

SHRIMP IN ÍSAFJARÐARDJÚP – RÆKJA Í ÍSAFJARÐARDJÚPI

Pandalus borealis

THE FISHERY

Shrimp fishing started in Ísafjarðardjúp in the 1930's. The catch fluctuated between 1000 and 3100 tonnes between 1978 and 2002. No fishing was allowed in 2003-2010 due to low biomass indices, but since 2011 annual catches have been 300-1100 tonnes (Figure 1). CPUE fluctuated without a trend between 1978 and 2003. However, since 2011 CPUE has been higher compared with the years before the closure, mainly due to increased density of shrimp within the innermost part of the fjord.

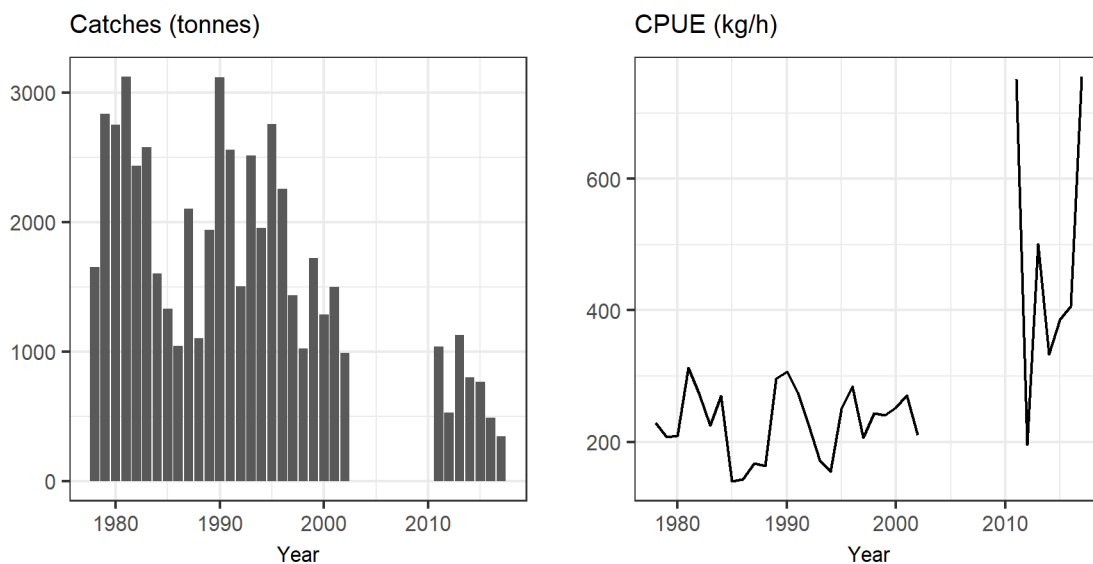


Figure 1. Shrimp in Ísafjarðardjúp. Total catch and catch per unit effort.

Mynd 1. Rækja í Ísafjarðardjúpi. Heildarafli og afli á sóknareiningu.

The distribution of the fishery has varied over time (Figure 2). Since 1999, there have been two main fishing areas; at the innermost part of the fjord and the outermost part.

