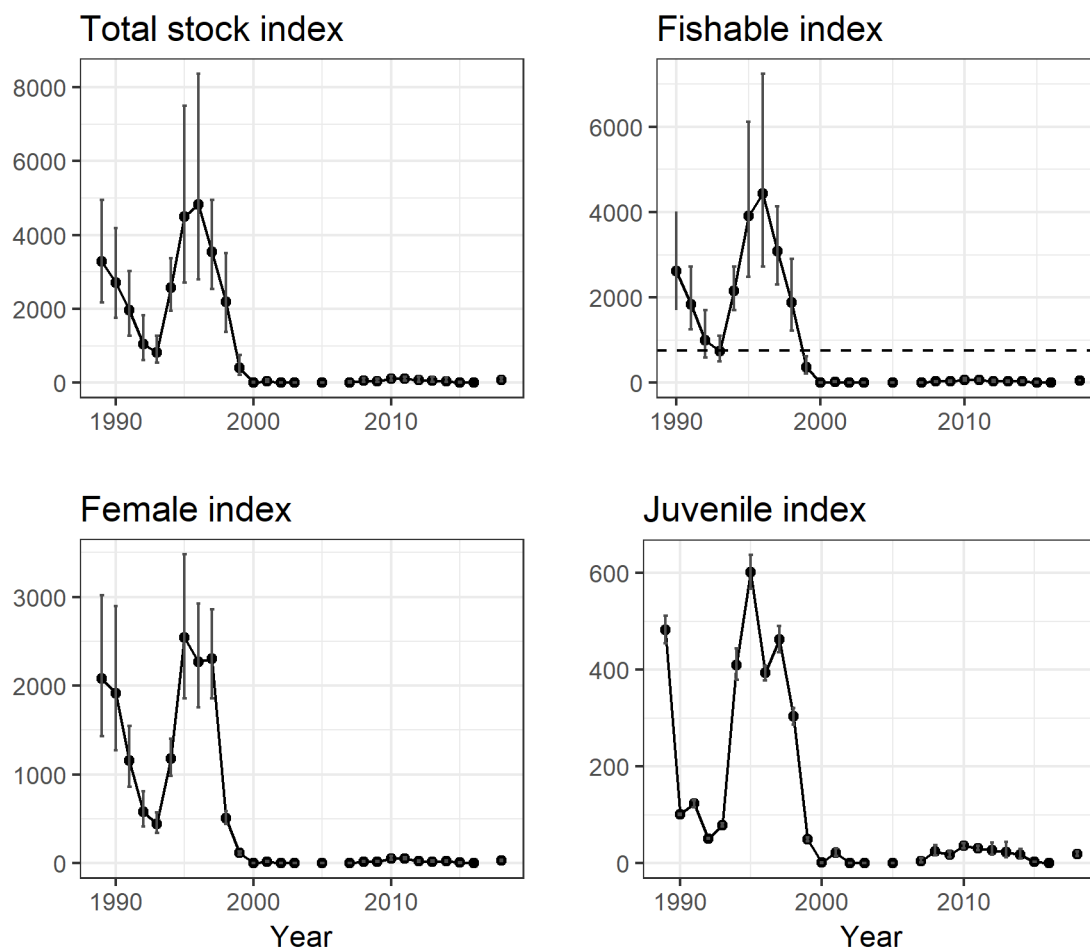


Figure 3. Shrimp in Skagafjörður. Stock biomass index, fishable biomass index, female biomass index and juvenile biomass index of shrimp. The horizontal line indicates a value where the state of the stock is considered to be critical (20% of the mean of the three highest indices).

Mynd 3. Rækja í Skagafirði. Heildarstofnsvísitala, veiðistofnsvísitala, kvendýravísitala og vísitala ungrækju. Lárétt lína sýnir viðmiðunargildi fyrir ástand stofnsins (20% af meðaltali þriggja hæstu vísitalna).

LENGTH DISTRIBUTION

In 1989-1997, large females were found in high abundance in Skagafjörður. However, in 1998 the female biomass decreased but there was still a large year class of males. Since 2000, one cohort of males has been found in Skagafjörður but very few females have been observed (Figure 4).

