

NORTHERN SHRIMP IN ÍSAFJARÐARDJÚP – RÆKJA Í ÍSAFJARÐARDJÚPI

Pandalus borealis

COMMERCIAL FISHING

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 500-1100 tonnes (Figure 1). The fishing season has been from early winter (following the survey in October) until 30th April. Catch per unit effort (CPUE) remained relatively stable between 1978 and 2002. Since 2011 CPUE has been higher, mainly due to increased density of shrimp within the innermost part of the fjord.

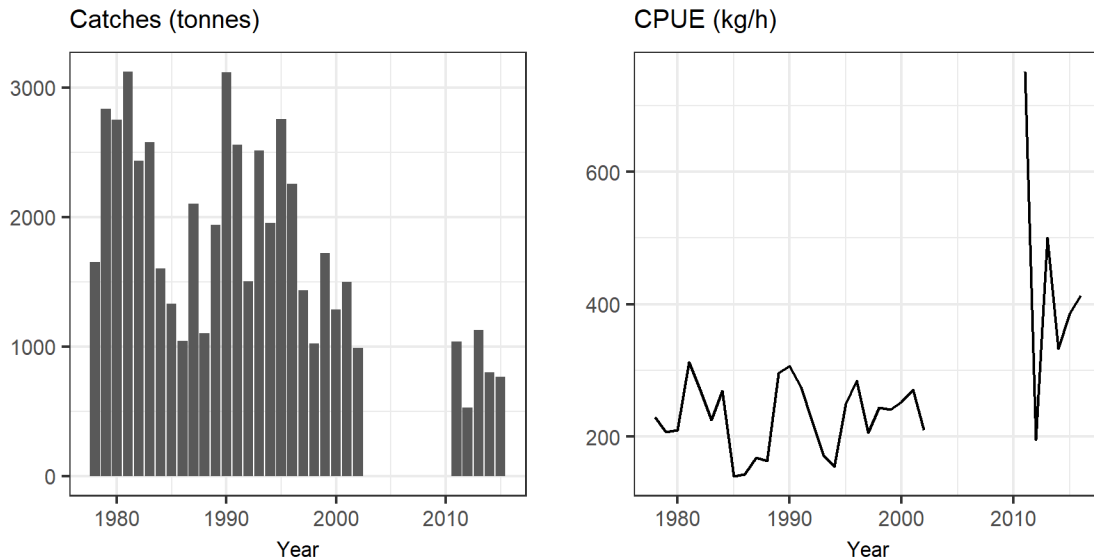


Figure 1. Total catch and catch per unit effort in Ísafjarðardjúp.

Mynd 1. Heildarafli og afli á sóknareiningu í Ísafjarðardjúpi.

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.

