SHRIMP IN THE SNÆFELLSNES AREA
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).

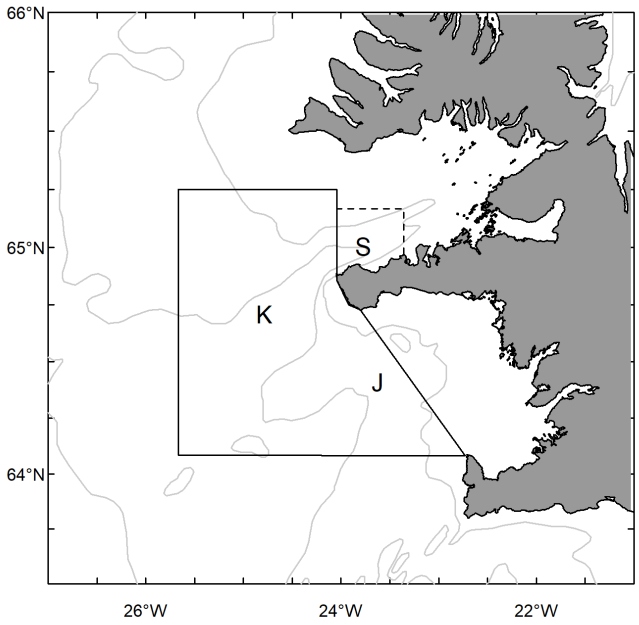

Figure 1. The defined area for shrimp fishing in the Snæfellsnes area (K=Kolluáll, J=Jökuldjúp, S=southern part of Breiðafjörður). The broken line defines southern Breiðafjörður where shrimp fishing is allowed between 8 May and 31 July vessels 105 GRT or smaller and with quota at the Snæfellsnes area.

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 lead 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. In 2019, the catch was very low but increased again in 2020 and 2021. 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 and only 3 vessels landed shrimp in 2021.

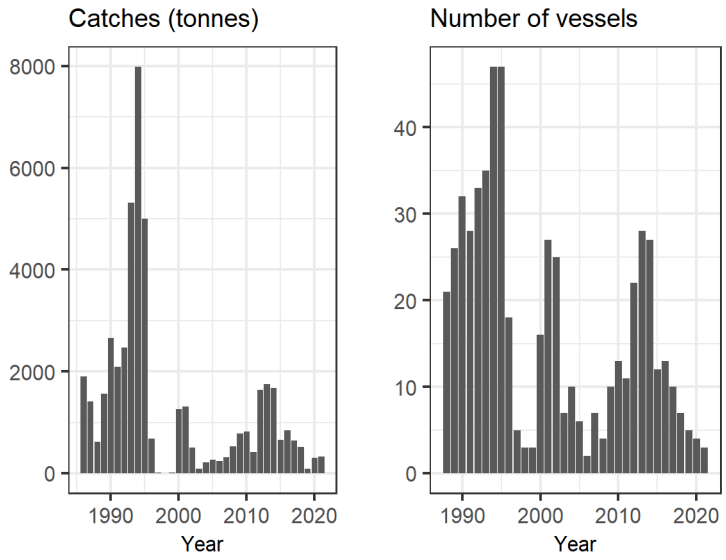

Figure 2. Shrimp in Snæfellsnes area. Total catch and number of commercial vessels operating in the area.

Catch per unit effort (CPUE) decreased from 2000 to 2003 but increased again until 2006 when it highest (Figure 3). It decreased until 2011 and has been relatively stable since then. CPUE was highest in March-May but decreases in the following months. Changes in CPUE are limited with increasing trawl size, except for trawl with 3500-4000 meshes.