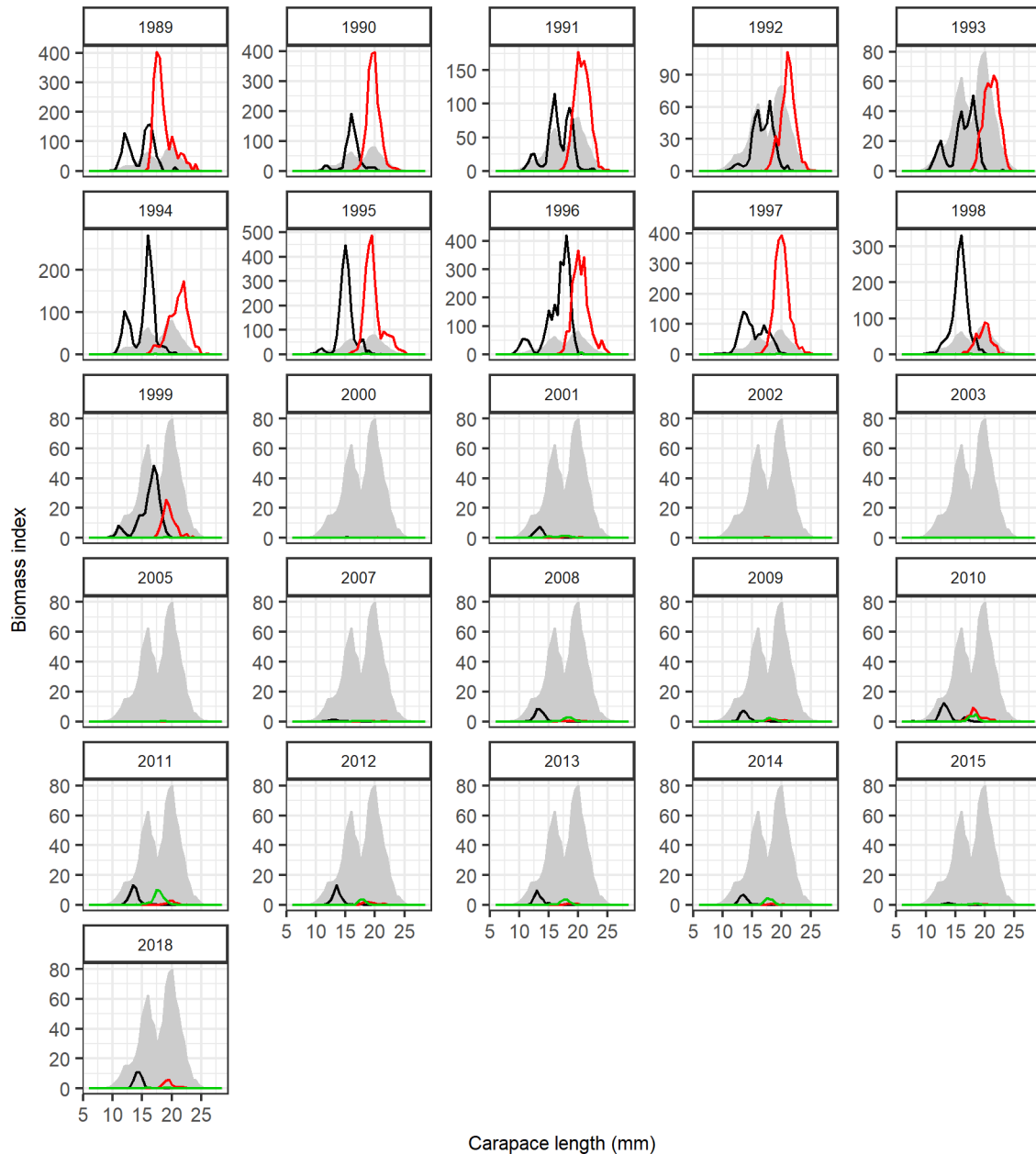


Figure 4. Shrimp in Skagafjörður. Length distribution of shrimp. The black line indicates males, the green immature females, and the red line mature females. The grey area is the mean length distribution of both sexes for the whole study period. Note different scales on y-axes.

Mynd 4. Rækja í Skagafirði. Lengdardreifing rækju í stofnmælingu. Svört lína sýnir karldýr, græn lína ókynþroska kvendýr og sú rauða kynþroska kvendýr. Gráa svæðið sýnir meðallengdardreifingu beggja kynja allt rannsóknatímabilið. Ath. mismundandi skala á y-ás.

ABUNDANCE OF COD AND HADDOCK

Cod juvenile abundance index was higher in 1994-1999 compared with the period since 2000 (Figure 5). The juvenile haddock index has fluctuated without a trend through the study period, with the exception of a very high abundance in 2003.

The cod abundance has fluctuated between 1994 and 2018. Almost no haddock was observed in Skagafjörður until 1999 but in 1999-2005 the haddock abundance index increased. It decreased between 2005 and 2012 and has remained relatively constant since then.

