

# OFFSHORE NORTHERN SHRIMP – ÚTHAFSRÆKJA

## *Pandalus borealis*

### COMMERCIAL FISHING

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 thousand 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 have decreased.

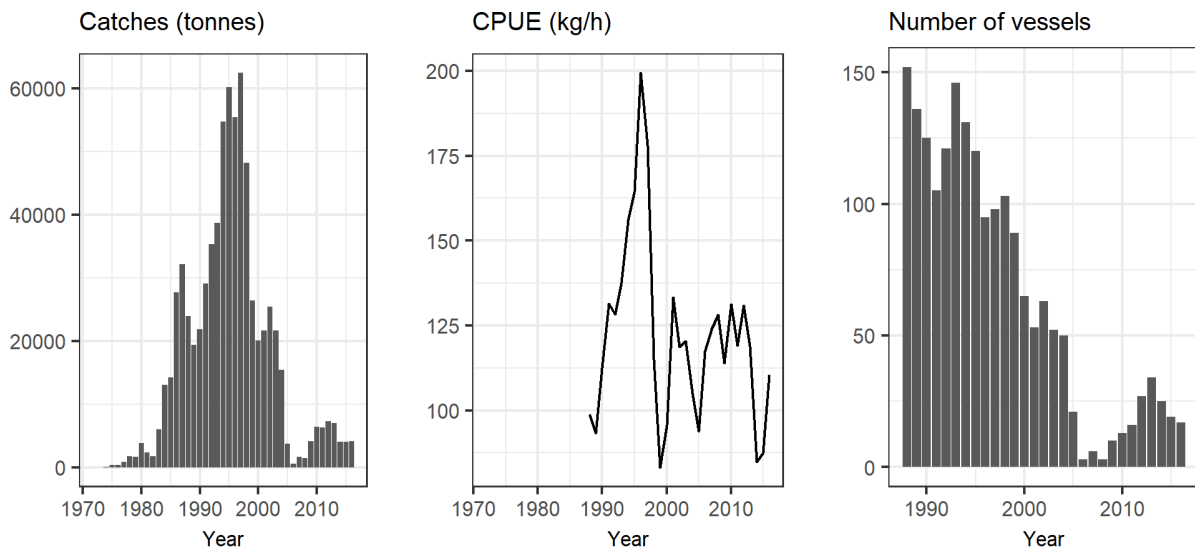


Figure 1. Total catch, catch per unit effort (CPUE) and number of commercial vessels in the offshore area.

*Mynd 1. Heildarafli, afli á sóknareiningu og fjöldi skipa á úthafsrækjuveiðum.*

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 2006-2016. At that time, a high proportion of the catch was taken from Norðurkantur and around Kolbeinsey (north and north-west of the Westfjord 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.