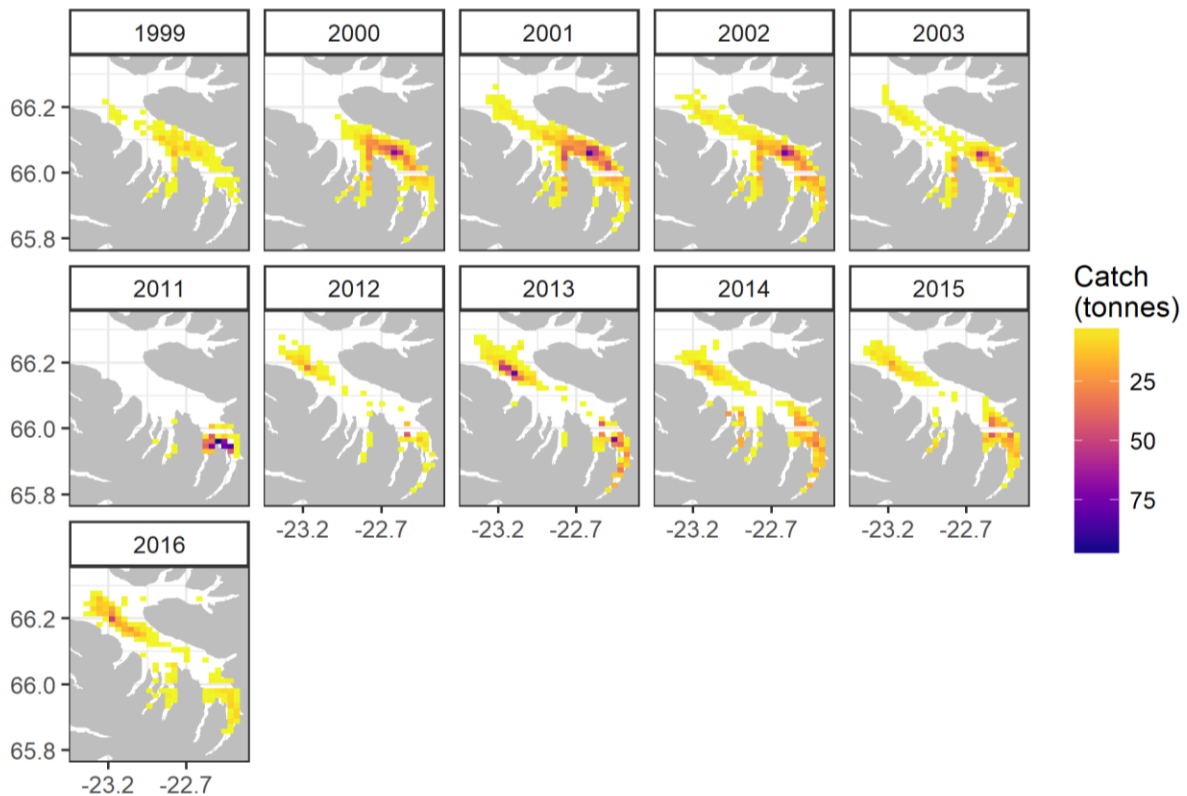


Figure 2. Distribution of shrimp catch in Ísafjarðardjúp from 1999 to 2016.

Mynd 2. Dreifing rækjuafli í Ísafjarðardjúpi 1999-2016.

ICELANDIC SHRIMP SURVEY

The annual Icelandic shrimp survey has been conducted since 1988 in Ísafjarðardjúp. The survey was conducted from 29th October to 4th of November 2017 and included 26 fixed stations and 10 random stations at 49-133 m depth. Due to diurnal vertical migration of shrimp, all tows are carried out during the daylight hours. All 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.

