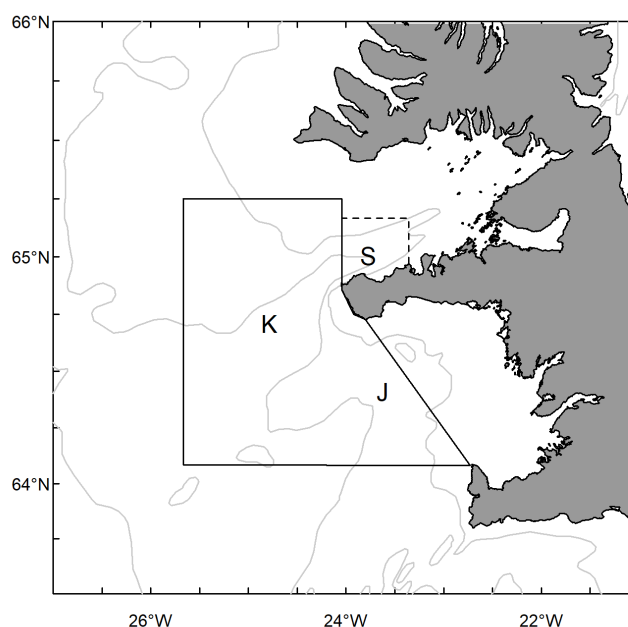


# SHRIMP IN THE SNÆFELLSNES AREA – RÆKJA VIÐ SNÆFELLSNES

## *Pandalus borealis*

### THE FISHERY

The fishing ground for shrimp in the Snæfellsnes area is defined by Kolluáll, southern part of Breiðafjörður and Jökuldjúp (Figure 1). Shrimp fishing in the southern part of Breiðafjörður is only allowed between 8 May and 31 July for vessels 105 GRT or smaller, which have quota in the Snæfellsnes area (Figure 1).

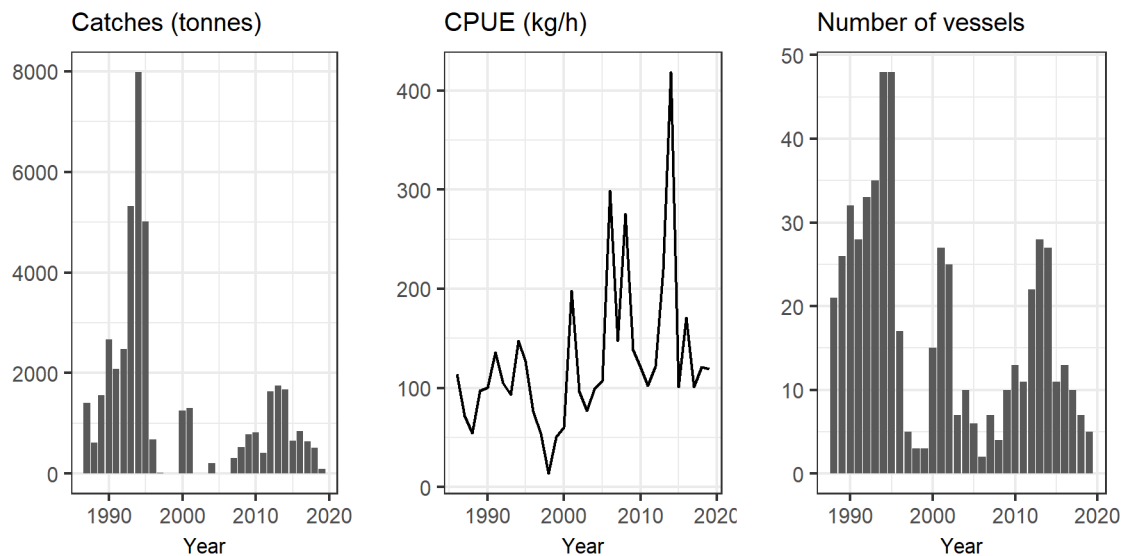


**Figure 1.** The defined area for shrimp fishing in the Snæfellsnes area (K=Kolluáll, J=Jökuldjúp, S=southern part of Breiðafjörður). The broken line defines southern Breiðafjörður where shrimp fishing is allowed between 8 May and 31 July vessels 105 GRT or smaller and with quota at the Snæfellsnes area.

