

OFFSHORE NORTHERN SHRIMP – ÚTHAFSRÆKJA

Pandalus borealis

THE FISHERY

Shrimp fishing in the offshore area started in the early 1970's. Catch levels were low during the first decade but increased steadily from 1982 until it peaked in 1997 at 62 thous. tonnes. After 1997, the catch decreased sharply and reached a minimum of 600 tonnes in 2006 (Figure 1). CPUE increased from 1988 to a peak in 1996. CPUE decreased sharply between 1996 and 1999, then fluctuated between 2001 and 2013 when it decreased suddenly (Figure 1). In 1988, 152 commercial vessels landed offshore shrimp. The number of commercial shrimp vessels steadily decreased from 1993 to 2006, when only one vessel landed offshore shrimp (Figure 1). The number of vessels increased again until 2013, when 34 vessels landed offshore shrimp, but since 2013 the number of vessels has decreased.

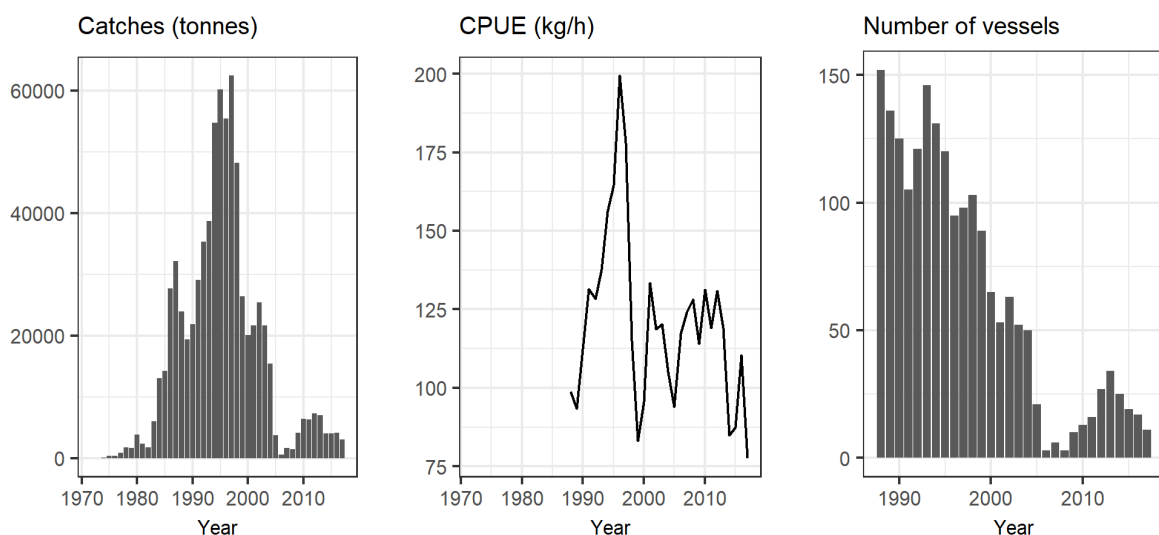


Figure 1. Offshore northern shrimp. Total catch, catch per unit effort (CPUE), and number of commercial vessels.

Mynd 1. Úthafsrækja. Heildarafli, afli á sóknareiningu og fjöldi skipa.

Offshore shrimp fishing takes place in the waters north of Iceland. The main distribution of the fishery has varied over time (Figure 2). In 1988-2004, the main fishing ground was larger compared with 2006-2017. At that time, a high proportion of the catch was taken from Norðurkantur and around Kolbeinsey (north and northeast of the Vestfirðir peninsula). However, since 2008, the main catches were caught in the areas north of Skjálfandi and Öxarfjörður bays. Since 2004, no shrimp fishing has taken place north-east of Iceland.