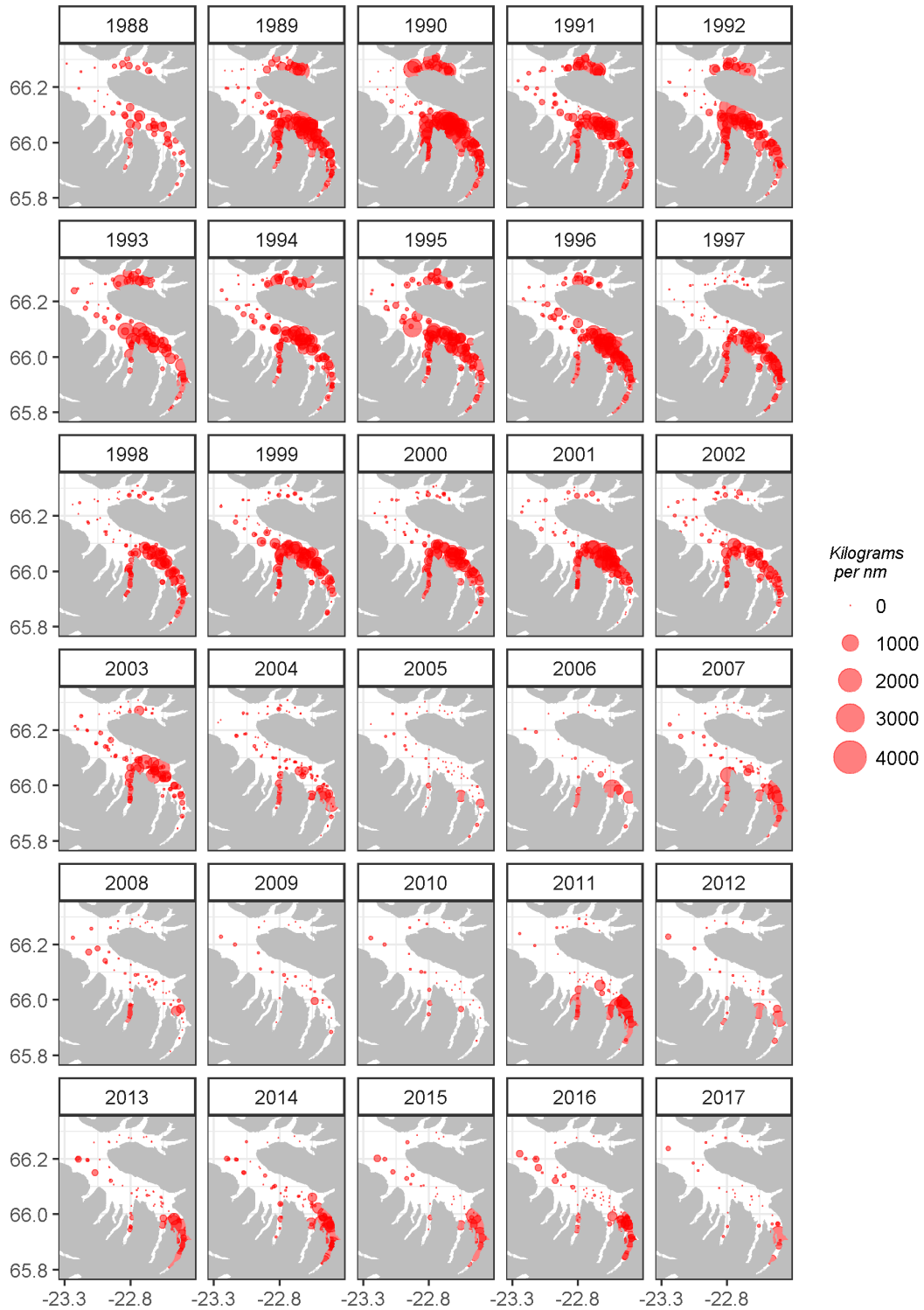


Figure 3. Distribution and abundance of shrimp in the annual shrimp survey 1988-2017.

Mynd 3. Útbreiðsla og magn rækju í stofnmælingu 1988-2017.

SURVEY INDICES

Four indices are used to assess the state of the shrimp 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 include 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 and is equivalent to the spawning stock biomass of various fish species.

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 2017 the fishable index was below the reference level where the state of the stock is considered critical.