*Mynd 1. Skilgreint rækjuveiðisvæði við Snæfellsnes (K=Kolluáll, J=Jökuldjúp, S=sunnanverður Breiðafjörður). Brotalínan sýnir sunnanverðan Breiðafjörð þar sem veiðar eru heimilaðar frá 8. maí – 31. júlí skipum sem eru 105 brl að stærð eða minni og hafa aflamark á veiðisvæðinu við Snæfellsnes.*

Shrimp catch in the Snæfellsnes area was high from 1992 to 1995, when the annual catch reached almost 8000 tonnes (Figure 2). It is likely that high fishing pressure during that time led to a collapse of the shrimp stock. The shrimp catch was low from 1997 to 1999 but increased after 2007 until it reached a maximum in 2012-2014. Catch per unit effort increased from 1998 to 2014 but fluctuated greatly during that period. The number of commercial shrimp vessels in the Snæfellsnes area increased sharply until 1994 when 47 vessels landed shrimp. In 2006, few vessels landed shrimp, but the number increased again in the following years until 2015 when it decreased again. Since 2016, the catch has decreased

steadily as the shrimp biomass decreased. In 2019, the catch was very low as only few vessels fished in the area.



**Figure 2. Shrimp in Snæfellsnes area. Total catch, catch per unit effort and number of commercial vessels operating in the area.**

*Mynd 2. Rækja við Snæfellsnes. Heildaraflí, aflí á sóknareiningu og fjöldi skipa á rækjuveiðum við Snæfellsnes.*

The distribution of the fishery has varied over time (Figure 3). Between 1988 and 1996, the main fishing grounds were in the western part of the Snæfellsnes area (Kolluáll). Since 2006 the main fishing grounds have been closer to land, northwest of the Snæfellsnes peninsula.