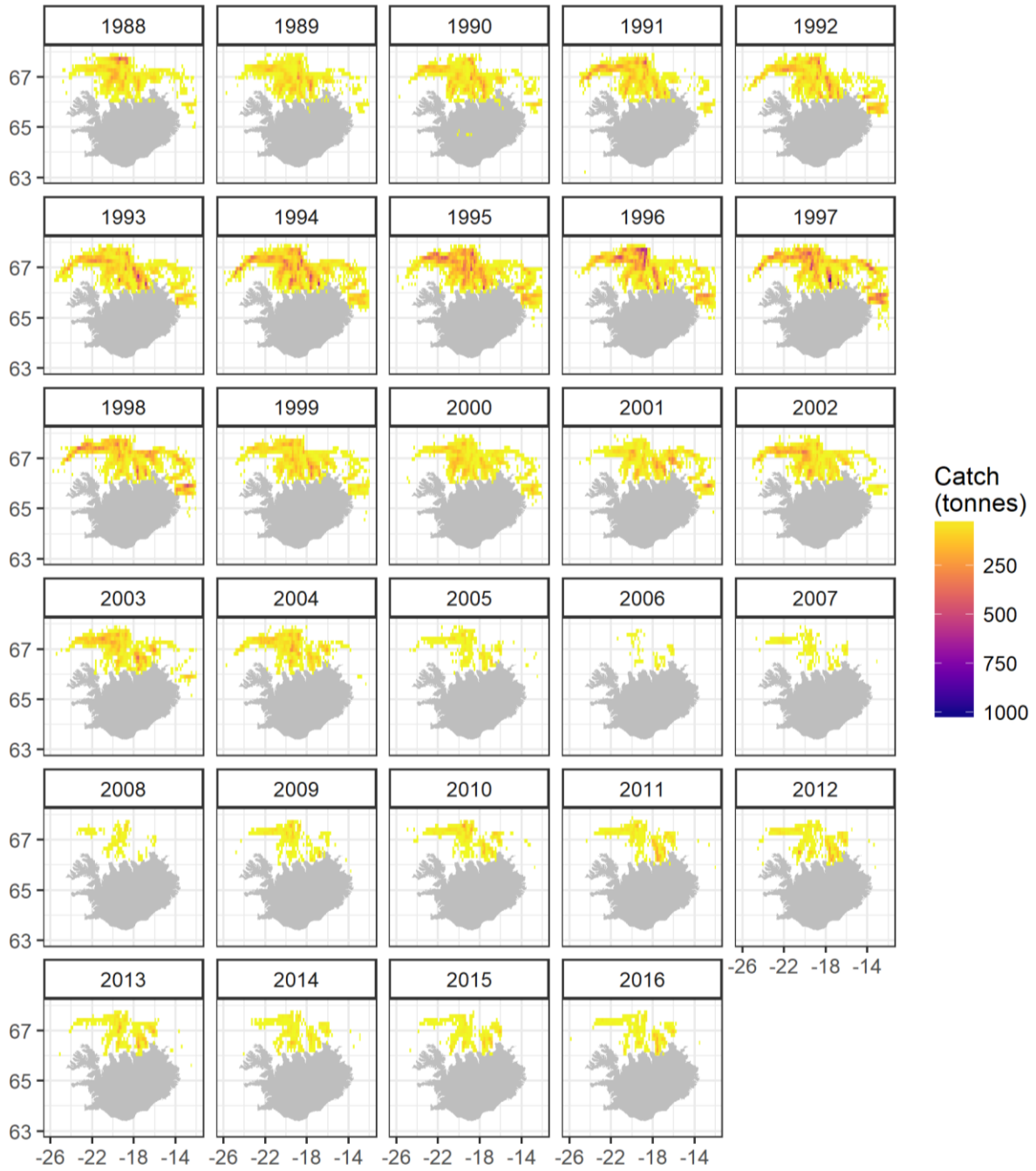


Figure 2. Distribution of offshore shrimp catch from 1988 to 2016.

*Mynd 2. Dreifing úthafsækjuafla 1989-2016.*

## ICELANDIC SHRIMP SURVEY

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. The survey indices are calculated based on all stations available in each year. Since 2014 the survey includes 86 fixed stations at depths to 700 m. The survey was conducted between 14<sup>th</sup> and 28<sup>th</sup> of July 2017. 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. Distribution and abundance of offshore shrimp in the annual shrimp survey 1988-2017.