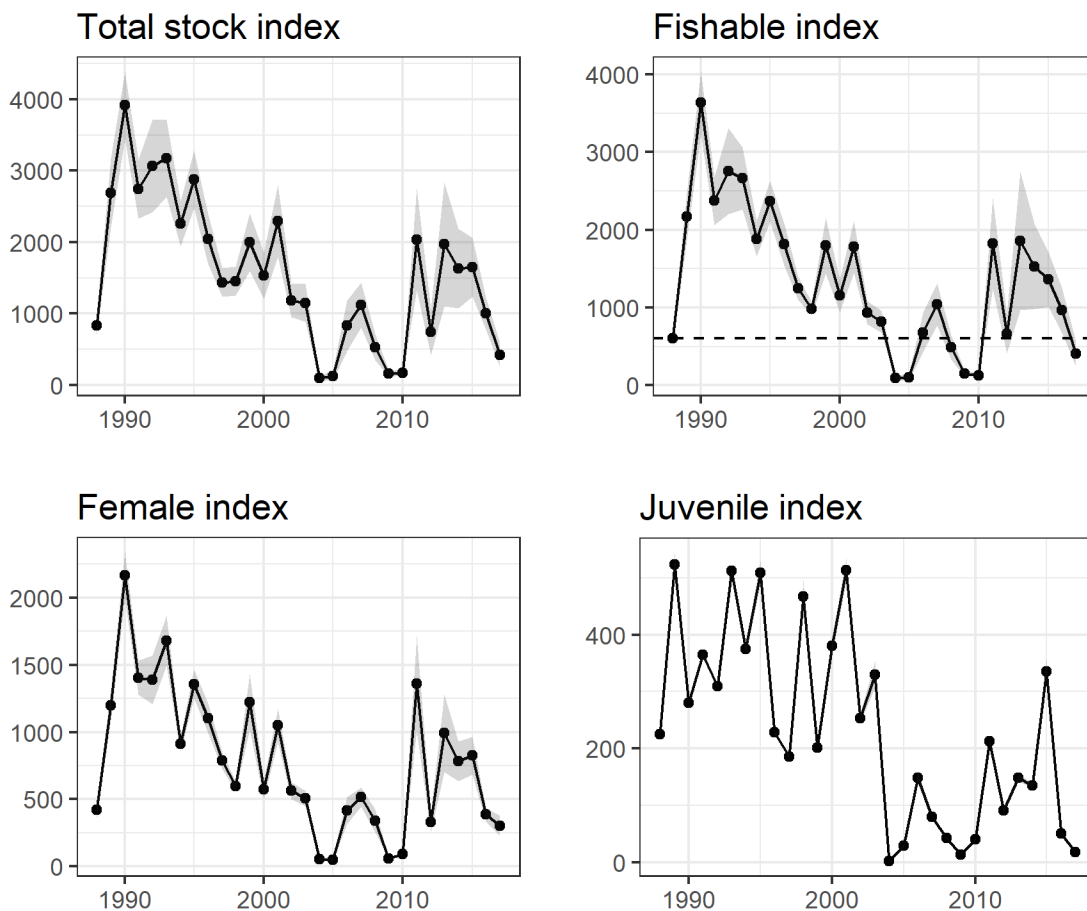


Figure 4. Stock biomass index, fishable biomass index, female biomass index, and juvenile biomass index of shrimp. The horizontal line indicates a value where the state of the stock is considered critical.

Mynd 4. Heildarstofnsvísitala, veiðistofnsvísitala, kvendýravisitala og vísitala ungrækju í Ísafjarðardjúpi 1988-2017. Lárétt lína sýnir viðmiðunargildi fyrir ástand stofnsins.