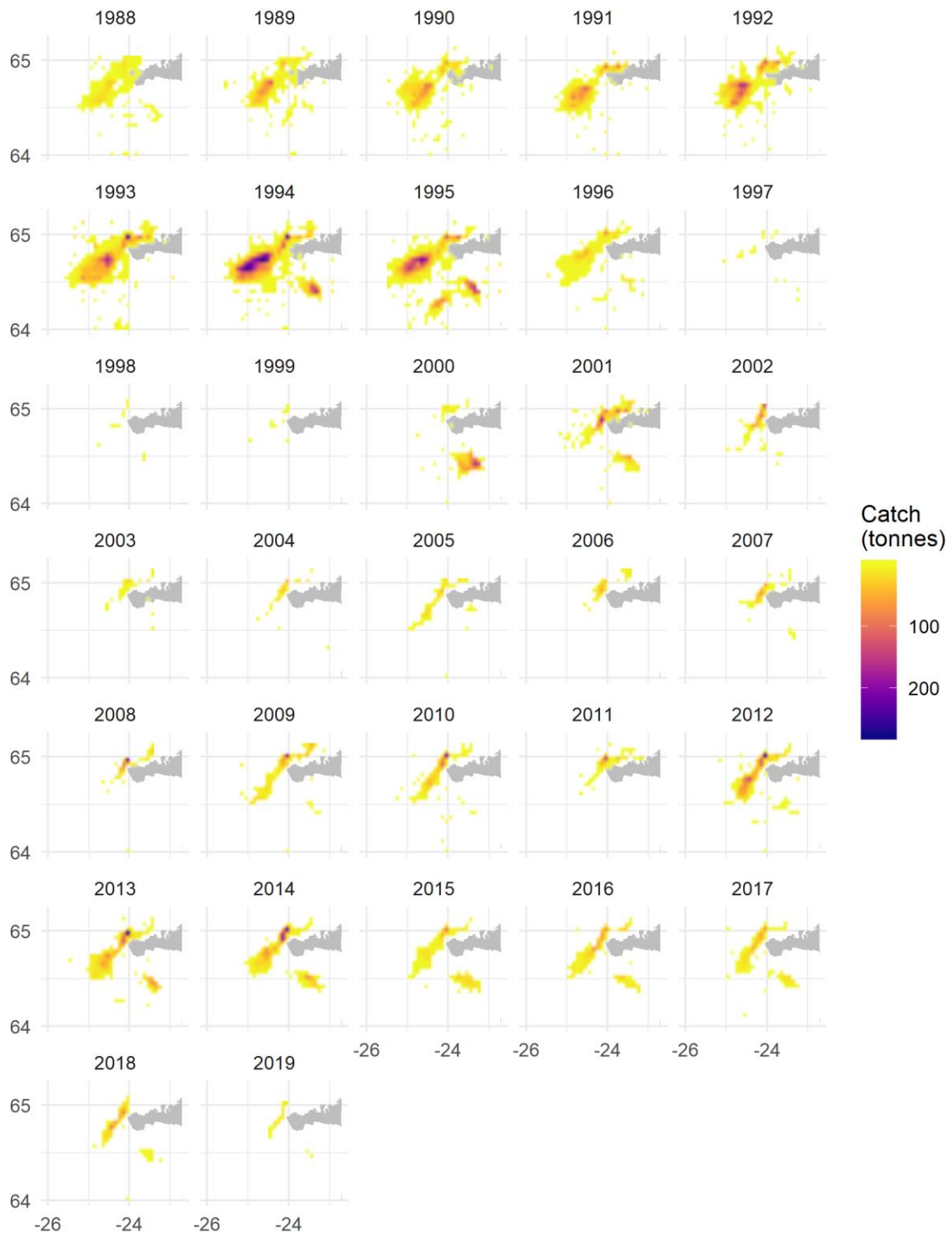


Figure 3. Shrimp in Snæfellsnes area. Distribution of commercial shrimp catch.

*Mynd 3. Rækja við Snæfellsnes. Dreifing rækjuafla.*

## SURVEY DATA

The annual Icelandic shrimp survey has been conducted since 1990 in the Snæfellsnes area. The 2020 survey was conducted on 20-24 April with 31 fixed stations at depths of 116-317 m. Information on sampling procedure can be found in the report "Northern shrimp research in Icelandic waters, 1988-2015" (Jónsdóttir et al. 2017). The survey was not conducted in the area in 2007.

In the past, the density of shrimp was usually greatest in Breiðafjörður (north of the Snæfellsnes peninsula) but less at the western part of the area (Kolluáll) (Figure 4). However, in 2017-2020 the shrimp density was low in Breiðafjörður compared with previous years.



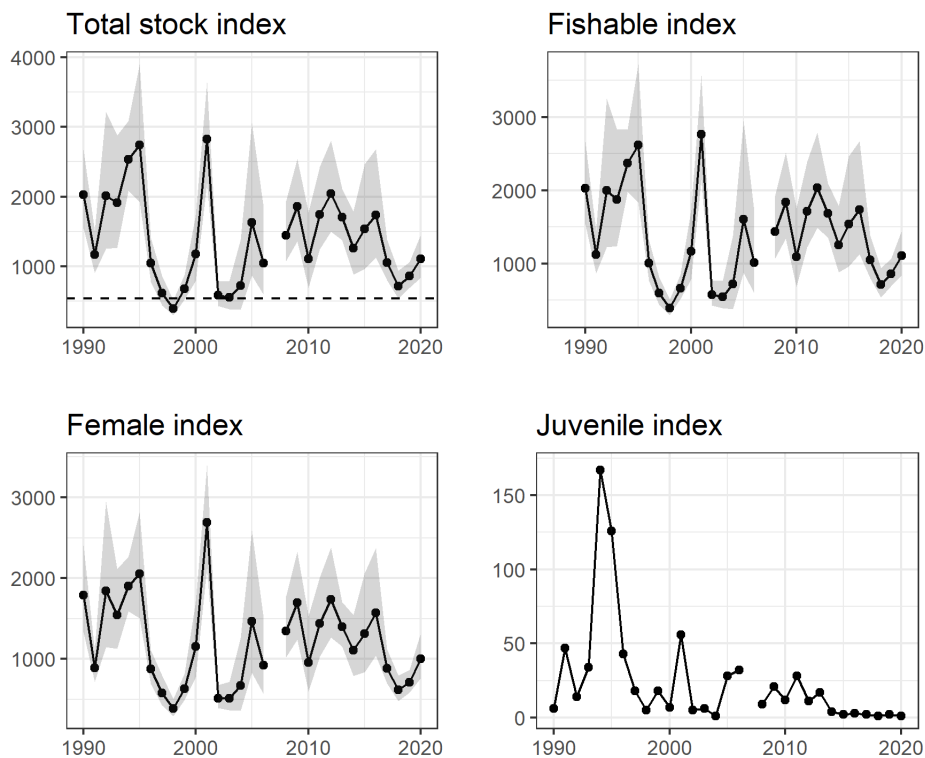
**Figure 4. Shrimp in Snæfellsnes area. Distribution and abundance in the annual shrimp survey. The survey was not conducted in 2007.**

