NORWAY LOBSTER – HUMAR
Nephrops norvegicus

INTRODUCTION

Fishery of Norway lobster (*Nephrops norvegicus*) initiated in the early 1950s and during the first two decades it was mainly conducted by Icelandic, Belgian and French vessels (Table 1). The species has been fished only by Icelandic boats since 1974. In the beginning it was fished mainly during spring and summer and the fleet was large or up to 200 boats in the 1970's. In recent years, the season is longer, and the fishery starts in the middle of March and ends in November/December. There has been a gradual decrease in number of boats participating in the lobster fishery and during the last couple of years there have been as few as nine boats active in the fishery. The lobster is entirely caught in *Nephrops* trawls, but through the decades there have been occasional creel trials.

Fishing grounds in Iceland are at the northernmost part of the species distributional range. For females it has been shown that there is a biennial reproductive cycle and, therefore, slower postmaturity growth than in, for example, Scottish, Irish, French and Portuguese waters of mostly annual spawning (Eiriksson, 2014). That affects the productivity of the stock and warrants lower exploitation rate than applied in other *Nephrops* stocks.

COMMERCIAL FISHING

LANDINGS

In 2018, 728 tonnes of *Nephrops* were landed, which is a reduction of 466 tonnes from the previous year and lowest catch since 1957 (Table 1, Figure 1). The catch declined since 2010 when it reached 2540 tonnes. There have been periodic fluctuations in landings since the onset of the fishery in the 1950's, which soon reached 6000 tonnes in 1963, following a few years with high catches (Eiríksson and Jónasson, 2018).

In 2018, 402 tonnes were landed from the southwestern ground, a reduction of 309 tonnes from the previous year (Table 2, Figure 2). Large portion of the catch from the southwestern area was from Jökuldjúp or 187 tonnes. On the southern ground only 10 tonnes were landed, same as in 2017, which was the lowest catch historically. In the southeast area 316 tonnes were landed, a decrease of 213 tonnes from the previous year.

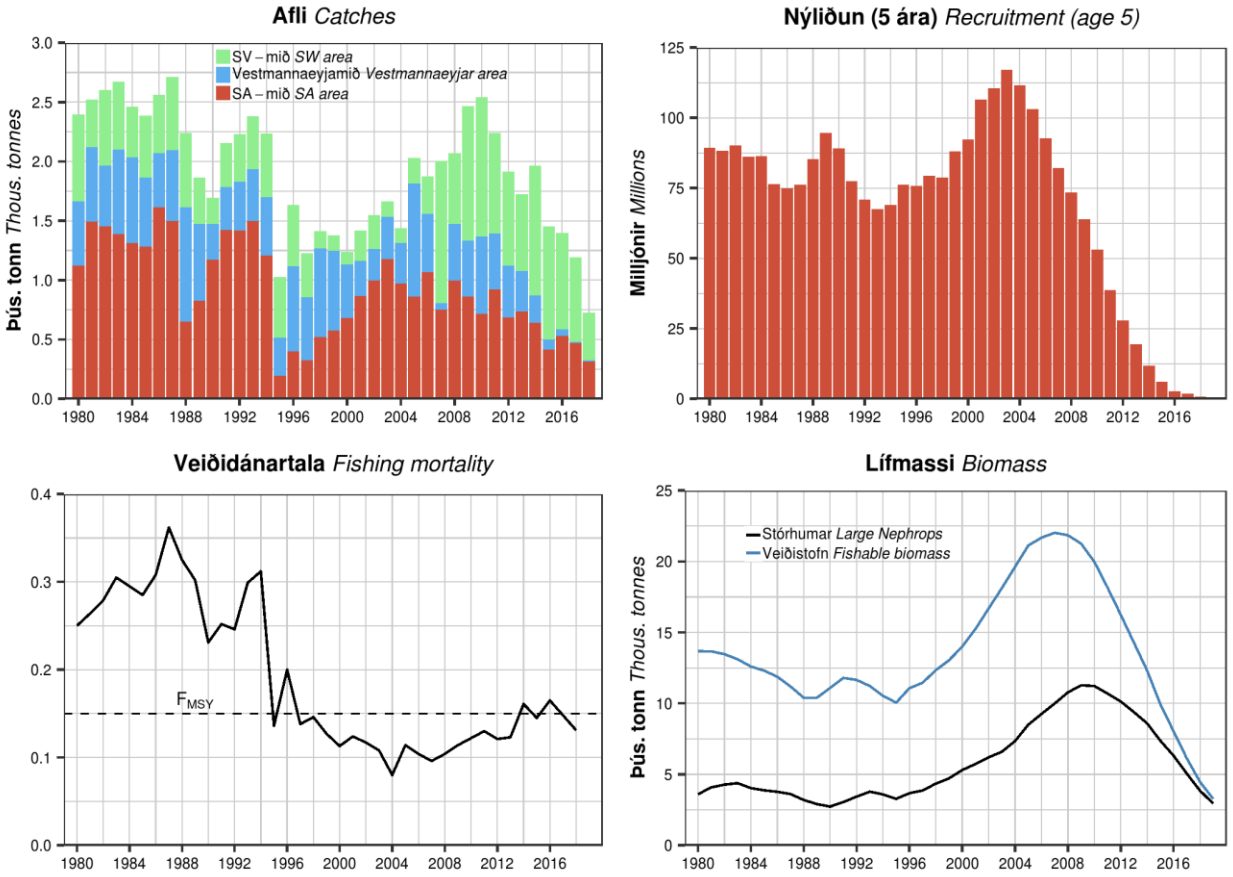

Figure 1. Norway lobster. Catches by area and output from VPA analysis; recruitment at age 5, fishing mortality and indices of fishable (6 years and older) and large category (10 years and older) biomass.

Mynd 1. Humar. Afli eftir svæðum og niðurstöður VPA líkans; nýliðun 5 ára, veiðidánartala og vísitölur veiðistofns (6 ára og eldri) og stórhumars (10 ára og eldri).

CPUE AND EFFORT

Catch per unit effort (CPUE, standardized to 1 trawl and the period May–August) declined between 2017 and 2018, from 44.5 to 28.3 kg per hour towed (Table 2, Figure 3). CPUE has declined drastically since the peak in 2007 and 2008 when more than 100 kg of *Nephrops* were caught per hour towed. Only in 1995 was the CPUE lower, but in that year a three weeks strike interrupted the fisheries during May/June. There have been overall similar fluctuations between areas with regards to CPUE (Figure 4). CPUE has on average been higher in the southeast area, and in recent years it has been lowest in the southern area.

There was a decreasing trend in the fishing effort from 1970 to 2000-2008, depending on areas. Since 2008, there has been a decrease in effort in the southern area, an increase in southwestern area, but effort has not changed much in the southeastern area (Figure 5).