*Mynd 3. Útbreiðsla og magn úthafsækju í stofnmælingu 1988-2017.*

## 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. 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.

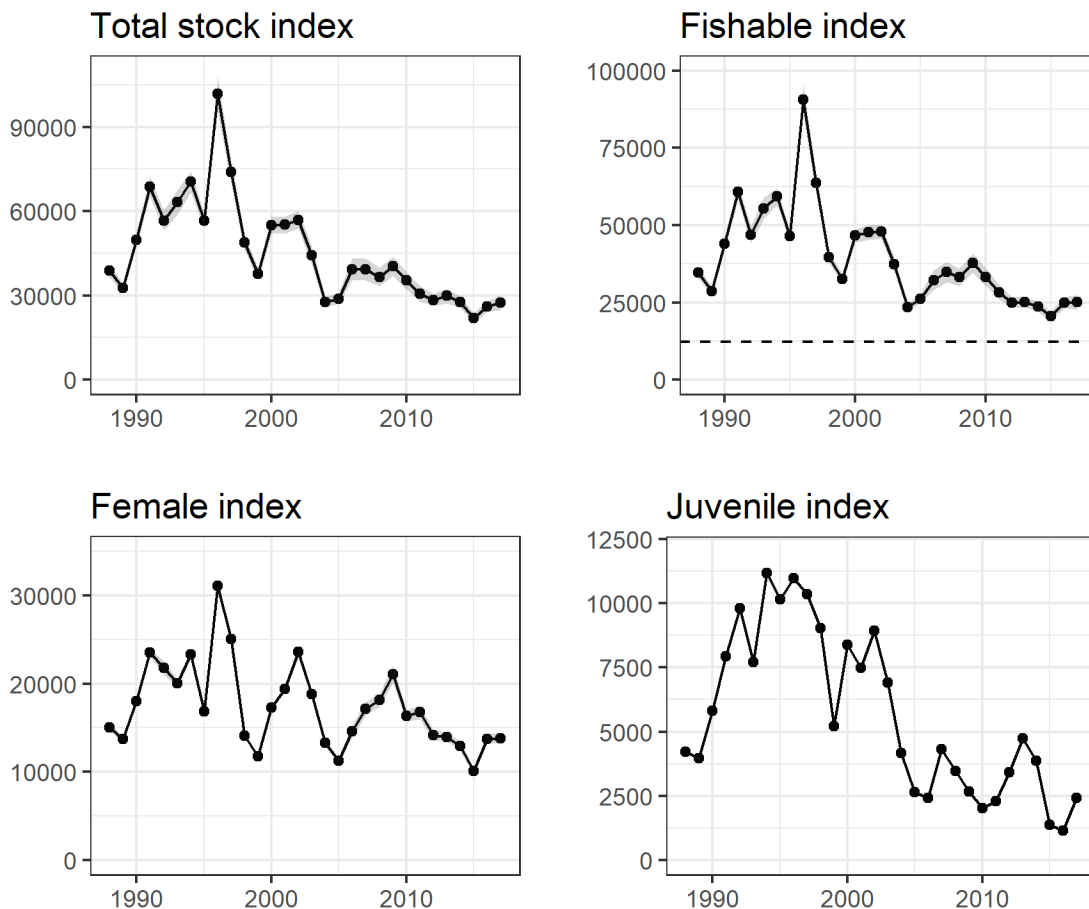


Figure 4. Stock biomass index, fishable biomass index, female biomass index and juvenile biomass index of shrimp. The horizontal line indicates a value below which the state of the stock is considered to be critical.

Mynd 4. Heildarstofnsvísitala, veiðistofnsvísitala, kvendýravísitala og vísitala ungrækju úthafs-rækju 1988-2017. Lárétt lína sýnir viðmiðunargildi fyrir ástand stofnsins.

## LENGTH DISTRIBUTION OF SHRIMP

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 have decreased and has been around or below average since 2004. Since 2015 the smallest individuals were missing in the survey (Figure 5).