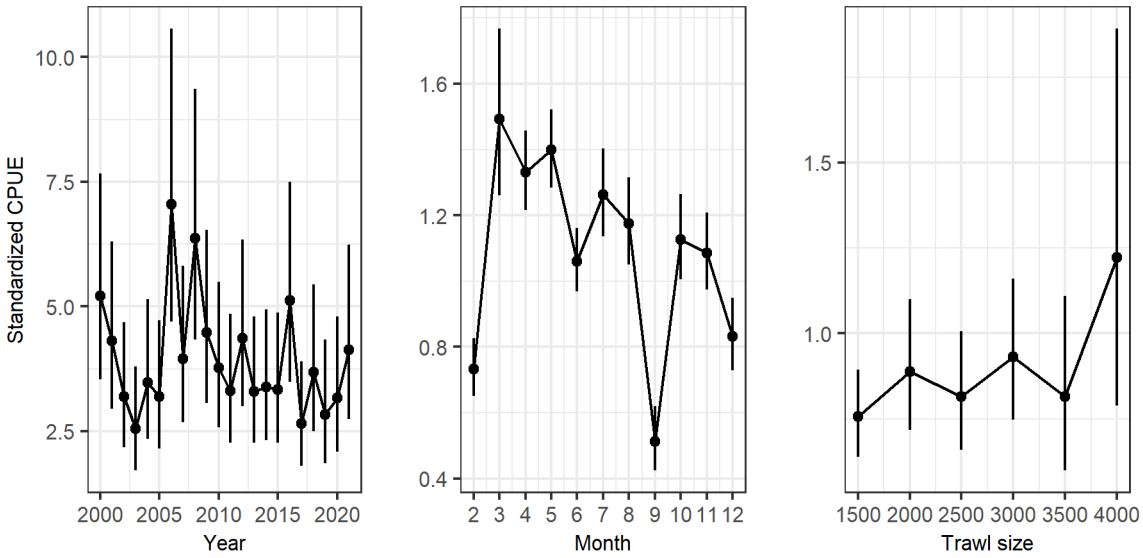

Figure 3. Shrimp in Snæfellsnes area. Standardized catch per unit effort (CPUE) of shrimp by year, month and trawl size (number of meshes).

Generally, CPUE increases with increasing total biomass index (Figure 4). However, the variability is higher when the total biomass index is above 1000. There is a decent consistency between CPUE and the total biomass index.

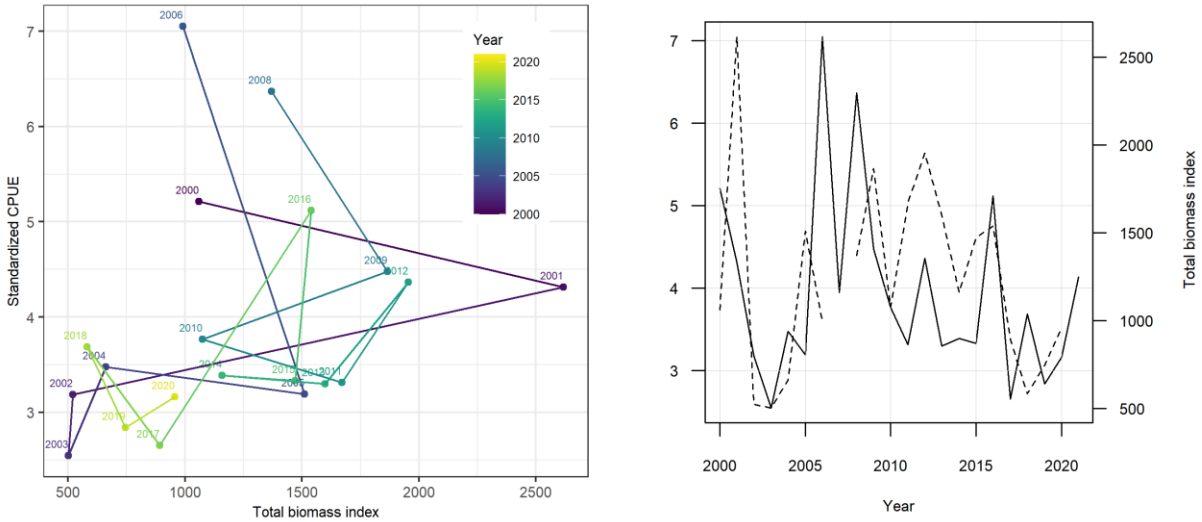

Figure 4. Shrimp in Snæfellsnes area. On the left: Relationship between standardized catch per unit effort (CPUE) and total biomass index. To the right: Standardized CPUE (solid line, left axis) and total biomass index (broken line, right axis).