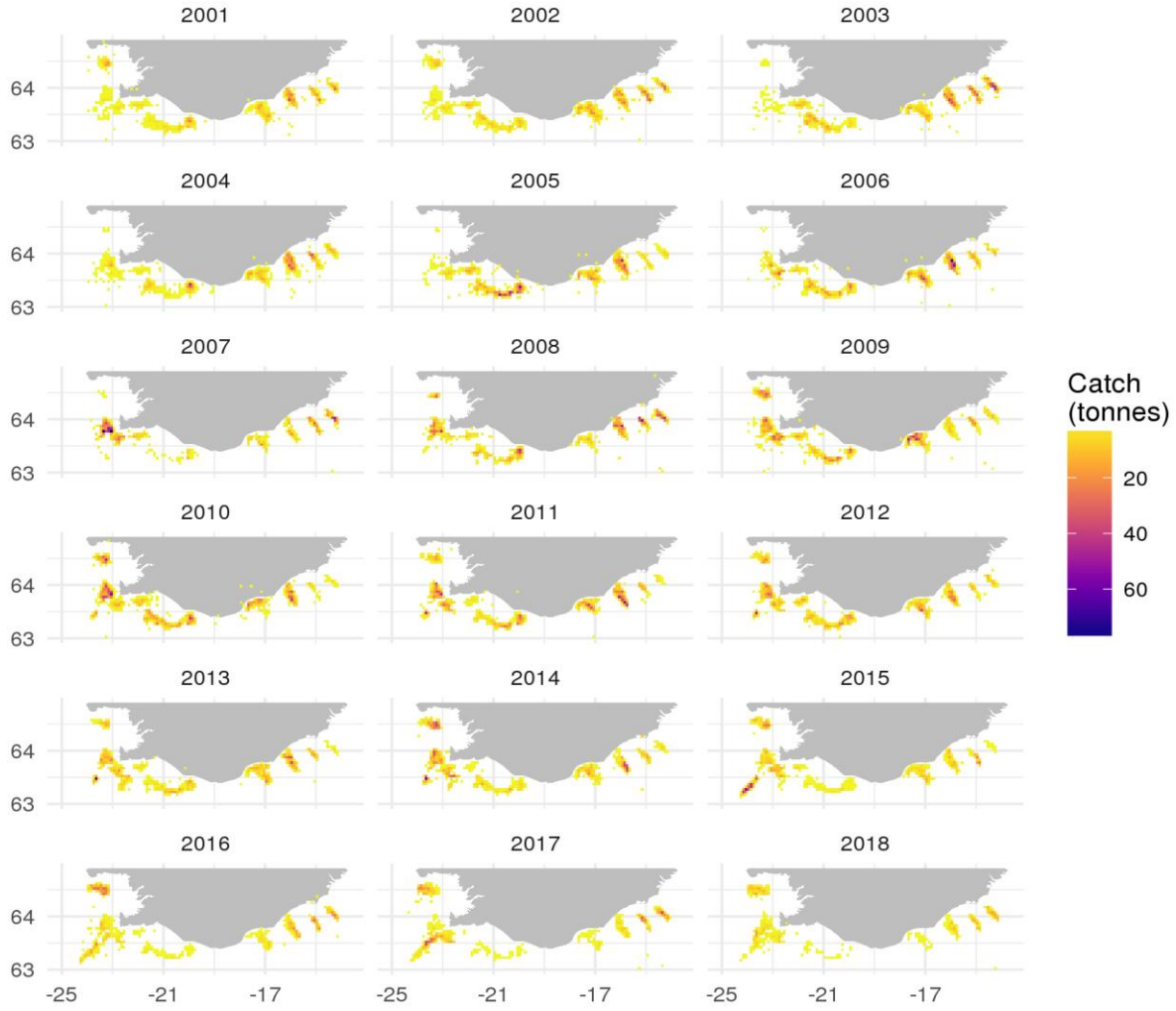

Figure 2. Norway lobster. Distribution of catches in 2001-2018.
Mynd 2. Humar. Dreifing afla árin 2001-2018.

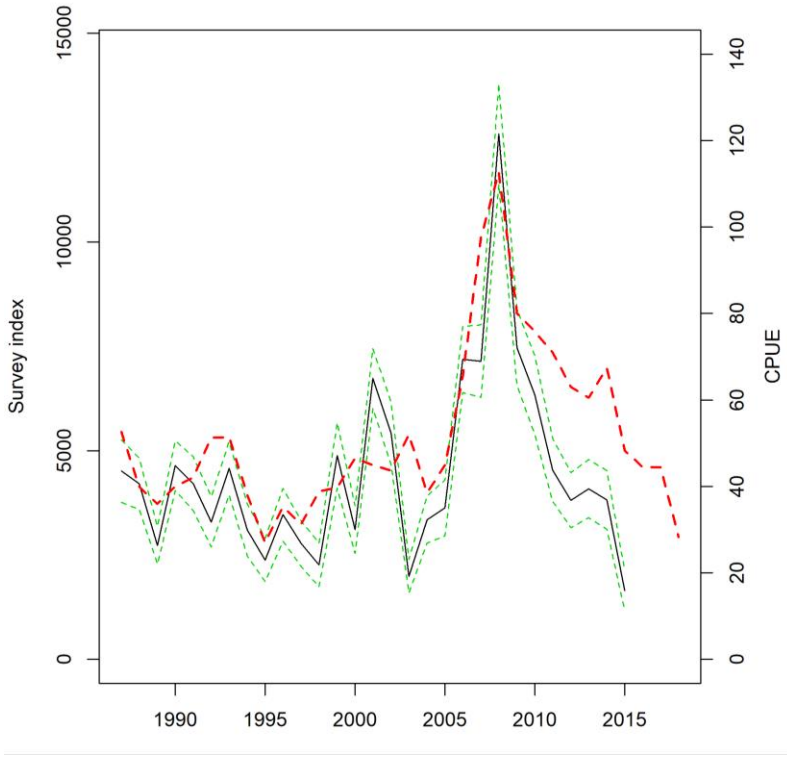

Figure 3. Norway lobster. Total biomass indices from the *Nephrops* survey 1987–2015 (black line) and standardized CPUE from 1987–2018 (red dotted line).

Mynd 3. Humar. Vísitala (þyngd) úr togleiðöngrum 1987-2015 (svört lína) og staðlaður afli á sóknareiningu 1987-2018 (rauð brotalína).

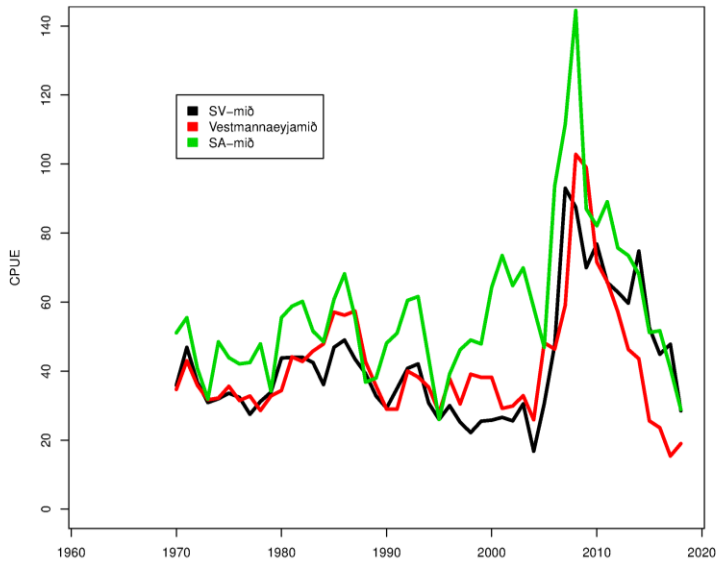

Figure 4. Norway lobster. Standardized CPUE in 1970–2018 in the SW- (black), Vestmannaeyjar- (south) (red) and SE areas (green).

Mynd 4. Humar. Staðalaður afli á sóknareiningu á SV-, Vesmannaeyja- og SA-miðum árin 1970–2018.