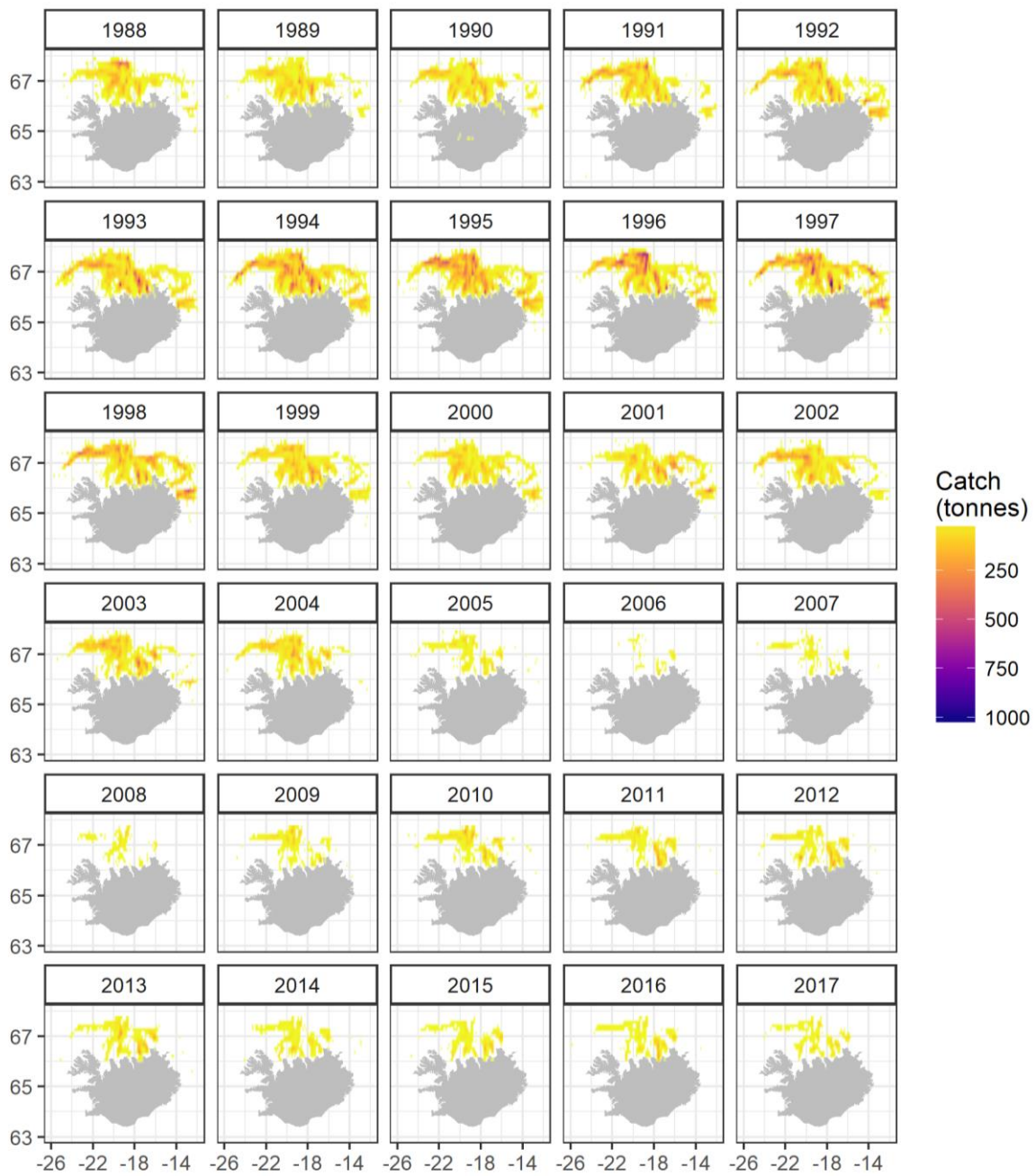


Figure 2. Offshore northern shrimp. Spatial distribution of catch.

Mynd 2. Úthafsærkja. Dreifing afla.

SURVEY DATA

The annual offshore Icelandic shrimp survey has been conducted since 1988. Originally, the number of stations were about 190, but in 2006 the number of stations was reduced to 92 covering the same area as before with less density of stations. Since 2014 the survey includes 86 fixed stations at depths to 700 m. The survey indices are calculated based on all available stations within the area that has been sampled annually since 1988. The survey was conducted between 13th and 24th of July 2018. 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 Jónsdóttir et al. (2017).