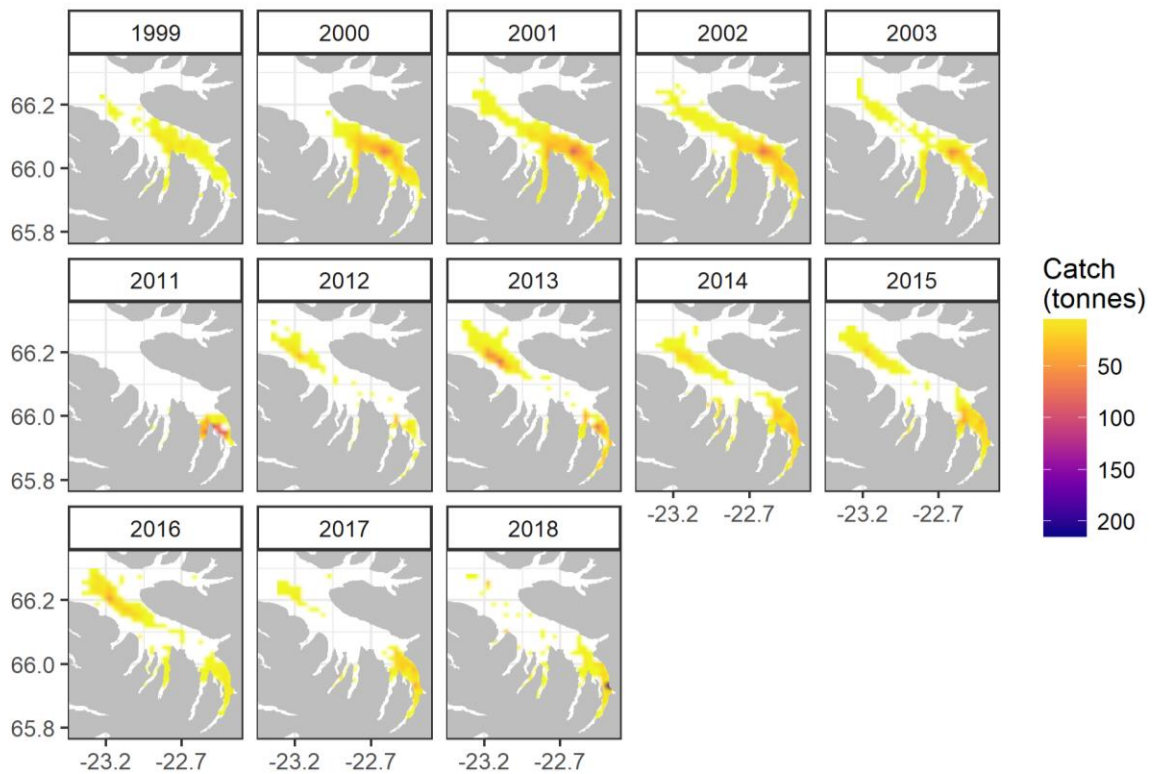


Figure 2. Shrimp in Ísafjarðardjúp. Distribution of shrimp catch in Ísafjarðardjúp.

Mynd 2. Rækja í Ísafjarðardjúpi. Dreifing rækjuafla í Ísafjarðardjúpi.

SURVEY DATA

The annual Icelandic shrimp survey has been conducted since 1988 in Ísafjarðardjúp. The 2018 survey was conducted on 10-16 October 2018 and included 26 fixed and 19 random stations at depths of 41-130 m. Information on sampling procedure can be found in the report 'Northern shrimp research in Icelandic waters, 1988-2015' (Jónsdóttir et al. 2017).

From 1988, shrimp was found within the inner part of the fjord as well as in Jökulfirðir. However, following the decrease in biomass index, the distributional area of shrimp decreased (Figure 3). Since 2011, shrimp has been found within a small area at the innermost part of the fjord and in less density at the outermost part of the fjord.