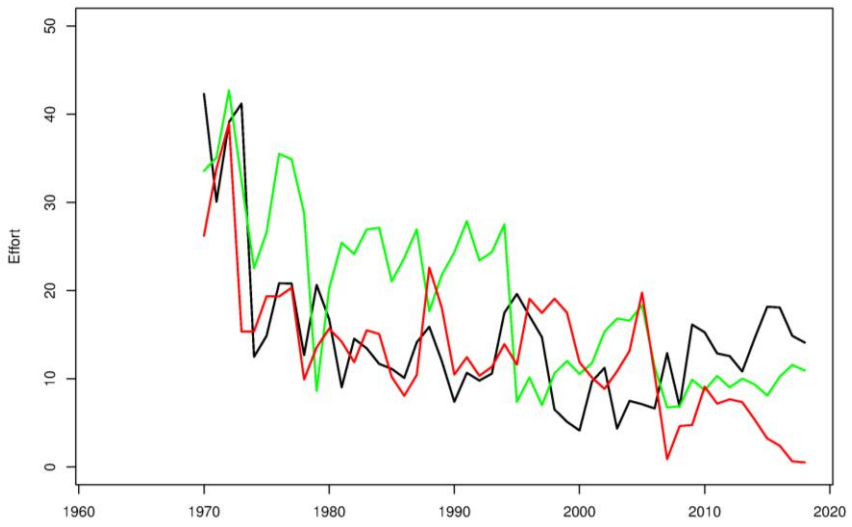

Figure 5. Norway lobster. Standardized effort in 1970–2018 in the SW- (black), Vestmannaeyjar- (south) (red) and SE-areas (green).

Mynd 5. Humar. Stöðluð sókn á SV-, Vesmannaeyja- og SA-miðum árin 1970–2018.

SURVEYS

TRAWL SURVEY

A *Nephrops* trawl survey was conducted from 1973 to 2015. In the survey, 55 standardized two-hour tows were conducted on all *Nephrops* grounds. The stock abundance index declined from the peak in 2009 and reached the lowest value in 2015 (Figure 3). There have been some similarities between the stock index and CPUE, but less in recent years and during the early years of the survey. Catchability has been related to water clarity (mainly due to phytoplankton) with generally higher catches in murkier waters, and with less *Nephrops* when groundfish numbers are high. This is reflected in the biology and the burrowing behavior of *Nephrops* as the strong temporal patterns in catch rates make the traditional trawl surveys unfeasible to estimate abundance. This led to the progress of using UWTV survey in 2016-2018 to assess stock development and provide management advice for the *Nephrops* stock in Icelandic waters (Campbell, *et al.,* 2009).

LENGTH DISTRIBUTION

In 2018, 74 length samples were obtained from the landed catch and survey, which is a reduction from 89 samples in 2017. The most frequent sizes (CL) of males in the samples in 2018 were between 57 and 60 mm (Figure 6). In recent years very few small *Nephrops* have been caught and in 2018 was the lowest ratio of *Nephrops* smaller than 40 mm CL recorded. Large proportion was above 60 mm and the ratio of animals over 70 mm CL was higher than for those below 40 mm CL.

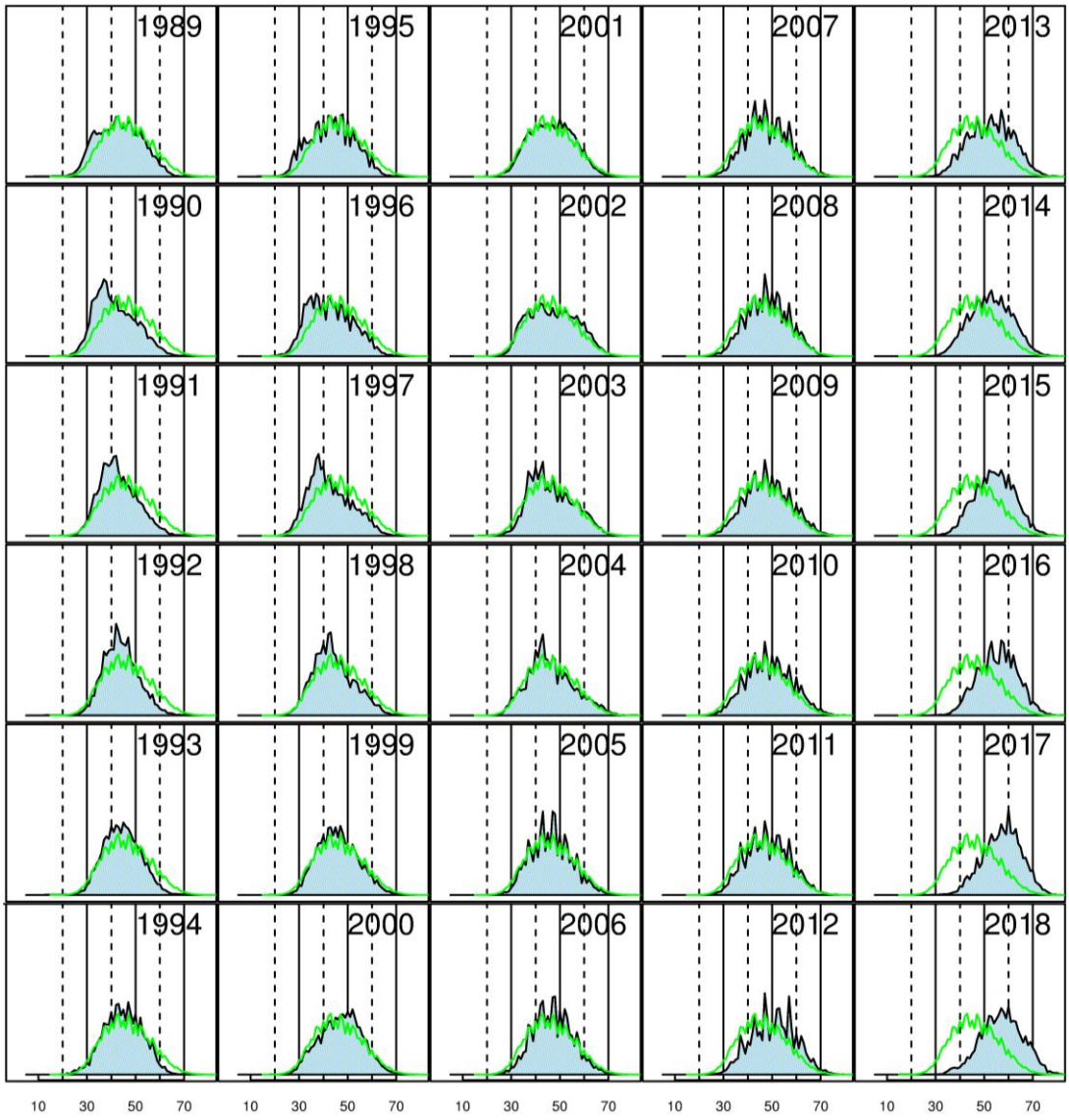

Figure 6. Norway lobster. Length frequency distribution (blue area) of all samples 1989–2018. The green line shows the average of the years 1970–2018.

Mynd 6. Humar. Lengdardreifing (blátt svæði) allra sýna 1989–2018. Græna línan sýnir meðaltal áranna 1970-2018.

Figure 7. Norway lobster. Polygons of *Nephrops* grounds (see Figure 2) based on VMS data. See name of grounds marked by the red number in Table 7.

Mynd 7. Humarsvæði áætluð úr frá veiðigögnum (VMS, sjá Mynd 2). Sjá töflu 7 fyrir heiti svæða sem táknuð eru með rauðu númeri.

UWTV SURVEY

The first UWTV survey in Icelandic water was conducted in June 2016, following a pilot study in Jökuldjúp in April. In total, 86 UWTV-stations were completed on all known *Nephrops* grounds in 2016. The size of the *Nephrops* area was estimated from VMS data. A minimum of 6 pings from *Nephrops* vessel at fishing speed on 800*800 meters resolution grid was used as a threshold, which approximately includes 99% of the pings. Adjoining grids are then combined and fishing grounds smaller than 4 km^2 are excluded. The total size of the fishing grounds was estimated to be 5989 km^2 based on data from 2007–2016, but there was a gradual shift to fishing on new or connected grounds in 2017 and 2018, especially in the SW area. The estimated size of *Nephrops* grounds in 2018 was 6588 km^2 (Table 7, Figure 7). In total there where nine distinct areas ranging from 247 km^2 to 1400 km^2. The largest ground (Vestmannaeyjar) is in the southern part (Háfadjúp to Selvogsbanki) and the smallest one is Lónsdjúp in the east. Three grounds were split up into 2–3 patches; Vestmannaeyjar, Hornafjarðardjúp and Selvogsgrunn.