LENGTH DISTRIBUTION OF SHRIMP

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

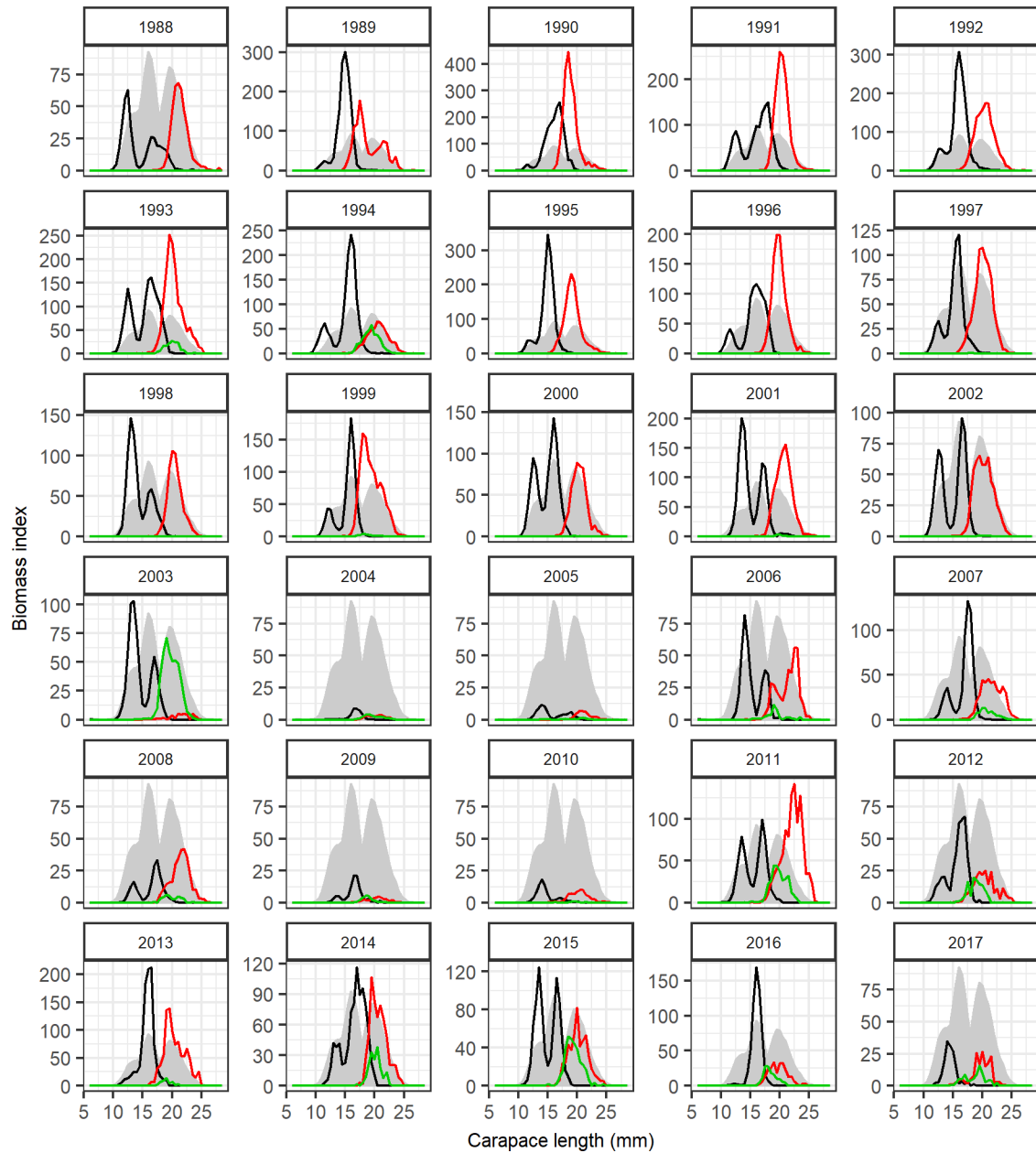


Figure 5. Length distribution of shrimp. The black line indicates males, the green immature females, and the red line mature females. The grey area is the mean length distribution of both sexes for the whole study period. Please note different scales on the y-axes.

Mynd 5. Lengdardreifing rækju í stofnmælingu í Ísafjarðardjúpi 1988-2017. Svört lína sýnir karldýr, græn lína ókynþroska kvendýr og sú rauða kynþroska kvendýr. Grúa svæðið sýnir meðallengdardreifingu beggja kynja allt rannsóknatímabilið. Athugið að skalinn á y-ás er mismunandi.

ABUNDANCE OF COD AND HADDOCK

The 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. The haddock abundance index increased steadily from 1994 to 2005 and has since then fluctuated at higher levels (Figure 6).