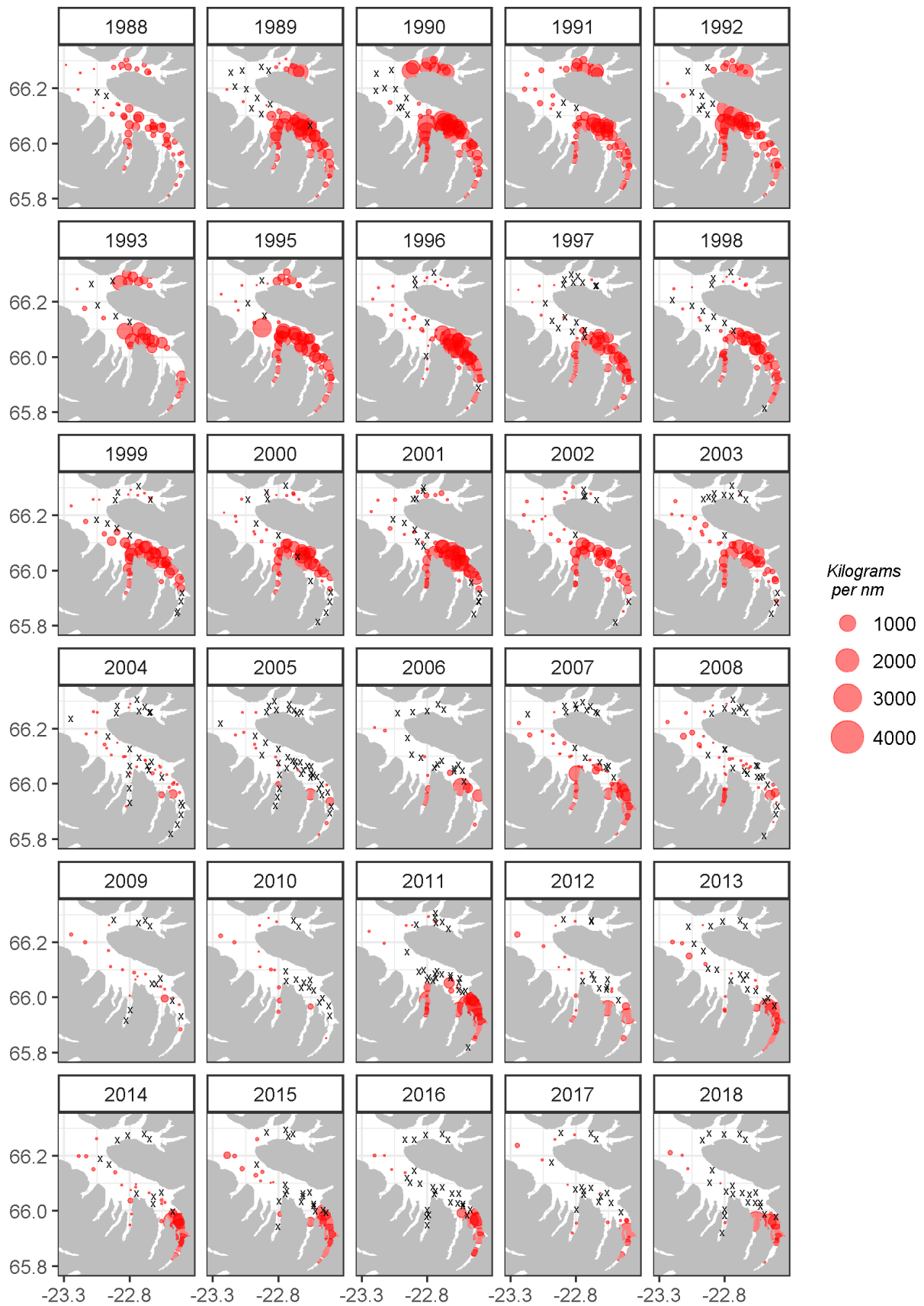


Figure 3. Shrimp in Ísafjarðardjúp. Distribution and abundance of shrimp in the annual shrimp survey. X denotes stations where no northern shrimp was found.

Mynd 3. Rækja í Ísafjarðardjúpi. 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, except the juvenile index, decreased steadily from 1990 to 2004 when they were at historically low levels (Figure 4). In 2011, the indices increased and fluctuated for three years. Since 2013 the indices have decreased and in 2018 the fishable index was above the reference level where the state of the stock is considered critical.