The total number of *Nephrops* in June 2018 on all Icelandic grounds was estimated to be 482 million animals, a decline from 602 million animals in 2017. Average density in 2018 was 0.073 burrows per square meter (Figure 8). Highest density of burrows was in Breiðamerkurdjúp and Jökuldjúp; 0.10 burrows per m^2 (Figure 9 & 10). The largest ground (Vestmannaeyjar, 1400 km^2) had the lowest density or 0.05 burrows per m^2. Highest number of burrows was found on the Grindavíkurdjúp-Skerjadjúp ground (1307 km^2) or 77 million.

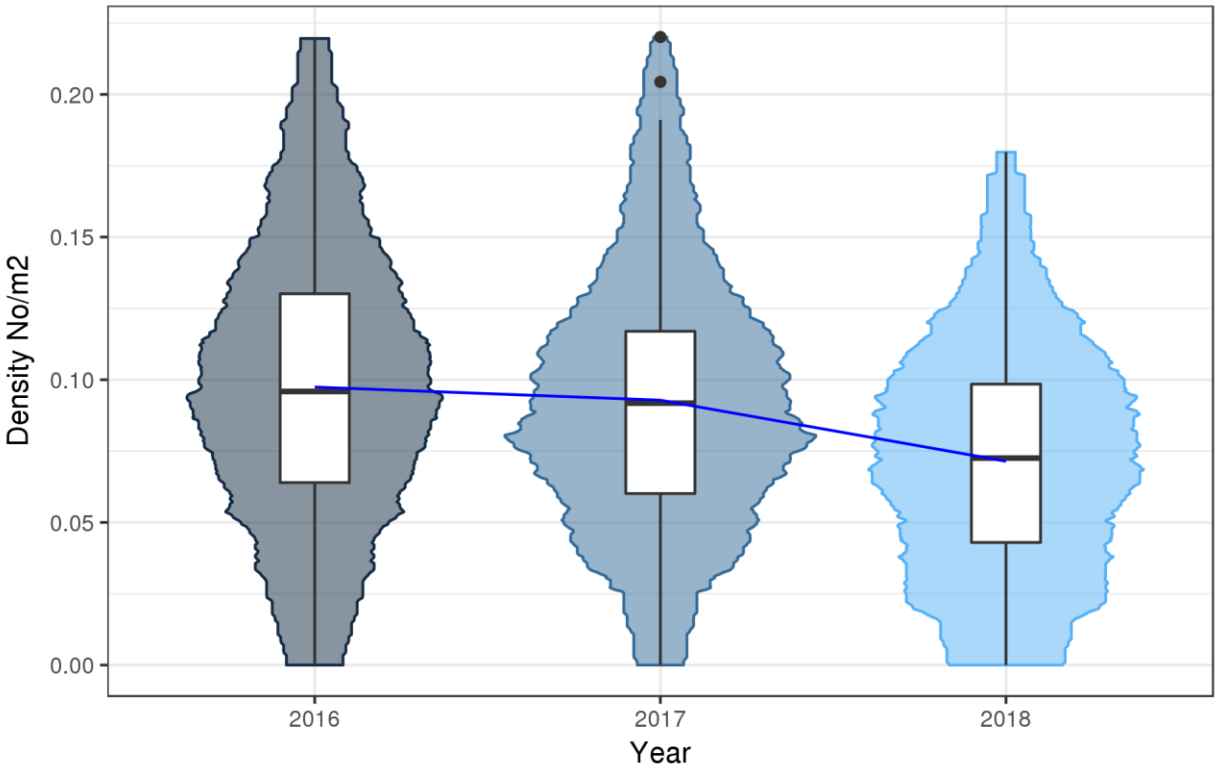

Figure 8. Norway lobster. Violin and boxplots of adjusted burrow density distributions by year 2016-2018. The blue line indicates the mean density over time. The horizontal black lines represent the median, white boxes are the inter quartile ranges, the black vertical lines show the range and the black dots are outliers.

Mynd 8. Humar. Þéttleiki (fiðlu- og kassagröf) af leiðréttum fjölda humarhola 2016-2018. Bláa línan táknar meðal þéttleika, svarta línan í miðjum kassa sýnir miðgildi, kassinn sýnir fjórðungsmörk dreifingar, svört lóðrétt lína spönn og svartir punktar útgildi.

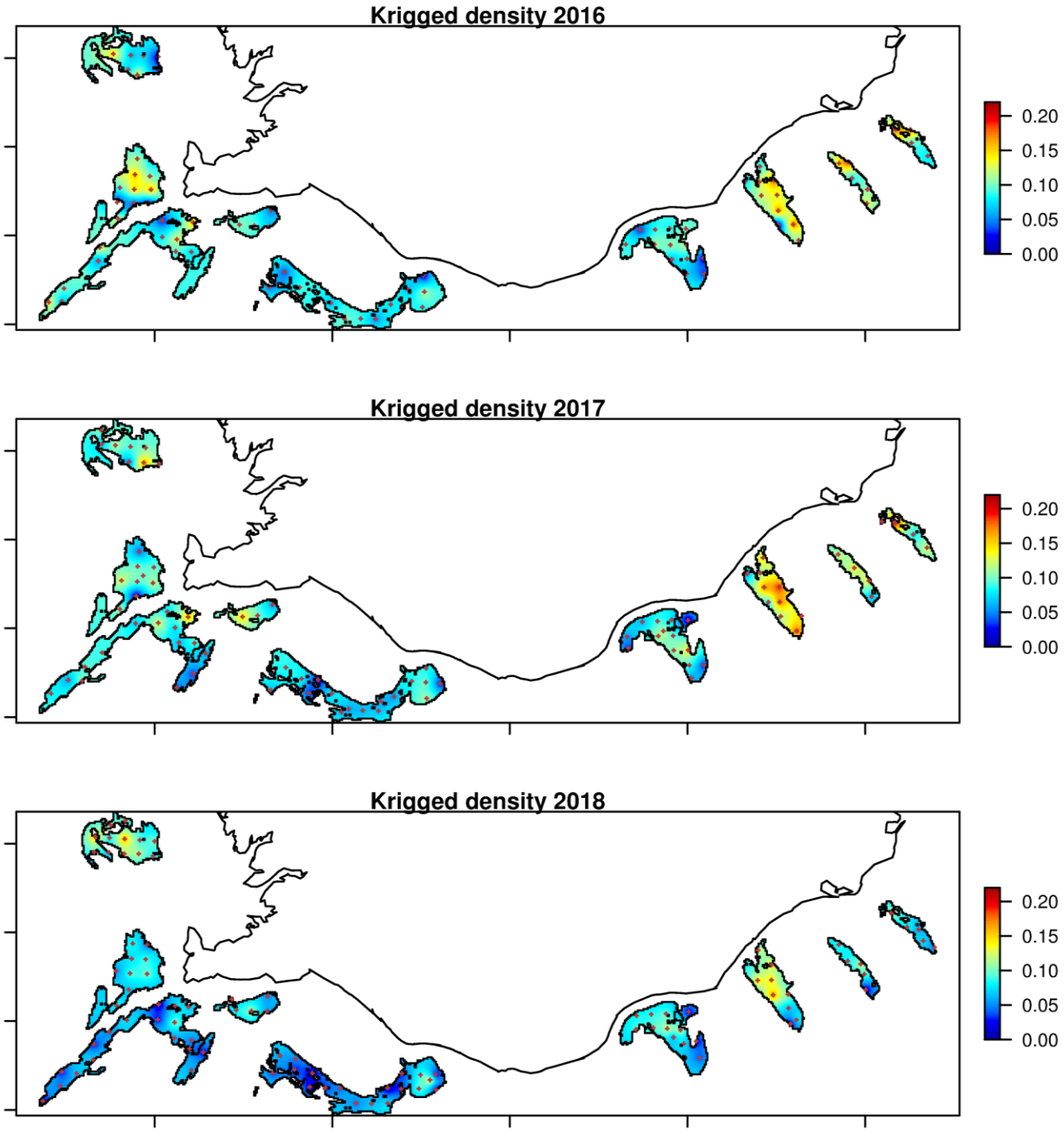

Figure 9. Norway lobster. Density of burrows (krigged density per 100 m^2, gaussian model) on *Nephrops* grounds from the UWTV surveys conducted in 2016-2018. The brown crosses represent the stations.