The distribution of the fishery has varied over time (Figure 5). 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. The fishery is mainly conducted during the summer and in 2021 the fishery only took place in May and June (Figure 6).

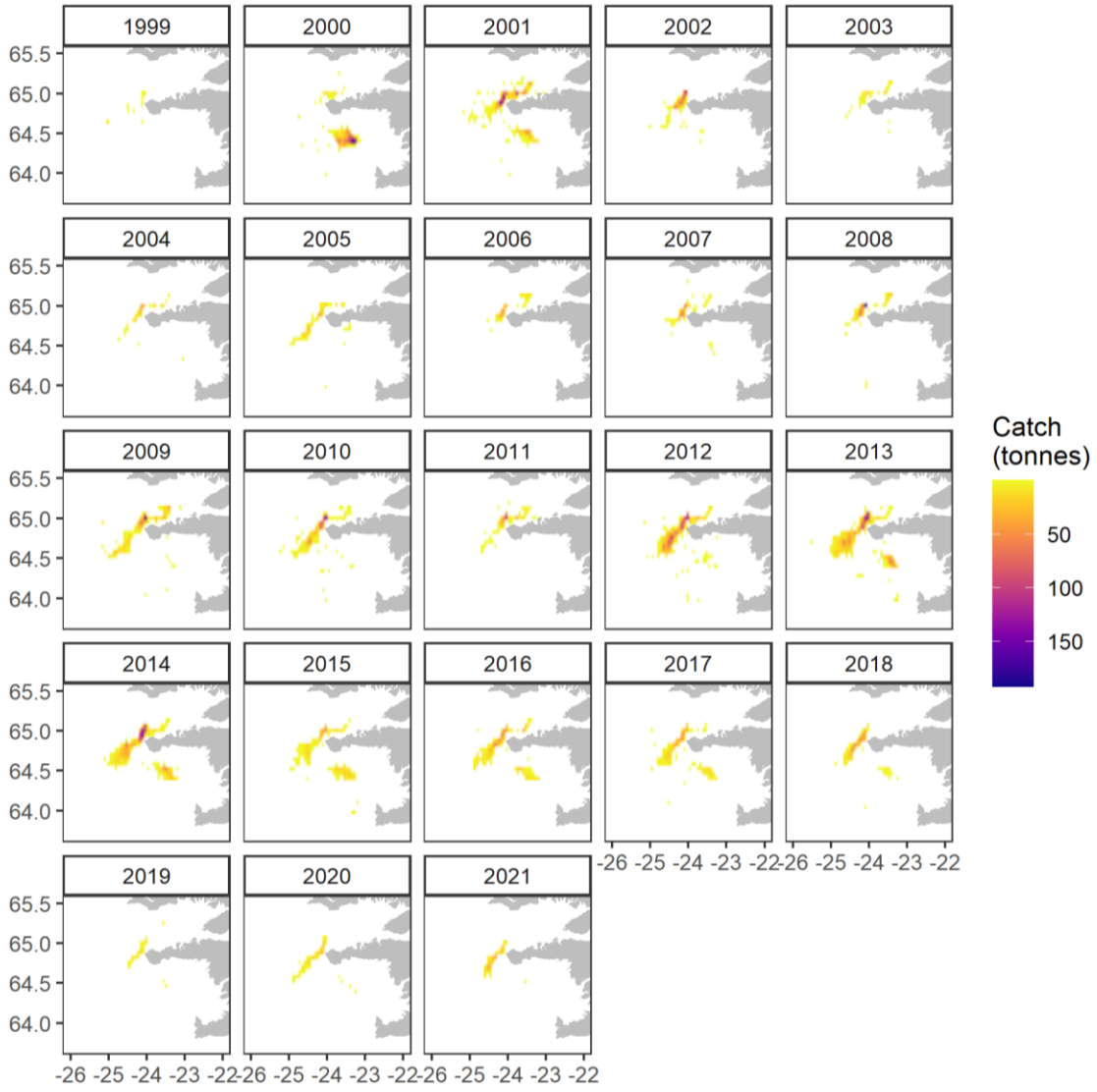

Figure 5. Shrimp in Snæfellsnes area. Distribution of commercial shrimp catch.

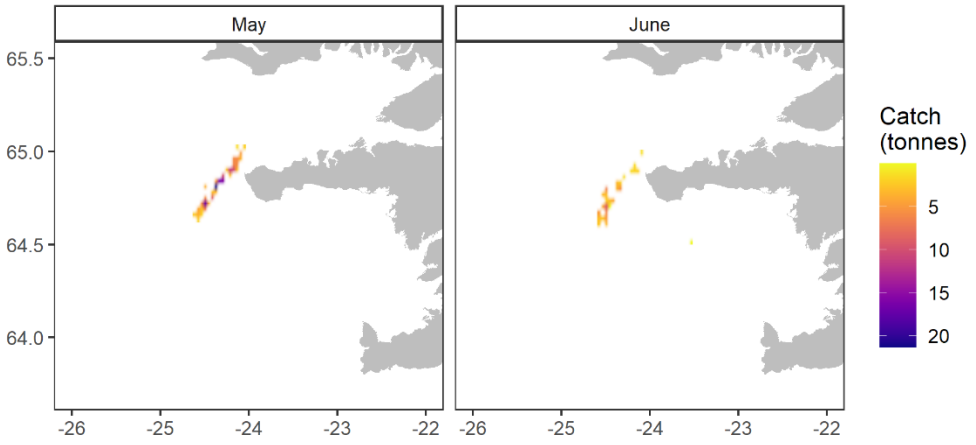

Figure 6. Shrimp in Snæfellsnes area. Distribution of commercial shrimp catch by month in 2021.

SURVEY DATA

The Icelandic shrimp survey in the Snæfellsnes area has been conducted annually since 1990 (except in 2007). 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 2021 or in 2022.

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 7). However, in 2017-2020 the shrimp density was low in Breiðafjörður compared with previous years.