The density of shrimp has decreased after 1996, when the biomass index was highest. Since 2004, density has been low east and northeast of Iceland. In the past years the density has been highest in the Grímsey and Kolbeinsey areas (Figure 3).

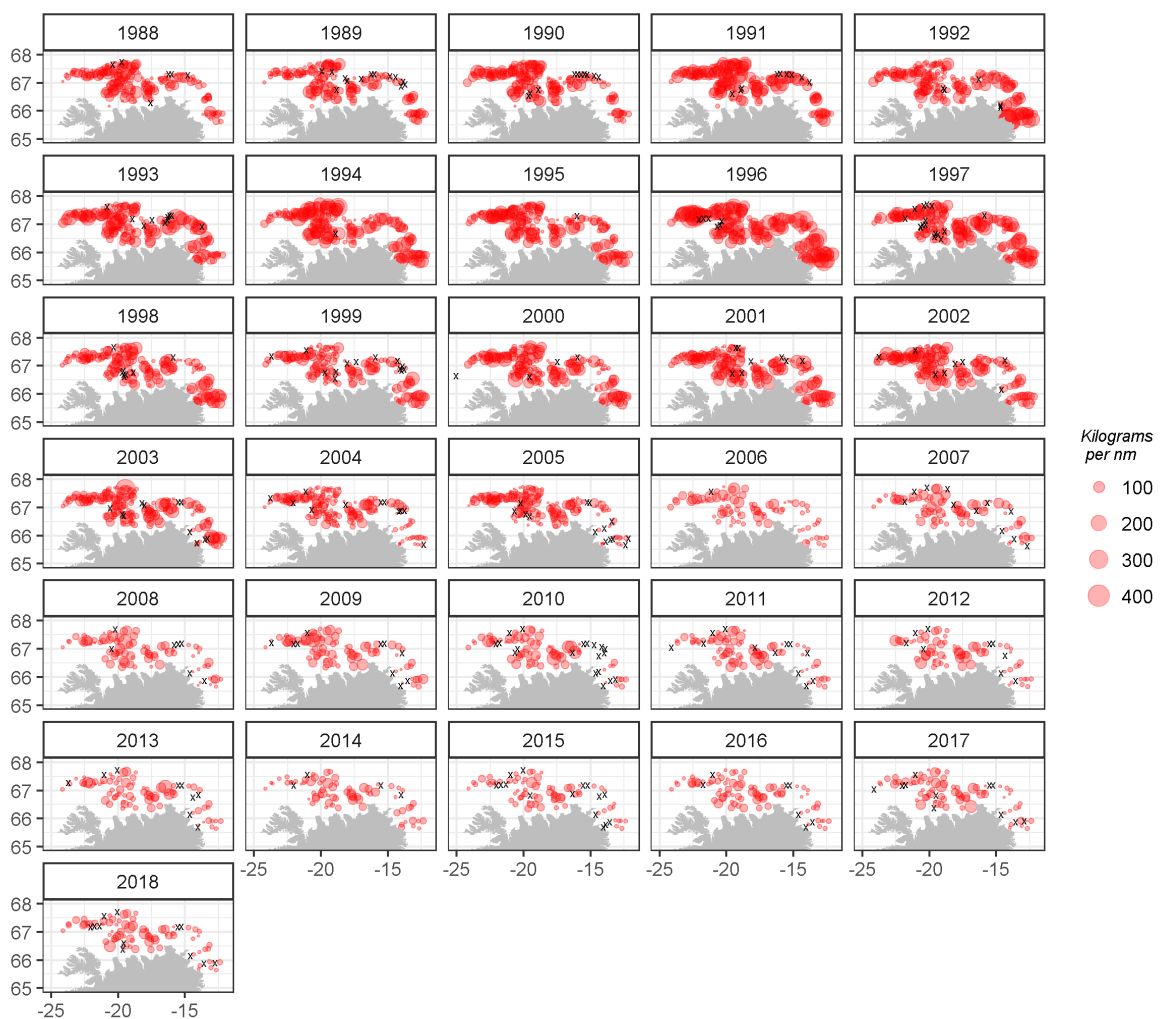


Figure 3. Offshore northern shrimp. Distribution and abundance in the annual shrimp survey. x indicates no shrimp.