Mynd 9. Humar. Þéttleiki humarhola (fjöldi á 100 m^2) í myndavélaleiðangri árin 2016-2018. Myndin að ofan sýnir brúuð gögn með kriging aðferð (Gaussian líkan). Brúnir krossar tákna stöðvar.

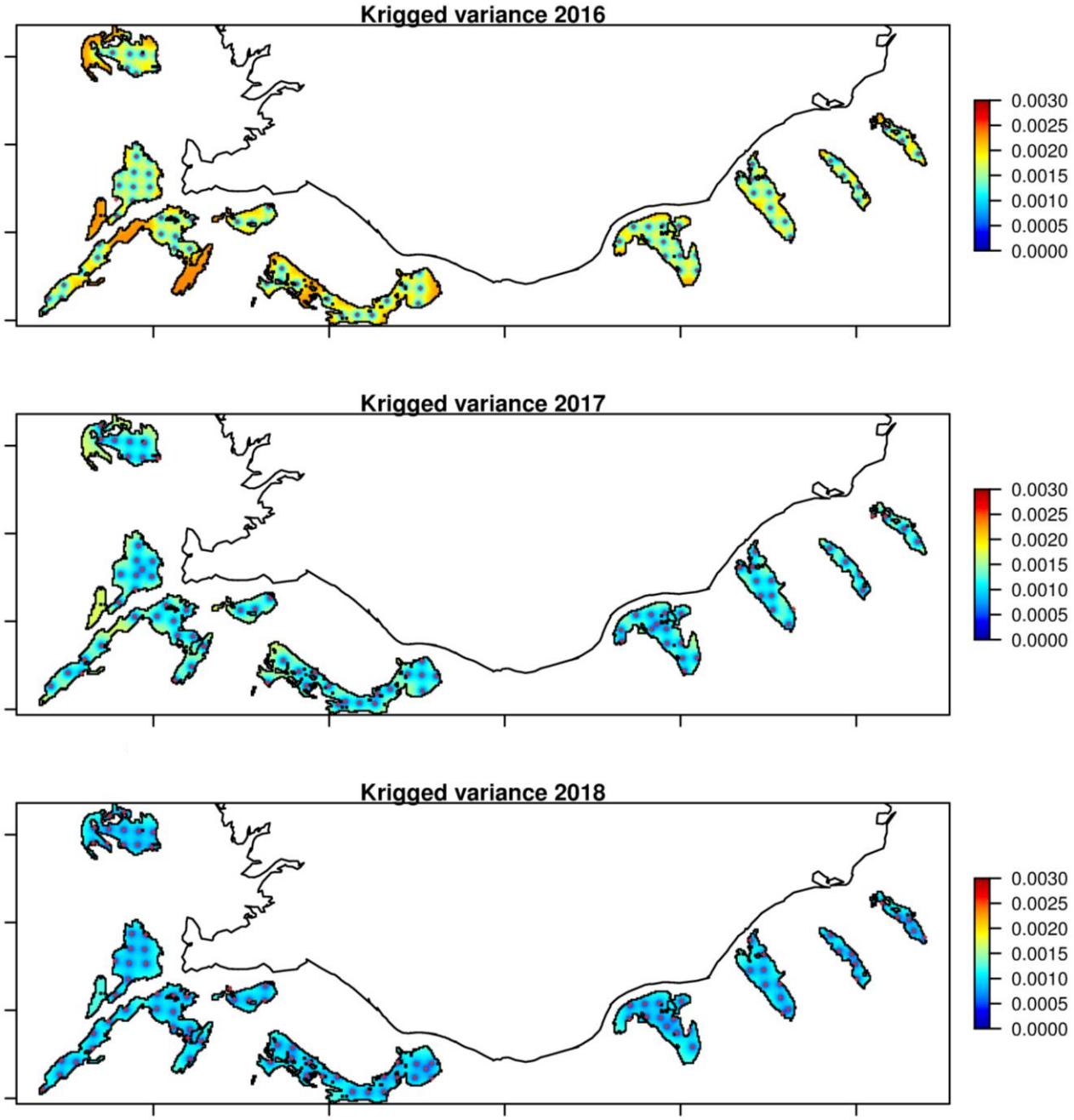

Figure 10. Norway lobster. Krigged variance of burrows density on *Nephrops* ground (per 100 m^2) from the UWTV surveys conducted in 2016-2018. The brown crosses represent the stations.

Mynd 10. Humar. Dreifni niðurstaðna úr brúunarfalli á holuþéttleika (humarholur á 100 m^2) í myndavélaleiðangri árin 2016-2018. Brúnir krossar tákna stöðvar.

LARVAE SURVEY

During the 2018 UWTV survey, for the first time, 23 bongo-net stations (500 µm mesh size) were accomplished after the completion of every forth UWTV station. The bongo-net was towed in a V–shaped manner down to 40 m and up to the surface. *Nephrops* larvae were found on 10 station, in densities from 3 to 193 larvae per 1000 m^3 (Figure 11). Highest number of larvae was found in Háfadjúp off the southern part of Iceland. Larvae were also found on most stations in the southeast area with highest numbers in Lónsdjúp, but all Zoea stages (I-III) where found in that region. It is proposed to continue with the larvae sampling during upcoming UWTV survey and hopefully the information can be indicative of future recruitment.

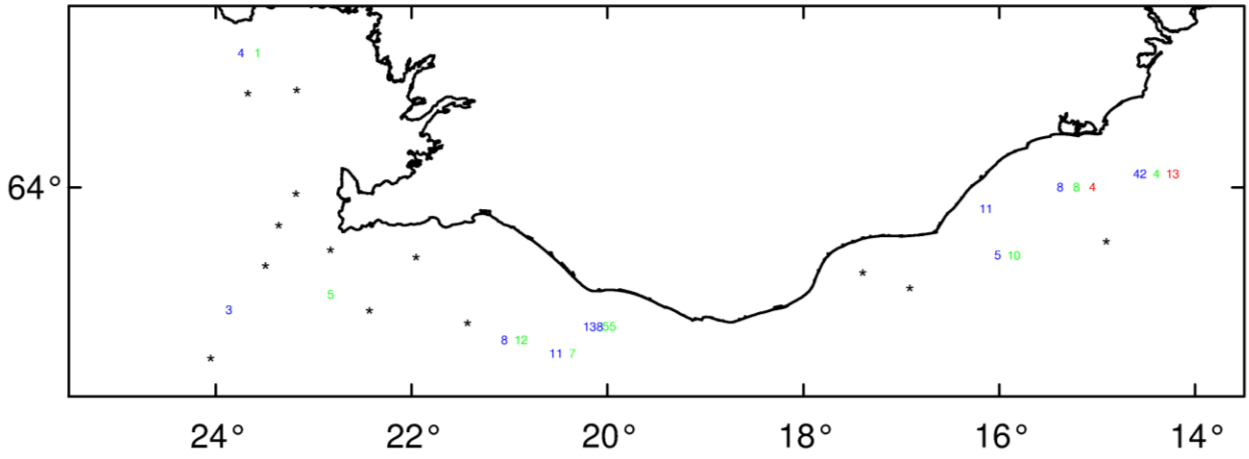

Figure 11. Norway lobster. Number of *Nephrops* larvae caught in bongo-net per 1000 m^3. Blue numbers indicate larvae on Zoea stage 1, green Zoea stage 2, and red Zoea stage 3. Black asterisks are stations where no *Nephrops* larvae were found.