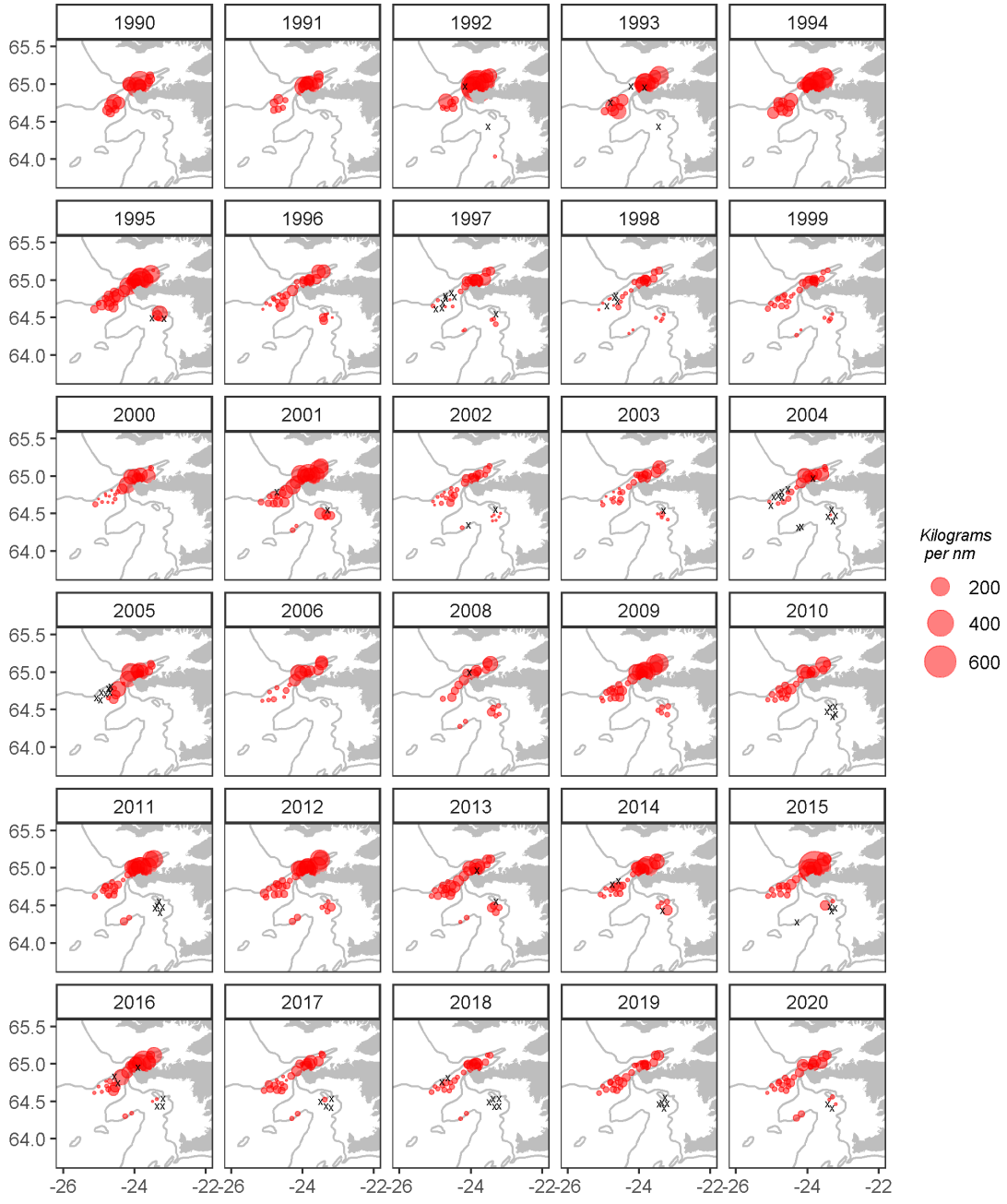

Figure 7. Shrimp in Snæfellsnes area. Distribution and abundance in the annual shrimp survey. The survey was not conducted in 2007, 2021 or 2022.

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 8). 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.