Mynd 3. Úthafsækja. Útbreiðsla og magn í stofnmælingu. x sýnir hvar engin rækja fannst.

INDICES

Four indices are used to assess the state of the offshore 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. The fishable biomass index is used for calculation of the advice. 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.

The total biomass index and the fishable index increased until 1996, after which they declined until 2004 (Figure 4). The indices increased slightly in 2006–2009. The indices declined between 2009 and 2012, and has remained relatively stable since then, with the exception of 2015 when they reached historically low levels. The female index has fluctuated during the study period with a general downward trend. The juvenile index increased from 1988 to 1994. Since then it has decreased and reached historically low levels in 2015 and 2016. The total biomass has increased slightly since 2015.

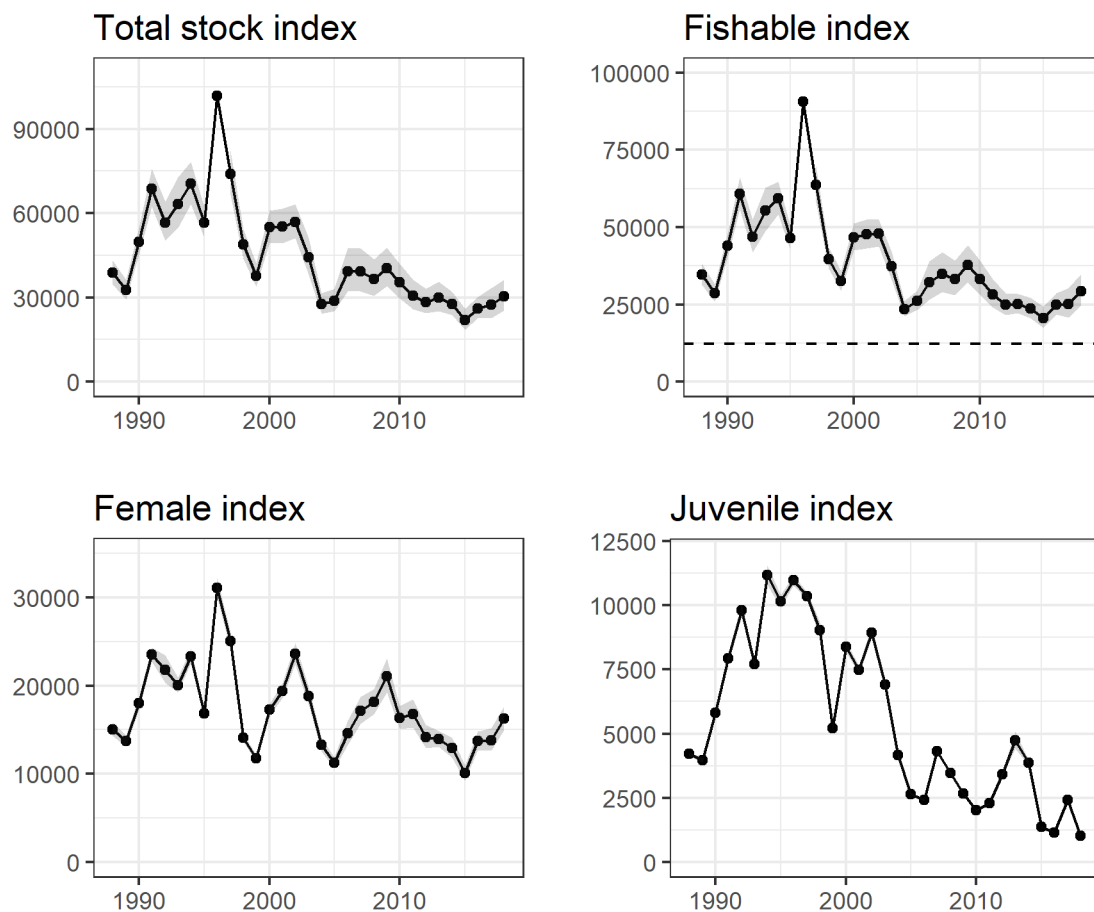


Figure 4. Offshore northern shrimp. Stock biomass index, fishable biomass index, female biomass index and juvenile biomass index. The horizontal line indicates a I_{lim} which is a proxy for B_{lim} (20% of the mean of the three highest indices).

Mynd 4. Úthafsrækja. Heildarstofnsvísitala, veiðistofnsvísitala, kvendýravísitala og vísitala ungrækju. Lárétt lína sýnir varúðarmörk I_{lim} nálgun á B_{lim} (20% af meðaltali þriggja hæstu vísitalna).

LENGTH DISTRIBUTION

Due to slower growth in the offshore area compared with inshore areas, it is difficult to estimate age and hence, cohorts, of offshore shrimp. The number of males has decreased and has been around or below average since 2004. Since 2015 the smallest individuals were missing in the survey (Figure 5).