Mynd 11. Humar. Fjöldi humarlirfa sem veiddust í bongóháf á hverja 1000 m^3. Blár tölur tákna fjölda lirfa á Zoea stigi 1, grænar Zoea stigi 2 og rauðar tölur Zoea stigi 3. Svartar stjörnur tákna stöðvar þar sem engar lirfur fundust.

BOTTOM TRAWLING ON *NEPHROPS* GROUNDS

TRAWLING INTENSITY

In addition to trawling with *Nephrops* trawl, a considerable amount of bottom trawling for groundfish occurs on *Nephrops* grounds. There are around 6600 towed hours annually (2014-2018) on *Nephrops* grounds (Table 8). Most of the activity is on the Vestmannaeyjar *Nephrops* ground or almost 4000 towed hours (2.4 hours annually per km^2). Slightly higher trawling activity is in Breiðamerkurdjúp or 2.5 h per km^2 and high trawling activity is also in Hornafjarðardjúp (0.9 h per km^2) and Lónsdjúp (0.7 h per km^2). On average, the CPUE of cod (*Gadus morhua*), the most important demersal fish species, south of 65°N is 0.5 tonnes per hour towed (Table 8). The CPUE of cod was high within Vestmannaeyjar grounds (1.2 t/h), but lower than average in the eastern *Nephrops* areas, i.e. Breiðamerkurdjúp, Hornafjarðardjúp and Lónsdjúp, or around 0.3 t/h in all regions (Figure 12, Table 8). CPUE of haddock (*Melanogrammus aeglefinus*) and ling (*Molva molva*) is also higher within the Vestmannaeyjar region compared to other areas south of 65°N (Table 8).

Because of poor state of the *Nephrops* stock, it is proposed to close the core *Nephrops* areas southeast of Iceland from additional disturbance of groundfish bottom trawling to protect the observed recruitment (Figure 12, Table 8). Those areas have relatively high trawling activity but are of less importance for groundfish than the Vestmannaeyjar grounds.

Recommended boundaries of closures for bottom trawling on Nephrops *grounds:*

Breiðamerkurdjúp

1. 63°52'50''N - 16°16'00''V
2. 63°35'00''N - 15°46'00''V
3. 63°37'00''N - 15°41'00''V
4. 63°57'50''N - 16°02'00''V
5. 63°52'50''N - 16°16'00''V

Hornafjarðardjúp

1. 64°00'00''N - 15°18'00''V
2. 63°43'00''N - 14°52'00''V
3. 63°46'00''N - 14°47'00''V
4. 64°00'00''N - 15°10'00''V
5. 64°00'00''N - 15°18'00''V

Lónsdjúp

1. 64°10'00''N - 14°42'00''V
2. 63°56'00''N - 14°12'00''V
3. 63°56'00''N - 14°50'00''V
4. 64°10'00''N - 14°30'00''V
5. 64°10'00''N - 14°42'00''V

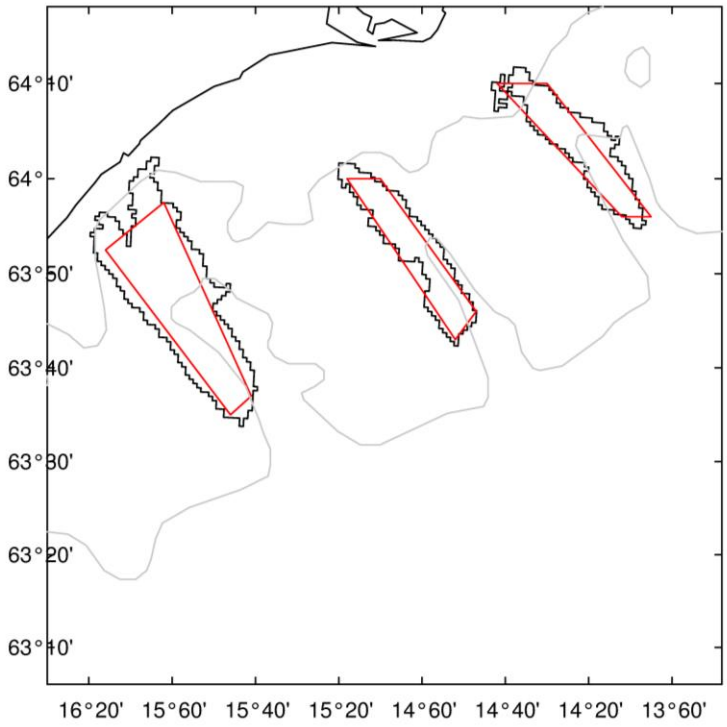

Figure 12. Norway lobster. Polygons of *Nephrops* grounds based on VMS data in southeastern Iceland. Proposed closed areas for bottom trawling within *Nephrops* areas are plotted (red lines) and depth contours (100 and 200 m, grey lines).

Mynd 12. Humar. Humarsvæði áætluð úr frá veiðigögnum (VMS) við Suðausturland og fyrirhugaðir lokanir fyrir botnvörpu (rauðar línur). Að auki eru 100 og 200 m dýptarlínur sýndar.

STOCK ASSESSMENT

VPA

Virtual population analysis (VPA) stock assessments were initiated in 1977. Since most *Nephrops* landings are composed of the larger-bodied males (>90-95%), stock assessment with VPA have concentrated only on males. In applying the VPA technique to numbers caught in each varying-sized length group, that is estimated to compose a certain virtual "age group", a number of input values are required such as M, K and L_∞. Maximum recorded size of males on all major *Nephrops* grounds around Iceland range from 77-88 mm CL (Eiríksson, 2014, personal observations) and here 80 mm CL for the asymptotic length (L_∞) has been the standard. Moreover, by assuming that the growth curve is of the von Bertalanffy type, the value of K (growth rate coefficient, *i.e.* the rate at L_∞ is approached) for a given value of L_∞ can be determined provided that at least one annual growth increment is known. Annual length frequency modal progressions, as well as certain amount of data on growth from tagging experiments, have indicated that the growth rate of male *Nephrops* decreases with size (age) from approximately 5 to 3 mm per annum within the size range of 25 to 50 mm CL (Eiríksson, 1982, 1992). As the slope of the Ford-Walford plot is exp(-K), the growth coefficient K was obtained from the relation $L_\infty - CL_{i+1} / L_\infty - CL_i$, giving K around 0.10 depending on points chosen in the length distribution. Therefore, the growth coefficient $K = 0.10$ was used as a near average.

Cohorts ("year-classes") were formed by slicing the length frequency distributions into knife-edged demarcations ranging from 6 mm (19-24 mm CL) to 2 mm (56+ mm CL). The validity of the cohorts was diagnosed by a steady state cohort analyses for a period of 5 years and the value of d t (the time required to grow from the beginning to the end of each length group) was approximated at around 1 in each case. Further, by using the von Bertalanffy equation and the parameters described above, gives similar divisions into length groups (Eiríksson, 1976, 1979).