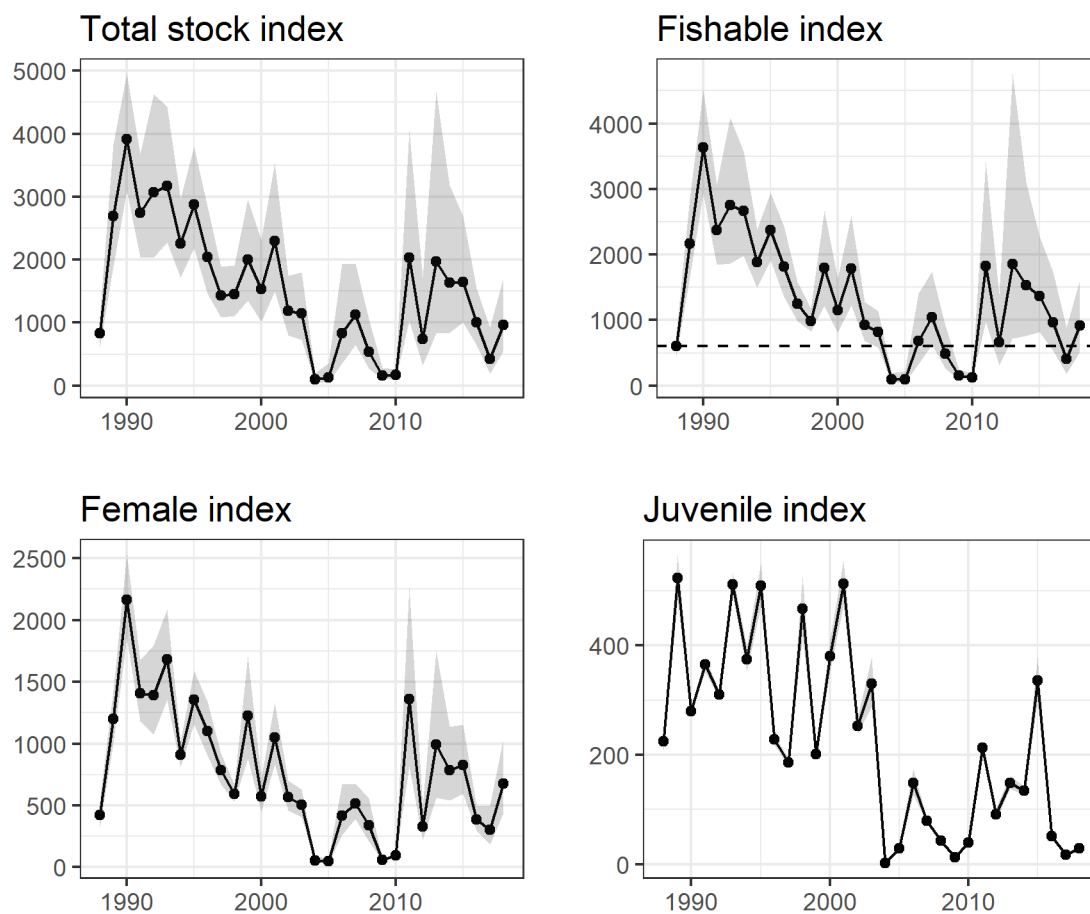


Figure 4. Shrimp in Ísafjarðardjúp. Stock biomass index, fishable biomass index, female biomass index and juvenile biomass index of shrimp. The horizontal line indicates a value where the state of the stock is considered to be critical (20% of the mean of the three highest indices).

Mynd 4. Rækja í Ísafjarðardjúpi. Heildarstofnsvísitala, veiðistofnsvísitala, kvendýravísitala og vísitala ungrækju. Lárétt lína sýnir viðmiðunargildi fyrir ástand stofnsins (20% af meðaltali þriggja hæstu vísitalna).

LENGTH DISTRIBUTION

From 2013 to 2015 the length distribution was close to average. In 2016 and 2017, the number of females were less than average whereas it was close to average in 2018 (Figure 5).