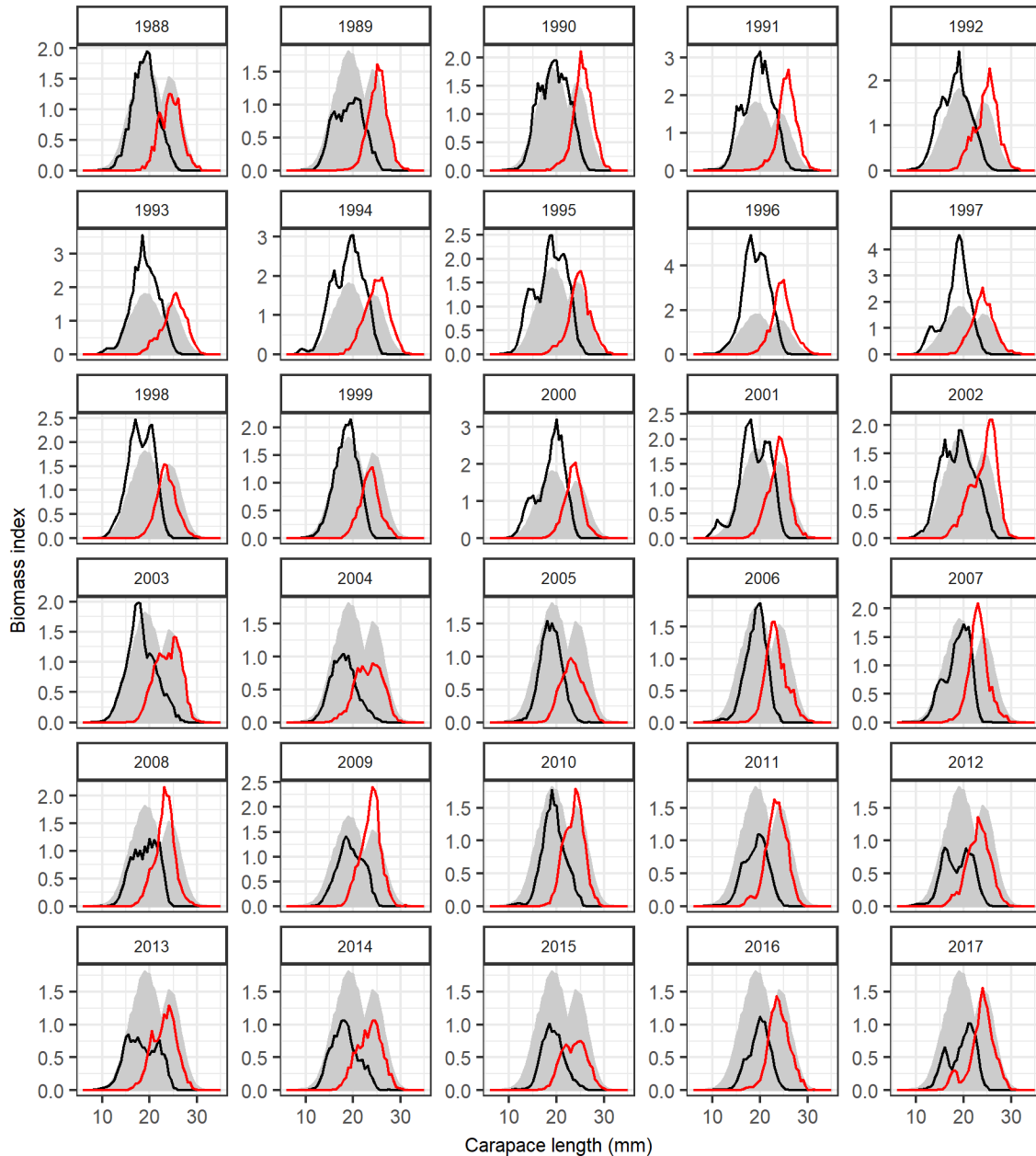


Figure 5. Length distribution of shrimp. The black line indicates males and the red line females. The grey area is the mean length distribution of both sexes for the whole study period.

*Mynd 5. Lengdardreifing úthafsækju í stofnmælingu 1988-2017. 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 to 2016. The Greenland halibut abundance decreased from 1991 to 2005. It increased sharply until 2011 when it started to decrease again. The Greenland halibut abundance has remained relatively stable from 2014 to 2017.