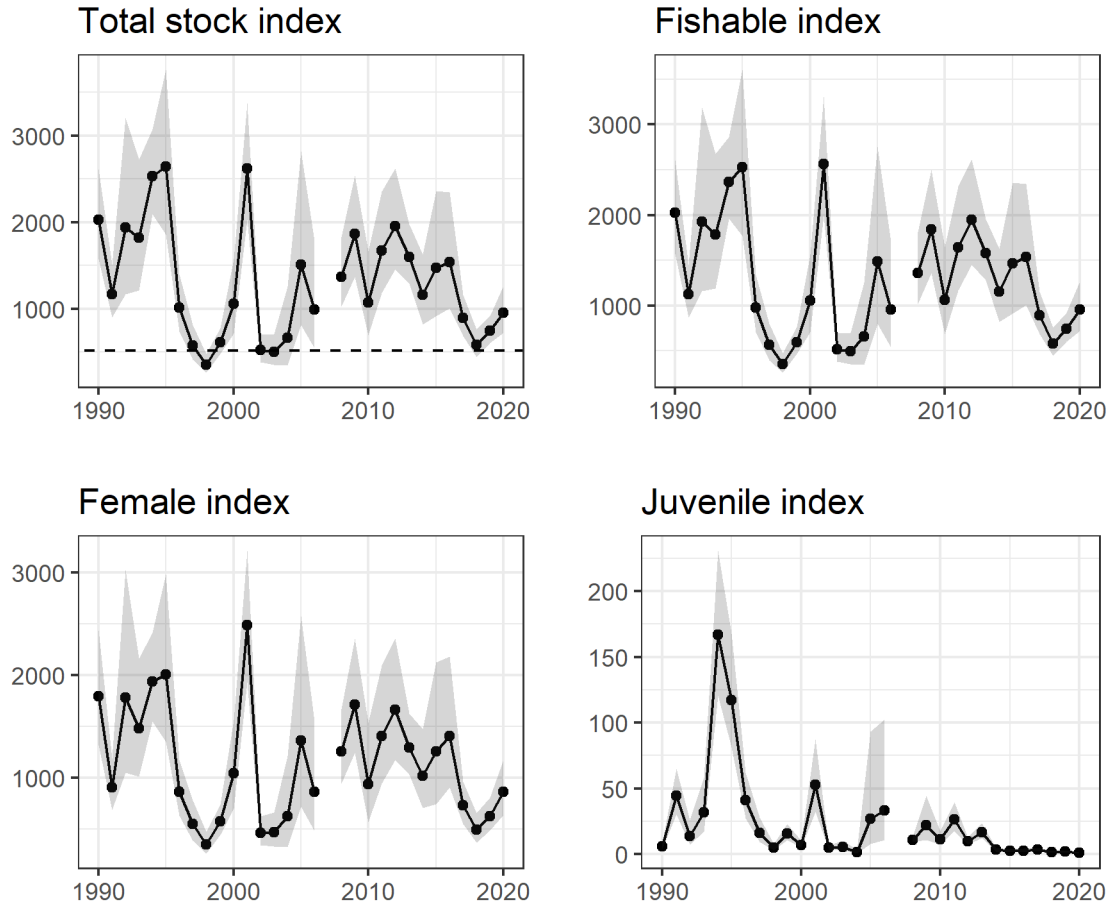

Figure 8. Shrimp in Snæfellsnes area. Stock biomass index, fishable biomass index, female biomass index and juvenile biomass index of shrimp. The horizontal line indicates a value where the state of the stock is considered to be critical (20% of the mean of the three highest indices). The survey was not conducted in 2007, 2021 or 2022

LENGTH DISTRIBUTION

A high proportion of the stock is mature females, whereas males compose a considerably lower proportion of the fishable biomass (Figure 9). 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.