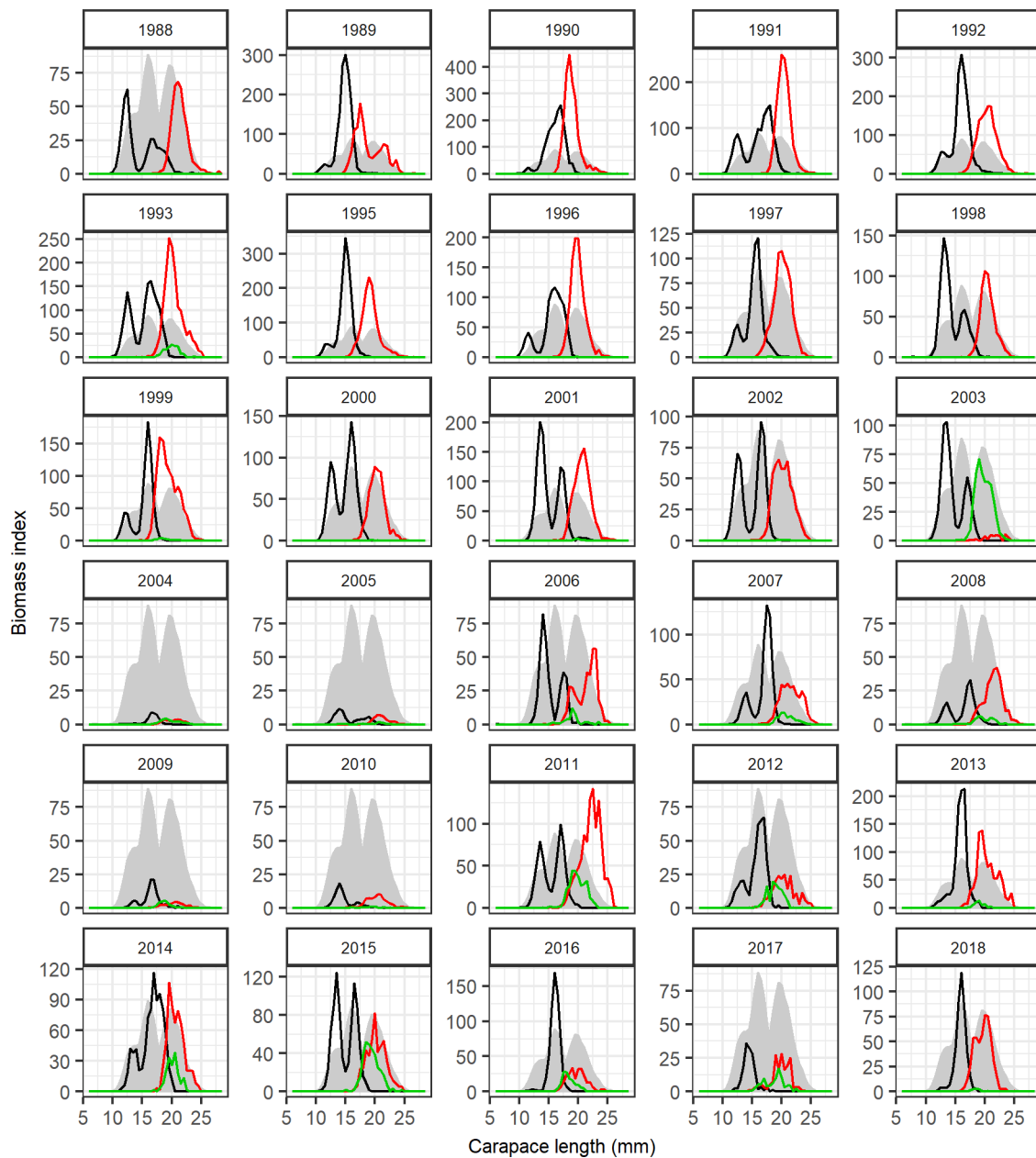


Figure 5. Shrimp in Ísafjarðardjúp. Length distribution. The black line indicates males, the green immature females, and the red line mature females. The grey area is the mean length distribution of both sexes for the whole study period. Note different scales on y-axes.

Mynd 5. Rækja í Ísafjarðardjúpi. Lengdardreifing stofnmælingu. Svört lína sýnir karldýr, græn lína ókynþroska kvendýr og sú rauða kynþroska kvendýr. Gráa svæðið sýnir meðallengdardreifingu beggja kynja allt rannsóknatímabilið. Athugið mismunandi skala á y-ás.

ABUNDANCE OF COD AND HADDOCK

0-group cod and haddock indices have fluctuated throughout the study period and have increased since 2010. The number of juvenile cod was relatively high in 2018 whereas the number of juvenile haddock was low (Figure 6). Cod abundance fluctuated between 1994 and 2010. In 2011 it increased and was in general at higher levels compared with before 2011. However, in 2017 the cod abundance index was very low. Haddock abundance index increased steadily in 1995-2005 and has since then fluctuated at higher levels (Figure 6).