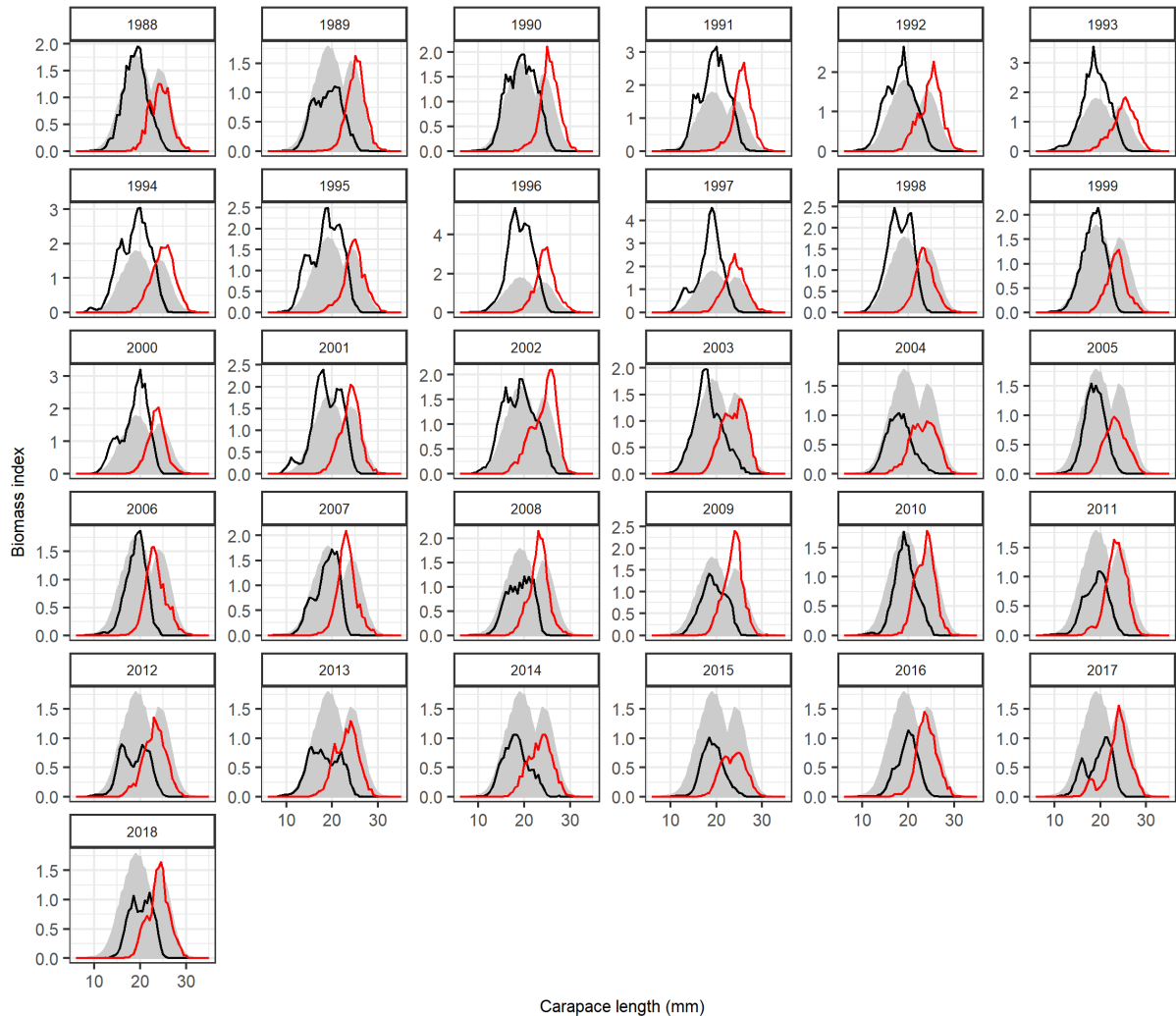


Figure 5. Offshore northern shrimp. Length distribution. The black line indicates males and the red line females. The grey area is the mean length distribution of both sexes for the whole study period.

Mynd 5. Úthafsrækja. Lengdardreifing í stofnmælingu. Svört lína sýnir karldýr og sú rauða kvendýr. Gráa svæðið sýnir meðallengdardreifingu beggja kynja allt rannsóknatímabilið.

ABUNDANCE OF COD AND GREENLAND HALIBUT