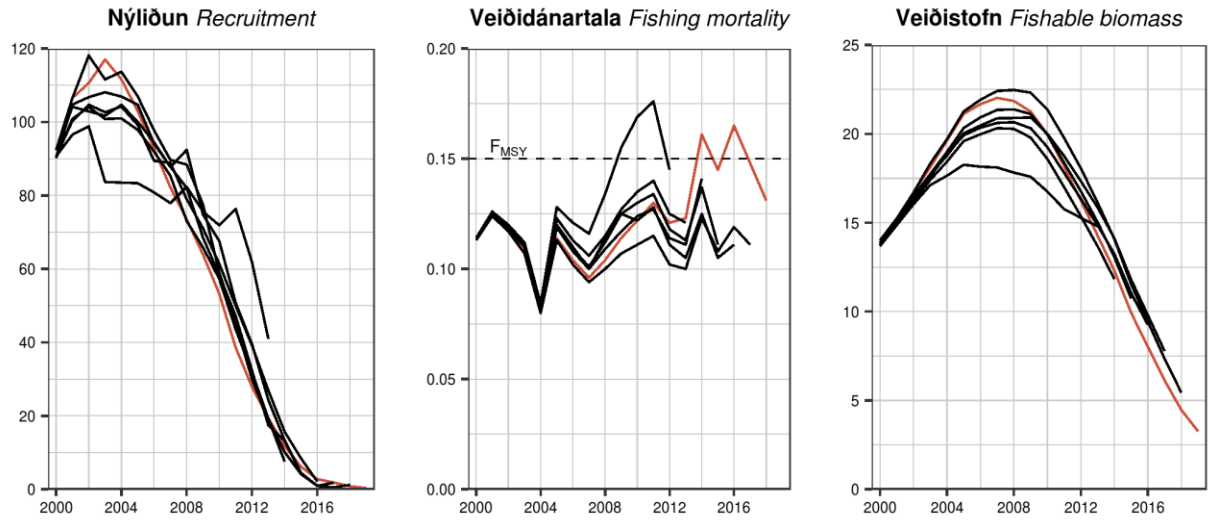

Figure 13. Norway lobster. Historical assessment results 2013–2019 (red line: 2019 assessment).

Mynd 13. Humar. Samanburður á stofnmati áranna 2013–2019 (rauð lína: stofnmat 2019).

The input data was derived from the discontinued trawl survey (conducted 1973-2015), samples from the commercial catches, and few trawl samples also carried out in the new UWTV survey (Table 3). The input data for catch in numbers was based on logbook data at the resolution of Icelandic statistical rectangles. When length samples were missing, data from adjacent rectangles were used.

In 1995, the estimated stock size was at minimum (Table 4, Figure 1). Since then the advice has been to fish at F_{MSY} of 0.15 (for yearclasses 6-13). Fishing mortality has been below or around F_{MSY} in recent years and is now slightly below F_{MSY}. Yearclasses from 1996–2000 are estimated to be large. Following those strong yearclasses and with less effort there was an increase in catch and subsequently CPUE. In 2006-2010 the estimated stock size was at maximum or above 20 thousand tonnes. Recruitment has gradually decreased from those strong yearclasses or since 2005. That trend led to large decrease in recommended TAC. All yearclasses from 2010 and onwards are below what was previously estimated as the lowest yearclass size.

Harvestable biomass is now estimated to be 3269 tonnes. The biomass has decreased sharply and is at its lowest level and the abundance of large specimens (10+) is also slowly decreasing to its lowest level. This year's assessment estimates of recruitment and reference biomass are in line with the assessments of 2013–2017, but fishing mortality is somewhat higher (Figure 13). The caveats of running the VPA without tuning and with poorly estimated age of large *Nephrops* currently in high proportion cast doubt on the credibility of the output from the VPA, especially on estimated absolute biomass levels. It is though believed to show the general trend in abundance for the stock. Further, VPA is not considered the appropriate assessment method by ICES and the now commonly used UWTV surveys is recommended.

BURROW COUNTS – UWTV SURVEY

According to the UWTV survey, the harvest rate of the total stock in 2018 varied from 0–4.27% between grounds, with an average harvest rate of 1.16% (Table 7). Limited fisheries were on Vestmannaeyjar, Selvogsbanki and Skeiðarárdjúp with subsequently low harvest rate. The highest harvest rate was in Lónsdjúp, followed by Hornafjarðardjúp and Jökuldjúp. The ratio of males in the catches was 60–99%. Unusually high amounts of females were caught in Breiðamerkurdjúp in 2018 (Table 7), as the ratio of males in the catches is usually around 90%.

With declining catches, the harvest rate has declined from 1.89% in 2016 to 1.16% in 2018 (Figure 14). Like the past 2 years, the highest harvest was on the eastern and westernmost areas, Lónsdjúp, Hornafjarðardjúp and Jökuldjúp (Figure 15). Despite the disjointed nature of the *Nephrops* ground in Iceland and therefore relatively small number of stations on each ground, the relative abundance has declined on all grounds apart in Jökuldjúp. With the recent expansion of the fishing in Jökuldjúp during the last three years, more stations have been added to the newly exploited western half of that area. The burrow abundance has been higher there and explains the overall increase in burrow abundance (Figure 9).

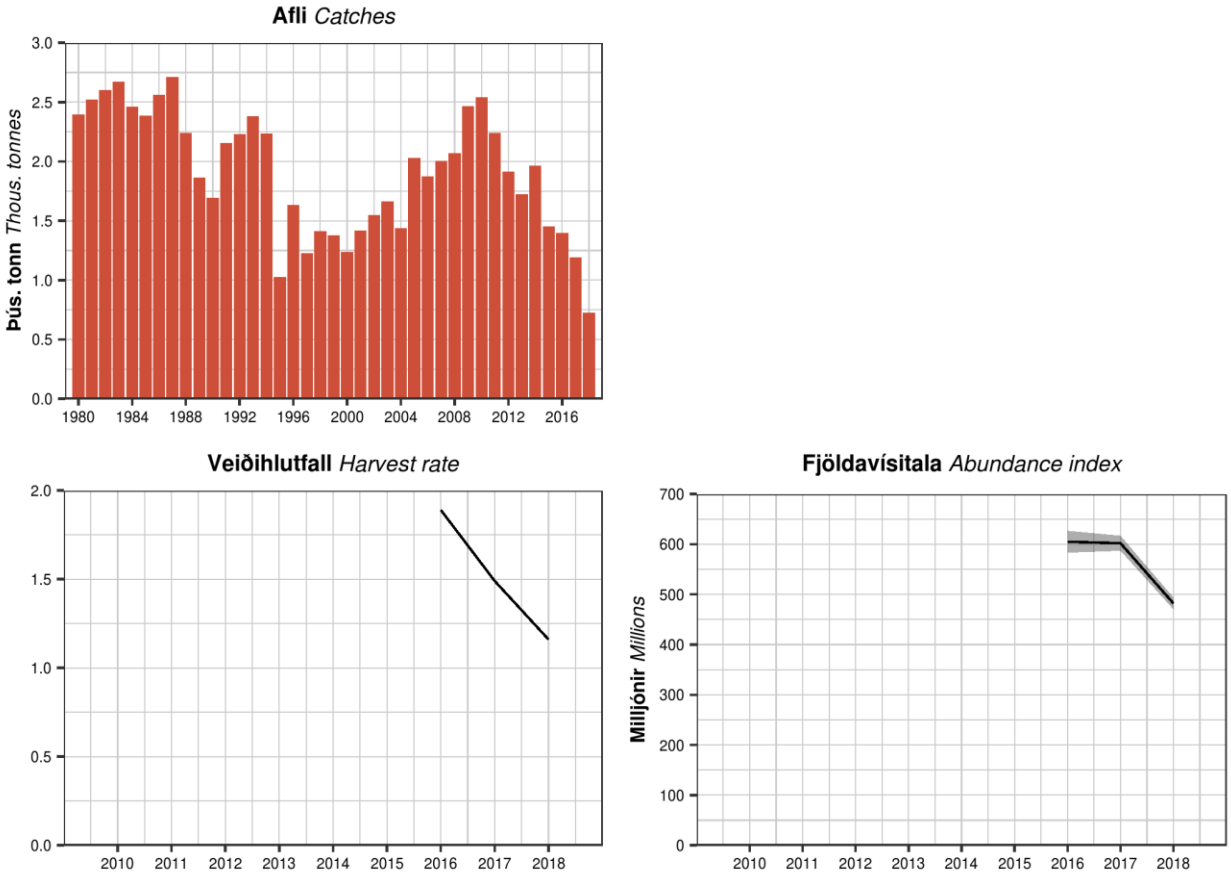

Figure 14. Norway lobster. Catches, harvest rate (sum of landings in numbers, divided by total abundance), stock abundance (Underwater TV, millions; SSB proxy, 95% confidence intervals).