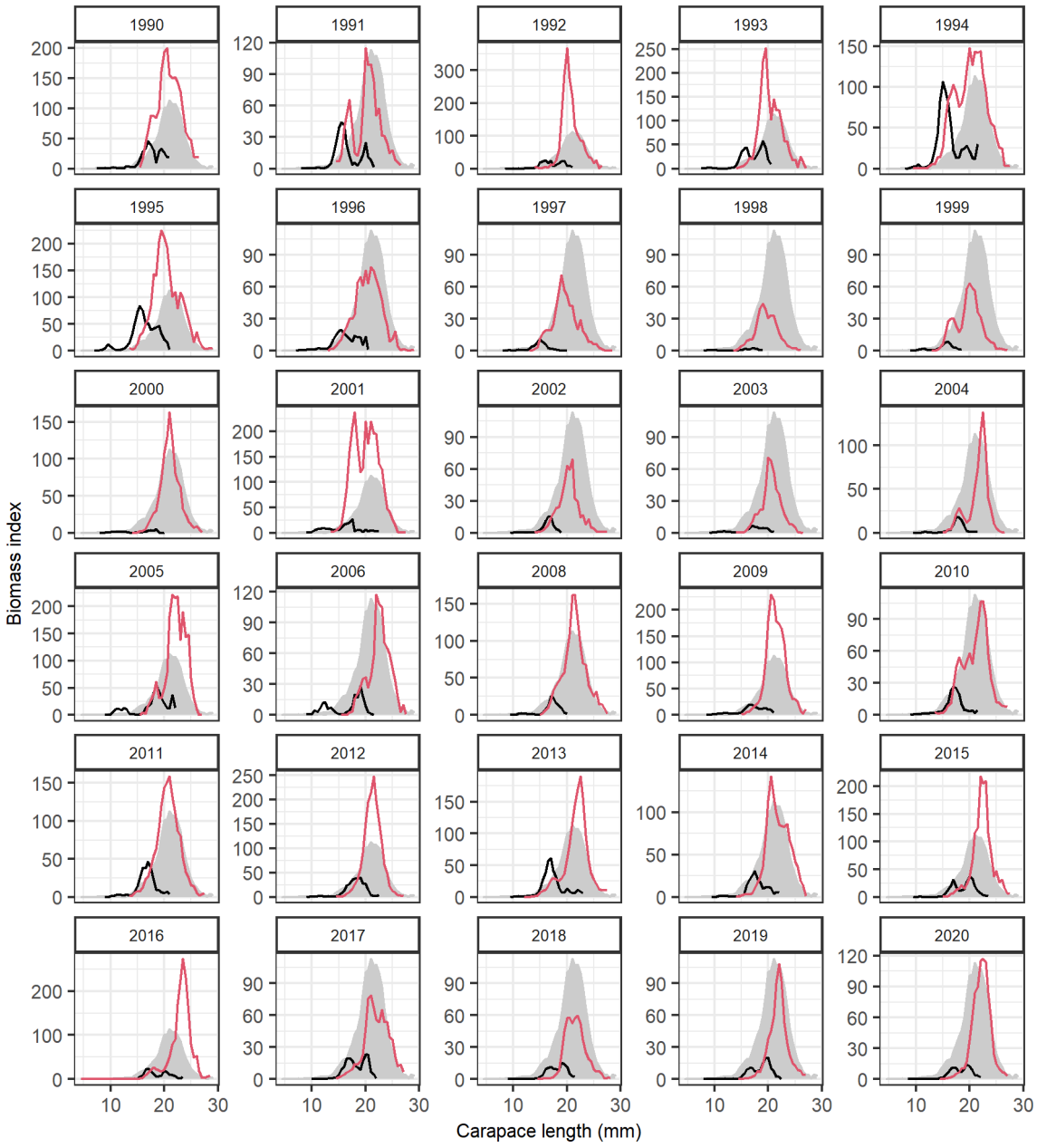

Figure 9. Shrimp in Snæfellsnes area. Length distribution of shrimp. The black line indicates males, and the red line females. The grey area is the mean length distribution of both sexes for the whole study period. The survey was not conducted in 2007, 2021 or 2022.

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 10). The haddock abundance index fluctuated during the study period and 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.