The abundance of cod was very low from 1988 to 1995 (Figure 6). Since 2003 it has remained much higher than between 1988 and 1995 and has increased sharply from 2013-2016. The cod abundance has remained high from 2015-2018. The Greenland halibut abundance decreased from 1991 to 2005. It increased sharply until 2011 when it started to decrease again. The Greenland halibut abundance remained relatively stable from 2014-2017 but increased slightly in 2018.

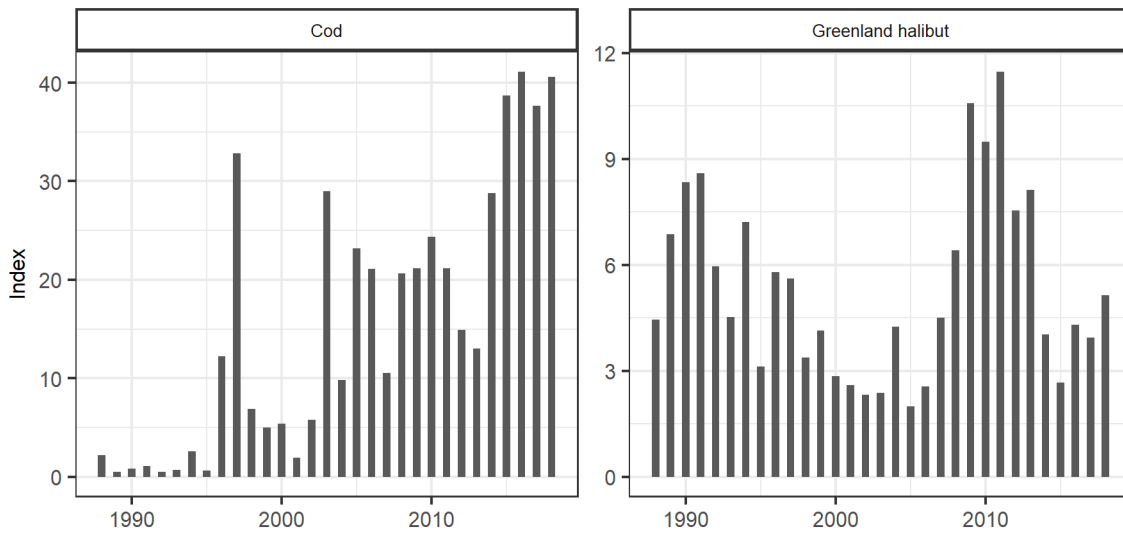


Figure 6. Cod and Greenland halibut. Abundance indices in the annual offshore shrimp survey.