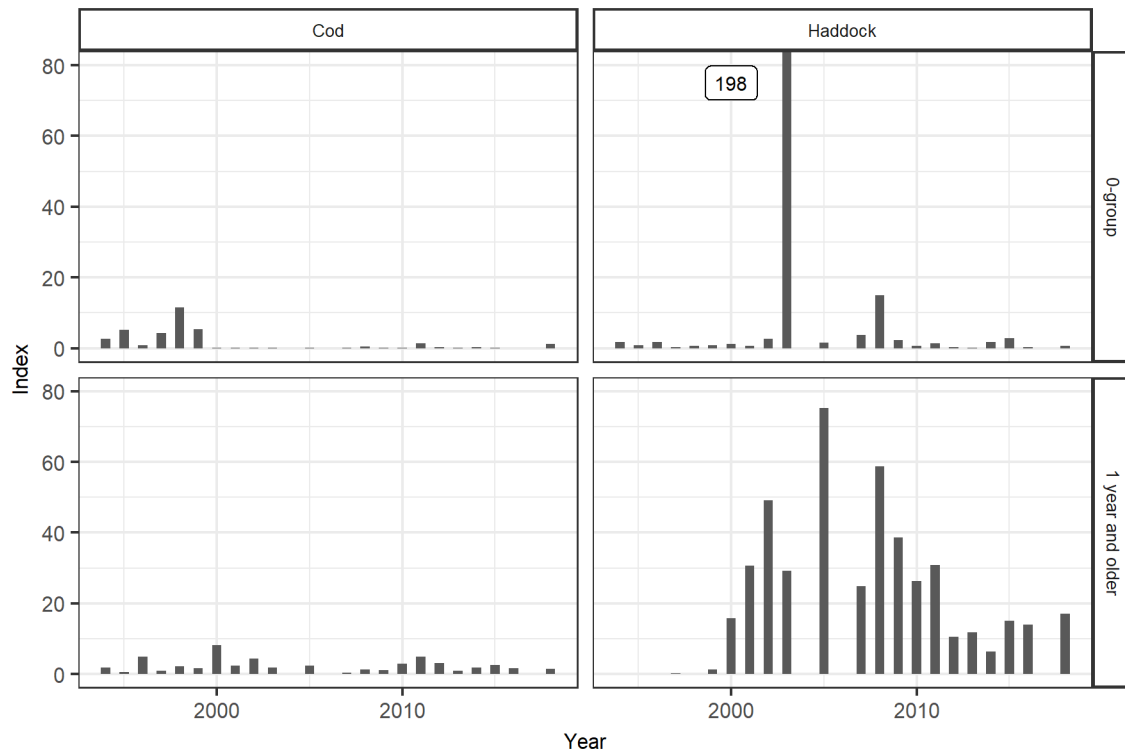


Figure 5. Cod and haddock in Skagafjörður. Abundance indices of cod and haddock in the annual shrimp survey. The number 198 indicates the abundance index in 2003.

Mynd 5. Þorskur og ýsa í Skagafirði. Vísitala þorsks og ýsu í stofnmælingu rækju. Talan 198 er vísitala 0-grúppu ýsu árið 2003.

MANAGEMENT

The Ministry of Industries and Innovation is responsible for management of all marine fisheries in Iceland and implementation of legislation. The Marine and Freshwater Research Institute (MFRI) has recommended TAC for shrimp in Skagafjörður since the beginning of the fishery. The fishing season was from early winter (following the annual Icelandic shrimp survey in September/October) until 30 April.

Table 1. Shrimp in Skagafjörður. Fishable biomass index, state of the stock (relative to the mean of the three highest indices), advice, catch (tonnes in fishing year) and F_{proxy} .

Tafla 1. Rækja í Skagafirði. Heildarstofnsvísitala, ástand stofns (vísitala miðað við meðaltal þriggja hæstu vísitölu gilda), ráðgjöf, aflí og vísitala veiðihlutfalls (F_{proxy}).

Year	Biomass index	Relative state	Rec. TAC	National TAC	Catch	F_{proxy}
1988						
1989	2794	0.73				
1990/91	2613	0.69	500	500	502	0.19
1991/92	1841	0.48	500	500	500	0.27
1992/93	1001	0.26	450	450	451	0.45
1993/94	741	0.19	500	500	501	0.68
1994/95	2152	0.57	700	700	708	0.33
1995/96	3902	1.02	1500	1500	1528	0.39
1996/97	4440	1.17	1500	1500	1570	0.35
1997/98	3080	0.81	1200	1200	1224	0.40
1998/99	1883	0.49	1000	1000	1010	0.54
1999/00	356	0.09	400	400	399	1.12
2000/01	4	0	0	0	0	-
2001/02	23	0.01	0	0	0	-
2002/03	2	0	0	0	0	-
2003/04	1	0	0	0	0	-
2004/05	-	-	-	-	0	-
2005/06	0.3	0	0	0	0	-
2006/07	-	-	-	-	0	-
2007/08	3	0	0	0	0	-
2008/09	26	0.01	0	0	0	-
2009/10	28	0.01	0	0	0	-
2010/11	69	0.02	0	0	0	-
2011/12	69	0.02	0	0	0	-
2012/13	39	0.01	0	0	0	-
2013/14	26	0.01	0	0	0	-
2014/15	27	0.01	0	0	0	-
2015/16	9	0	0	0	0	-
2016/17	0	0	0	0	0	-
2017/18	-	-	-	-	0	-
2018/19	47	0.01	0			

ADVICE 2018

The Icelandic shrimp survey was used as a biomass indicator. The target F_{proxy} (catch/survey biomass) of 0.5 is considered precautionary based on the historical relationship between catch and survey index.

The state of the stock is considered critical if the total biomass index is below 761 (equivalent to a relative state of 0.20; the biomass index divided with the mean of the three highest indices). The biomass index value of 761 can therefore be considered a proxy for B_{lim} or an I_{lim} . If the total biomass index is below 761, zero catch is advised, else the advice is based on multiplying the most recent index value with the target $F_{\text{proxy}} = 0.5$.

In October 2018, the total biomass index was below 761. Hence, MFRI advises zero catch in Skagafjörður in the quota year 2018/2019.