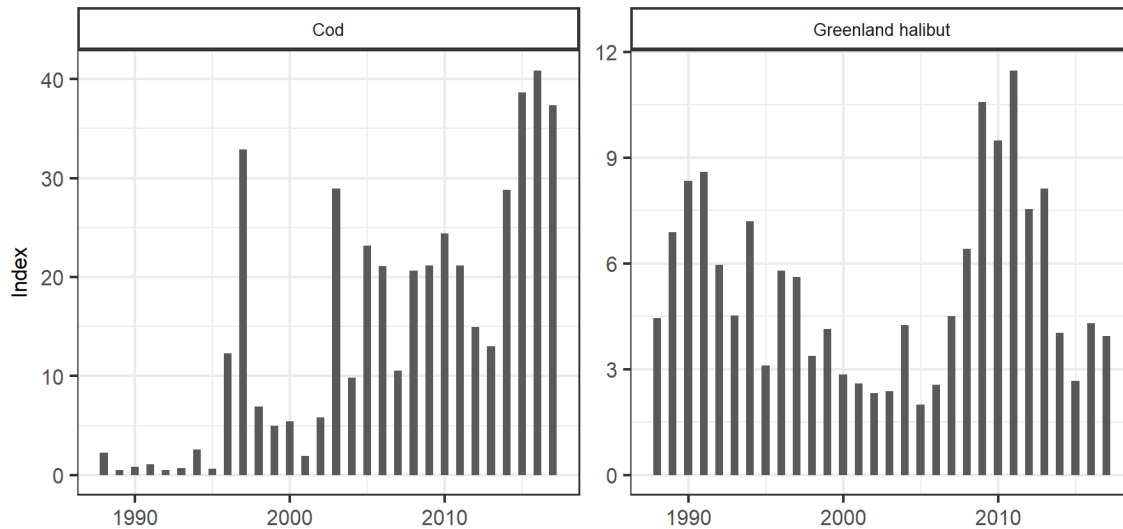


Figure 6. Abundance indices of cod and Greenland halibut from 1988 to 2017.

*Mynd 6. Vísitala þorsks og grálúðu í stofnmælingu úthafsækjju 1988 til 2017.*

## ADVICE

The Icelandic shrimp survey was used as a biomass indicator. The target  $F_{\text{proxy}}$  (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  $F_{\text{proxy}}$  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. Now the advice is based on this 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 decided with the mean of the three highest indices). The fishable biomass index value of 12 200 can be considered a proxy for  $B_{\text{lim}}$  or an  $I_{\text{lim}}$ . If the fishable biomass index is below 12 200, zero catch is advised. If the fishable biomass index is above  $I_{\text{lim}}$ , the advice is based on multiplying the most recent biomass index value with the target  $F_{\text{proxy}} = 0.2$ .

In July 2017, the fishable biomass index was 25 000, and hence the MFRI advises that catch in the offshore area should be no more than 5 000 tonnes in the fishing year 2017/2018.

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

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

Year	BI	Relative state	Rec. TAC	Catch	$F_{\text{proxy}}$
1988	34 600	0.57	30	25 353	0.73
1989	28 600	0.47	21	20 699	0.72
1990	44 000	0.72	25	22 125	0.50
1991	60 800	1		29 600	0.49
1992	46 900	0.77	40	37 102	0.79
1993	55 400	0.91	40	41 283	0.75
1994	59 300	0.97	52	56 150	0.95
1995	46 400	0.76	62	61 334	1.32
1996	90 700	1.49	63	55 996	0.62
1997	63 600	1.05	60	65 298	1.03
1998	39 700	0.65	75	49 667	1.25
1999	32 500	0.53	40	27 142	0.84
2000	46 600	0.77	20	20 196	0.43
2001	47 700	0.78	25	21 653	0.45
2002	47 900	0.79	35	26 656	0.56
2003	37 300	0.61	30	22 332	0.60
2004	23 500	0.39	20	15 799	0.67
2005	26 200	0.43	10	3 792	0.14
2006	32 200	0.53	10	608	0.02
2007	34 800	0.57	7	1 681	0.05
2008	33 200	0.55	7	1 450	0.04
2009	37 700	0.62	7	4 122	0.11
2010	33 300	0.55	7	6 400	0.19
2011	28 300	0.47	7	6 300	0.22
2012	25 000	0.41	5	7 340	0.29
2013	25 100	0.41	5	7 020	0.28
2014	23 700	0.39	5	4 020	0.17
2015	20 500	0.34	4	4 067	0.20
2016	25 000	0.41	4.1	4 109	0.16
2017	25 000	0.41	5		

## 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.