*Mynd 4. Rækja við Snæfellsnes. Útbreiðsla og magn í stofnmælingu, enginn leiðangur var farinn 2007.*

## 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 13.0-15.5 mm carapace length are divided between the juvenile and fishable biomass indices. The female biomass includes all females.

All the indices have fluctuated greatly without a clear long-term trend during the study period (Figure 5). The indices decreased sharply in 1995-1998 during the time of high fishing pressure. In 2008-2016 the indices, except the juvenile index, fluctuated around the long-term mean. In 2017-2020, the indices were substantially lower compared with previous years and were the lowest observed since 2005. The total biomass index was above the reference level where the state of the stock is considered critical. The biomass index value of 20% of the mean of the three highest indices ( $I_{lim}$ ) is used as a proxy for  $B_{lim}$ . The juvenile index fluctuated without a trend from 1990 to 2013 but has been very low since 2014.

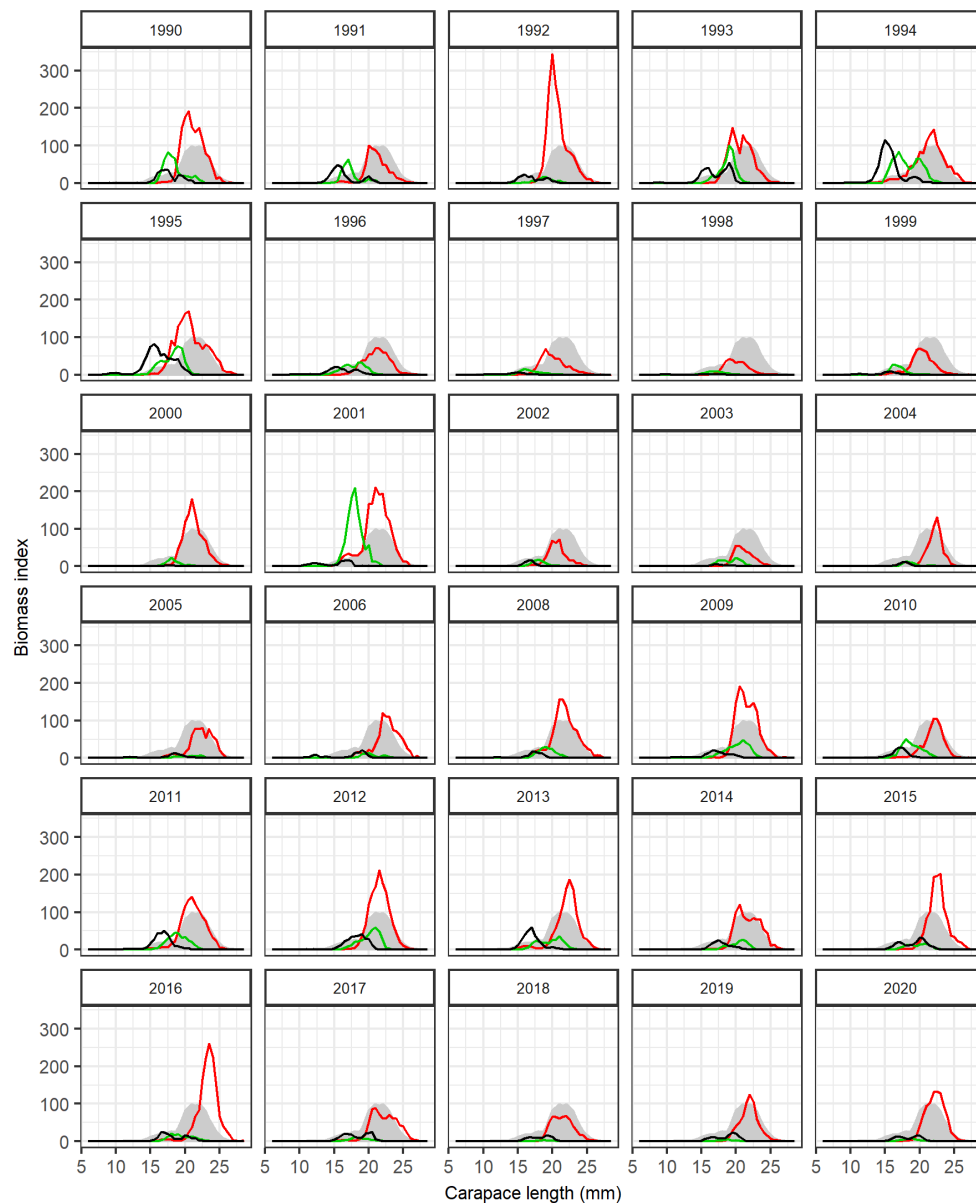


**Figure 5. Shrimp in Snæfellsnes area. Stock biomass index, fishable biomass index, female biomass index and juvenile biomass index of shrimp. The horizontal line indicates a value where the state of the stock is considered to be critical (20% of the mean of the three highest indices). The survey was not conducted in 2007.**

*Mynd 5. Rækja við Snæfellsnes. Heildarstofnsvísitala, veiðistofnsvísitala, kvendýrsvísitala og vísitala ungrækju. Lárétt lína sýnir viðmiðunargildi fyrir ástand stofnsins (20% af meðaltali þriggja hæstu vísitalna). Ekki var farið í leiðangur árið 2007.*