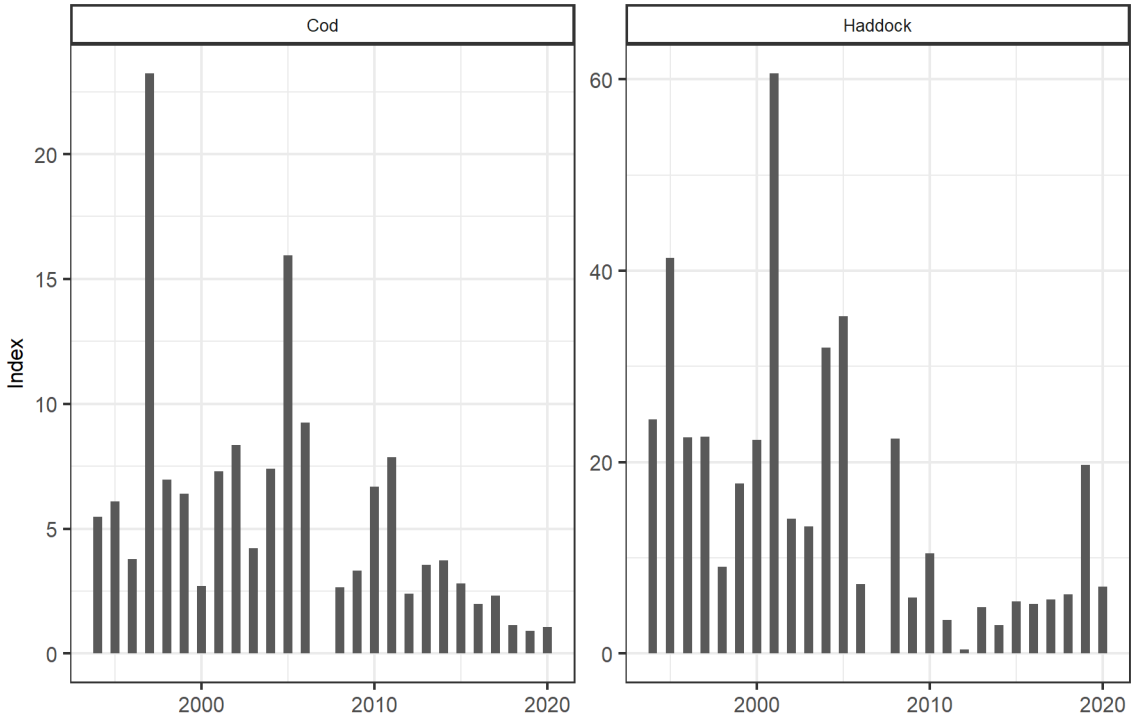

Figure 10. Cod and haddock. Abundance indices in the annual shrimp survey in the Snæfellsnes area. The survey was not conducted in 2007, 2021 or 2022.

MANAGEMENT

The Ministry of Food, Agriculture and Fisheries 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. Shrimp in 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}
1990/91	2 029	0.78			1 597	0.79
1991/92	1 168	0.45			2 111	1.81
1992/93	1 938	0.75			5 035	2.60
1993/94	1 817	0.70			4 809	2.65
1994/95	2 535	0.98			6 765	2.67
1995/96	2 643	1.02			2 432	0.92
1996/97	1 016	0.39			283	0.28
1997/98	579	0.22			11	0.02
1998/99	356	0.14			8	0.02
1999/00	610	0.23			65	0.11
2000/01	1 060	0.41			2 257	2.13
2001/02	2 618	1.01			506	0.19
2002/03	521	0.20	300		89	0.17
2003/04	501	0.19	200		209	0.42
2004/05	662	0.25	200		265	0.40
2005/06	1 511	0.58	200		238	0.16
2006/07	991	0.38	200		316	0.32
2007/08			400		530	
2008/09	1 371	0.53	400		779	0.57
2009/10	1 866	0.72	900		830	0.44
2010/11	1 076	0.41	450		414	0.38
2011/12	1 671	0.64	850		1 632	0.98
2012/13	1 955	0.75	1 000		1 755	0.90
2013/14	1 598	0.61	950		1 698	1.06
2014/15	1 159	0.45	600	600	133	0.11
2015/16	1 472	0.57	700	700	590	0.40
2016/17	1 539	0.59	820	820	826	0.54
2017/18	893	0.34	698	698	645	0.72
2018/19	582	0.22	442	442	516	0.89
2019/20	746	0.29	393	393	90	0.12
2020/21	957	0.37	491	491	304	0.31
2021/22	-	-	393	393	325	-
2022/23	-	-				

HEIMILDIR

Jónsdóttir, I.G., Bragason, G.S., Brynjólfsson, S.H., Guðlaugsdóttir, A.K. and Skúladóttir, U. 2017. Northern shrimp research in Icelandic waters, 1988-2015. Marine and Freshwater Research, Reykjavík, Iceland, HV2017-007.