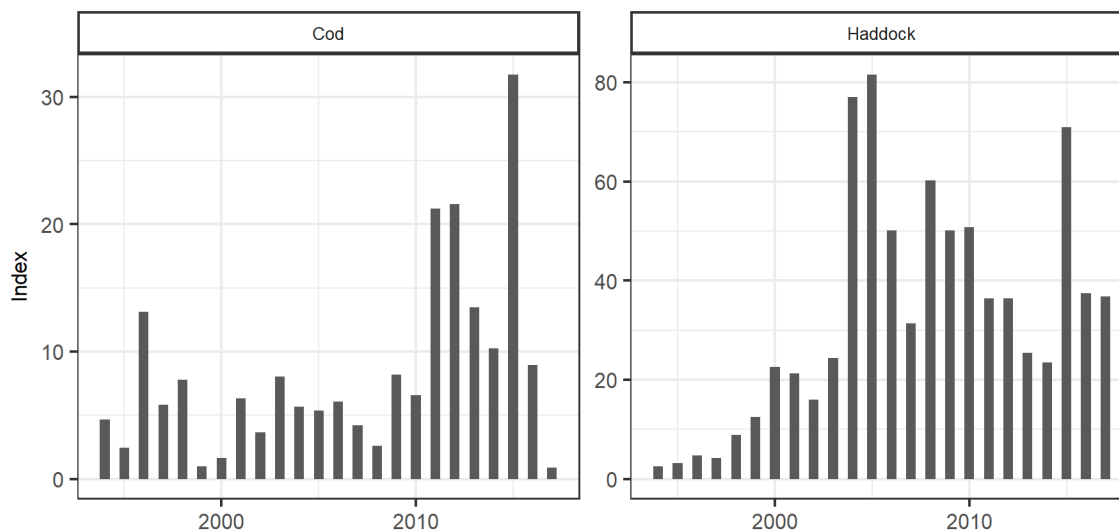


Figure 6. Abundance indices of cod and haddock from 1994 to 2017.

Mynd 6. Vísitala þorsks og ýsu í stofnmælingu rækju í Ísafjarðardjúpi 1994 til 2017.

ADVICE

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

The state of the stock is considered critical if the fishable biomass index is below $6\sigma_4$ (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 $6\sigma_4$ can be considered a proxy for B_{lim} or an I_{lim} . If the fishable biomass index is below $6\sigma_4$, zero catch is advised. If the fishable biomass index is above I_{lim} , the advice is based on multiplying the most recent biomass index value with the target F_{proxy} .

In October 2017, the fishable biomass index was below $6\sigma_4$. Hence, MFRI advises zero catch in the quota year 2017/2018 in Ísafjarðardjúp.

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

Tafla 1. Veidistofnsvísitala, ástand stofns (vísitala miðað við meðaltal þriggja hæstu vísitölu gilda), ráðgjöf, afli og vísitala veiðihlutfalls (F_{proxy})

Year	BI Fishable	Relative state	Rec. TAC	Catch	F_{proxy}
1988	607	0.20			1.81
1989	2169	0.70			0.89
1990	3636	1.17	3000	3309	0.86
1991	2377	0.76	2500	2554	1.07
1992	2759	0.89	2500	2501	0.91
1993	2663	0.86	2500	2511	0.94
1994	1885	0.61	2100	1955	1.04
1995	2370	0.76	2700	2756	1.16
1996	1814	0.58	2300	2254	1.25
1997	1249	0.40	1450	1435	1.15
1998	988	0.32	1000	1025	1.04
1999	1799	0.58	1800	1722	0.96
2000	1153	0.37	1200	1287	1.11
2001	1782	0.57	1500	1497	0.87
2002	931	0.30	1000	989	1.07
2003	819	0.26	0	0	-
2004	94	0.03	0	0	-
2005	100	0.03	0	3	-
2006	680	0.22	0	3	-
2007	1044	0.34	0	9	-
2008	489	0.16	0	2	-
2009	151	0.05	0	1	-
2010	129	0.04	0	0	-
2011	1823	0.59	1000	1040	0.57
2012	663	0.21	500	527	0.79
2013	1858	0.59	1100	1128	0.61
2014	1532	0.48	750	801	0.52
2015	1365	0.42	700	767	0.56
2016	967	0.31	484	491	0.51
2017	404	0.13	0		