## LENGTH DISTRIBUTION

A high proportion of the stock is mature females, whereas males compose a considerably lower proportion of the fishable biomass (Figure 6). The absence of juveniles indicates that the recruitment patterns and drift of larvae from adjacent areas are unknown. In 2020, the abundance of males and immature females was lower compared with the mean length distribution of the whole study period.

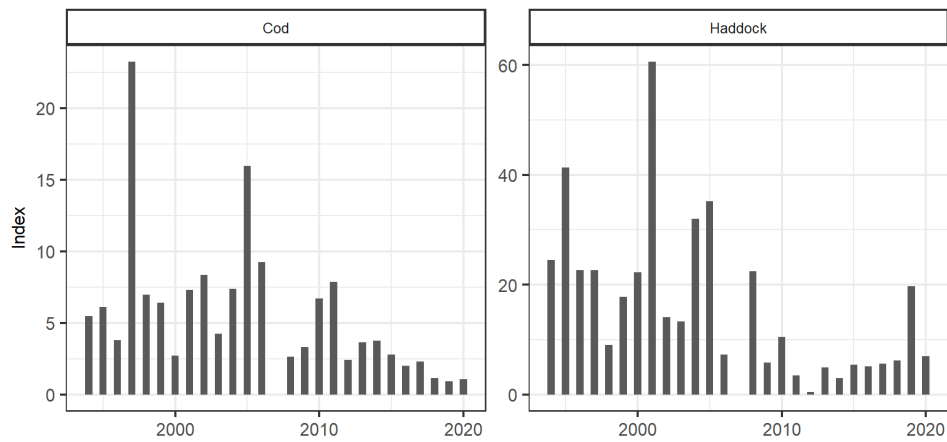


**Figure 6. Shrimp in Snæfellsnes area. Length distribution of shrimp. The black line indicates males, the green immature females, and the red line mature females. The grey area is the mean length distribution of both sexes for the whole study period. The survey was not conducted in 2007.**

*Mynd 6. Rækja við Snæfellsnes. 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. Ekki var farið í leiðangur árið 2007.*

## ABUNDANCE OF COD AND HADDOCK

The abundance index of cod in the annual shrimp survey in the Snæfellsnes area was relatively high between 1994 and 2006 but has decreased steadily since 2014 (Figure 7). The haddock abundance index has fluctuated during the study period, whereas it was highest in 2001. The haddock index has been relatively low since 2011, except for 2019 when it increased and was at similar levels as before 2009.