Mynd 6. Þorskur og grálúða. Vísitölur í stofnmælingu úthafsækju.

MANAGEMENT

The Ministry of Industries and Innovation is responsible for management of the Icelandic fisheries and implementation of legislation. The Marine Research Institute (MRI) first recommended TAC for offshore shrimp in 1987 and the fishery has been managed with TAC since then, except for the quota years 2010/2011 to 2013/2014, when the offshore shrimp fishery was open to all boats without a national TAC.

The quota year from 1 September to 31 August took an effect on 1 September 1991.

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

Tafla 1. Úthafsærækja. Veidistofnsvísitala, 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	34 573	0.48	30 000	30 000	24 500	0.71
1989	28 609	0.40	20 000	20 900	20 900	0.73
1990	43 959	0.61	22 000	24 600	24 400	0.56
1991	60 777	0.85	28 000	-	30 700	0.51
1991/92			35 000	40 000	34 200	
1992/93	46 892	0.65	35 000	40 000	41 800	0.89
1993/94	55 395	0.77	40 000	52 000	53 200	0.96
1994/95	59 256	0.83	60 000	62 000	61 200	1.03
1995/96	46 390	0.65	40 000	63 000	65 000	1.40
1996/97	90 689	1.26	55 000	60 000	57 300	0.63
1997/98	63 624	0.89	70 000	75 000	60 900	0.96
1998/99	39 731	0.55	40 000	40 000	30 700	0.77
1999/00	32 533	0.45	20 000	20 000	20 700	0.64
2000/01	46 615	0.65	25 000	25 000	22 100	0.47
2001/02	47 667	0.66	35 000	35 000	27 400	0.57
2002/03	47 924	0.67	30 000	30 000	24 300	0.51
2003/04	37 342	0.52	20 000	20 000	18 000	0.48
2004/05	23 498	0.33	15 000 ¹⁾	10 000	5 100	0.22
2005/06	26 225	0.37	10 000	10 000	800	0.03
2006/07	32 234	0.45	7 000	7 000	1 600	0.05
2007/08	34 850	0.49	7 000	7 000	1 300	0.04
2008/09	33 158	0.46	7 000	7 000	3 200	0.10
2009/10	37 691	0.53	7 000	7 000	6 300	0.17
2010/11	33 310	0.46	7 000	-	6 300	0.19
2011/12	28 263	0.39	7 000	-	7 300	0.26
2012/13	24 961	0.35	5 000	-	7 400	0.30
2013/14	25 099	0.35	5 000	-	5 100	0.20
2014/15	23 711	0.33	5 000	5 000	4 100	0.17
2015/16	20 524	0.29	4 000	4 000	4 300	0.21
2016/17	24 985	0.35	4 100	4 100	3 100	0.12
2017/18	25 023	0.35	5 000	5 000		
2018/19	29 262	0.41	5 852			

¹⁾ 2004/05: No recommended TAC but unchanged effort estimated to yield 15 000 tonnes.

ADVICE 2018

The Icelandic shrimp survey was used as a biomass indicator (Fishable biomass index). The target F_{proxy} (catch/survey biomass) of 0.2 is considered precautionary based on the historical relationship between catch and survey index. The advice is based on multiplying the target F_{proxy} with the most recent index value. Advice has been based on the index value of the previous year, i.e. the advice given in 2016 was based on the 2015 survey. Since 2017 the advice has been based on current year's survey.

The state of the stock is considered to be critical if the fishable biomass index is below 12 200 (equivalent to a relative state of 0.2; the biomass divided with the mean of the three highest indices). The fishable biomass index value of 12 200 can be considered a proxy for B_{lim} or an I_{lim} . If the fishable biomass index is below 12 200, 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 $F_{\text{proxy}} = 0.2$.

In July 2018, the fishable biomass index was 29 262, and hence the MFRI advices that catch in the offshore area should be no more than 5 852 tonnes in the quota year 2018/2019.

REFERENCES

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