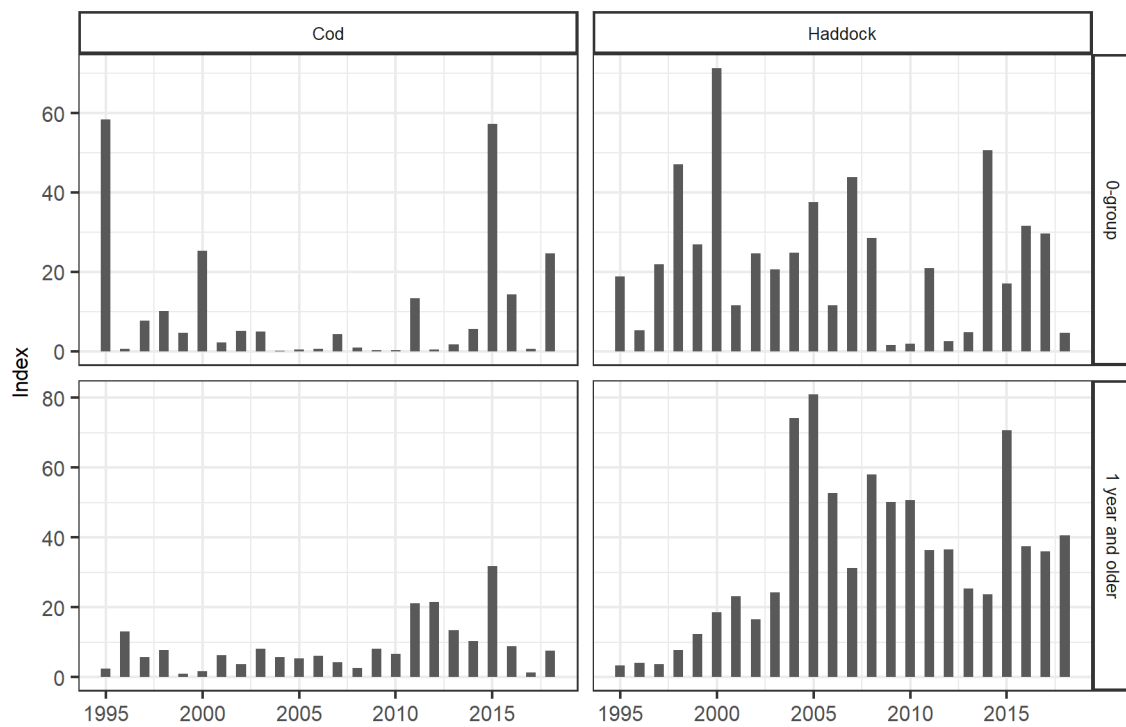


Figure 6. Cod and haddock in Ísafjarðardjúp. Abundance indices of cod and haddock in the annual shrimp survey.

Mynd 6. Þorskur og ýsa í Ísafjarðardjúpi. Vísitala þorsks og ýsu í stofnmælingu rækju.

MANAGEMENT

The Ministry of Industries and Innovation is responsible for management of all marine fisheries in Iceland and implementation of legislation. The quota year has been from early winter (following the survey in October) until 30 April but was in 2017 changed to 31 August.

Table 1. Shrimp in Ísafjarðardjúp. 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 Ísafjarðardjúpi. Heildarstofnsvísitala, ástand stofns (vísitala miðað við meðaltal þriggja hæstu vísitölu gilda), ráðgjöf, afli og vísitala veiðihlutfalls (F_{proxy}).

Year	Biomass index	Relative state	Rec. TAC	National TAC	Catch	F_{proxy}
1988/89	607	0.20				1.81
1989/90	2169	0.70				0.89
1990/91	3636	1.17	3000	3000	3309	0.86
1991/92	2377	0.76	2500	2500	2554	1.07
1992/93	2759	0.89	2500	2500	2501	0.91
1993/94	2663	0.86	2500	2500	2511	0.94
1994/95	1885	0.61	2100	2100	1955	1.04
1995/96	2370	0.76	2700	2700	2756	1.16
1996/97	1814	0.58	2300	2300	2254	1.25
1997/98	1249	0.40	1450	1450	1435	1.15
1998/99	988	0.32	1000	1000	1025	1.04
1999/00	1799	0.58	1800	1800	1722	0.96
2000/01	1153	0.37	1200	1200	1287	1.11
2001/02	1782	0.57	1500	1500	1497	0.87
2002/03	931	0.30	1000	1000	989	1.07
2003/04	819	0.26	0	0	0	-
2004/05	94	0.03	0	0	0	-
2005/06	100	0.03	0	0	3	-
2006/07	680	0.22	0	0	3	-
2007/08	1044	0.34	0	0	9	-
2008/09	489	0.16	0	0	2	-
2009/10	151	0.05	0	0	1	-
2010/11	129	0.04	0	0	0	-
2011/12	1823	0.59	1000	1000	1040	0.57
2012/13	663	0.21	500*	500	527	0.79
2013/14	1858	0.59	1100*	1100	1128	0.61
2014/15	1532	0.48	750	750	801	0.52
2015/16	1365	0.42	700	700	767	0.56
2016/17	967	0.31	484	484	491	0.51
2017/18	404	0.13	322*	322	343	0.85
2018/19	912	0.30	456			

* Recommended TAC re-evaluated after a survey in February.

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 604 (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 604 can therefore be considered a proxy for B_{lim} or I_{lim} . If the total biomass index is below 604, 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 above 604. Hence, MFRI advises that catch in Ísafjarðardjúp should be no more than 456 tonnes in the quota year 2018/2019. The abundance of cod juveniles was high and therefore the MFRI advises that the Directorate of Fisheries will monitor the shrimp fishery and close the area for fishing if bycatch will exceed the predetermined limits.