**Figure 7. Cod and haddock. Abundance indices in the annual shrimp survey in the Snæfellsnes area. The survey was not conducted in 2007.**

*Mynd 7. Þorskur og ýsa. Vísitölur í stofnmælingu rækju við Snæfellsnes. Ekki var farið í leiðangur árið 2007.*

## 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) first recommended TAC for shrimp in the Snæfellsnes area in 2002, but until 2014 this area was included with the offshore shrimp fishery and hence, no TAC was issued specifically for this area. For the quota years 2010/2011 to 2013/2014, the offshore shrimp fishery was open to all boats without a TAC. During some of these years, fishing of shrimp in the Snæfellsnes area was considerable higher than the recommended TAC (Table 1). In 2015, the MFRI suggested that the quota year for the area begins at 1 May and ends on 15 March the year after. Shrimp fishing has since been prohibited in the period 16 March to 30 April.

**Table 1. Shrimpin Snæfellsnes area. Biomass index, state of the stock (relative to the mean of the three highest indices), advice, catch (tonnes in fishing year) and  $F_{proxy}$ . All weights are in tonnes.**

*Tafla 1. Rækja við Snæfellsnes. Heildarstofnsvísitala, ástand stofns (vísitala miðað við meðaltal þriggja hæstu vísitölu gilda), ráðgjöf, afli og vísitala veiðihlutfalls ( $F_{proxy}$ ). Allar þyngdir eru í tonnum.*

Year	Biomass index	Relative state	Recommended TAC	National TAC	Catch	$F_{proxy}$
1990	2 030	0.75			1 597	0.79
1991	1 170	0.43			2 111	1.80
1992	2 008	0.74			5 035	2.51
1993	1 909	0.71			4 809	2.52
1994	2 536	0.94			6 765	2.67
1995	2 741	1.02			2 432	0.89
1996	1 048	0.39			283	0.27
1997	616	0.23			11	0.02
1998	395	0.15			8	0.02
1999	681	0.25			65	0.10
2000	1 173	0.43			2 257	1.92
2001	2 821	1.05			506	0.18
2002	584	0.22	300		89	0.15
2003	555	0.21	200		209	0.38
2004	725	0.27	200		265	0.37
2005	1 631	0.60	200		238	0.15
2006	1 042	0.39	200		316	0.39
2007			400		530	
2008	1 445	0.53	400		779	0.54
2009	1 858	0.69	900		830	0.45
2010	1 106	0.41	450		414	0.37
2011	1 735	0.64	850		1 632	0.94
2012	2 057	0.76	1 000		1 755	0.86
2013	1 704	0.63	950		1 698	1.00
2014	1 258	0.47	600	600	133	0.11
2015	1 540	0.57	700	700	589	0.38
2016	1 739	0.64	820	820	826	0.47
2017	1 054	0.39	698	698	642	0.61
2018	715	0.26	442	442	519	0.73
2019	858	0.32	393	393	90	0.10
2020	1 105	0.41	491			



## ADVICE 2020

The Icelandic shrimp survey is used as a biomass indicator. The target  $F_{\text{proxy}}$  (catch/survey biomass) of 0.5 is considered precautionary based on the historical relationship between catch and survey index. The advice is based on multiplying the target  $F_{\text{proxy}}$  with the mean of the two most recent index values. The state of the stock is considered critical if the total biomass index is below 540 (equivalent to a relative state of 0.2; the biomass index divided with the mean of the three highest indices). The biomass index value of 540 can therefore be considered a proxy for  $B_{\text{lim}}$  or an  $I_{\text{lim}}$ . If the total biomass index is below 540, zero catch is advised, else the advice is based on multiplying the mean of the two most recent index values with the target  $F_{\text{proxy}} = 0.5$ .

In April 2020, the total biomass index was above 540. Hence, MFRI advises that catch in the Snæfellsnes area should be no more than 491 tonnes in the period from 1 May 2020 to 15 March 2021.