Mynd 14. Humar. Afli, veiðihlutfall (fjöldi veiddra humra deilt með fjölda úr stofnmælingu), stofnstærð (humarholu myndataka, fjöldi í milljónum með 95% öryggismörkum).

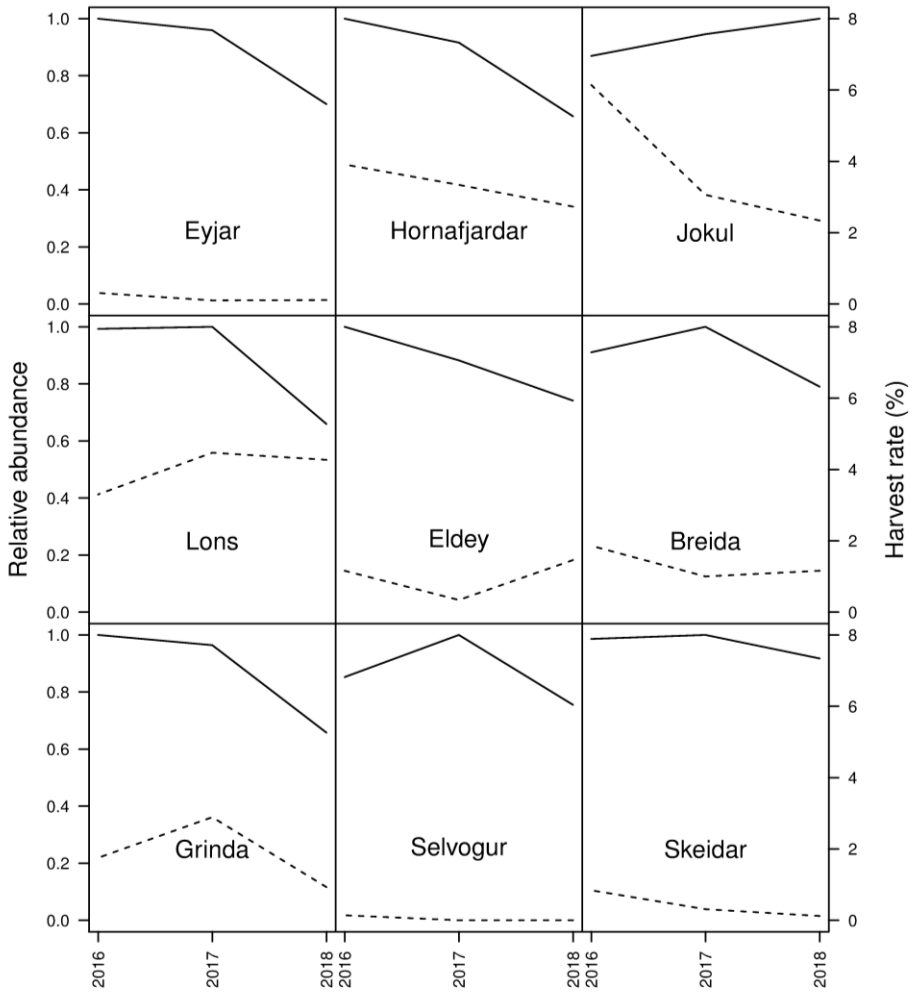

Figure 15. Norway lobster. Relative burrow abundance (solid line) and harvest rate (dotted line) in individual subareas (Eyjar–area 1, Hornafjardar – area 2, Jokul – area 3, Lons – area 4, Eldey – area 5, Breida area 6, Grinda – area 7, Selvogur – area 8 and Skeidar – area 9) during 2016 – 2018 (See Figure 7 for area id locations).

Mynd 15. Humar. Hlutfallslegur fjöldi humarhola (heil lína) og veiðihlutfall (brotin lína) á einstökum veiðisvæðum (Eyjar – svæði 1, Hornafjardar - svæði 2, Jokul – svæði 3, Lons – svæði 4, Eldey – svæði 5, Breida - svæði 6, Grinda – svæði 7, Selvogur – svæði 8 og Skeidar – svæði 9) árin 2016 til 2018 (sjá Mynd 7 fyrir staðsetningu svæða).

ADVICE

Since 1991, the TAC advice for the *Nephrops* stock has been given in early June prior to the onset of the fishing year from September to August next year. The new UWTV survey is however carried out in June. Given the negative indicators of the status of the *Nephrops* stock and to bring the assessment closer in time to the advice, the advice in 2018 was delayed to account for all fishing activity of 2018, as the *Nephrops* season runs from middle of March to the end of October. During September to October of 2018, it was permitted to fish what was left of the *Nephrops* quota from the previous fishing year (2017/2018). The advice given now is for the calendar year 2019.

All stock estimates have declined. Abundance, based on burrow counts, has declined by 20% between 2016 and 2018 and observed density in Iceland is among the lowest reported compared to other functional units within ICES areas. Based on VPA estimates, recruitment has decreased drastically since 2010 (yearclasses 2005 and later), which has led to a drastic decrease in harvestable biomass. The recruitment failure is also evident in the length measurements from catches as a high ratio of large animals. This stock has been monitored since the early 1960's and such a gap in the length frequency due to recruitment failure has not been seen before. The CPUE has also declined and was in 2018 the lowest in the time series, but no corrections are made for increased trawl size or gear development.

Reference points (B_{MSY} or $B_{trigger}$) have not been defined for the stock. Given the current knowledge it is reasonable to believe that the stock is now below B_{lim}. According to older assessment methods (VPA) the stock is only one third of probable precautionary reference point for spawning stock biomass (B_{pa}). B_{pa} is based on the 1995 value, which was the lowest observed historical biomass before the current decline. The harvest rate based on the UWTV abundance estimates decreased from 1.8% to 1.2%, from 2016 to 2018. At the same time the catches have decreased substantially.

MFRI advises, for 2019, a monitoring fishery for sampling and mapping of distribution and to monitor stock status. Furthermore, it is advised that the most intensively fished *Nephrops* grounds of Jökuldjúp and Lónsdjúp during recent years should be closed for all *Nephrops* trawling. Additionally, the *Nephrops* grounds in Breiðamerkurdjúp, Hornafjarðardjúp and Lónsdjúp should be closed for bottom trawling to decrease fishing disturbance in those areas.

Basis for the 2019 monitoring fishery advice is as follows. The harvest rate (HR_{2019}) in 2019 is based on the harvest rate of 2018 (UWTV HR_{2018} = 1.16%), scaled with the relative decline of the current VPA stock status (VPA B_{2019} = 3263 tonnes) from B_{pa} (B_{pa} = 10050 tonnes), which gives HR_{2019} = 0.376%. This value is multiplied with the UWTV survey $abundance_{2018}$ and the mean weight in landings in 2018:

$$HR_{2019} = \text{UWTV } HR_{2018} * (\text{VPA } B_{2018}/\text{VPA } B_{pa}) = 0.376\%$$

$$TAC_{2019} = HR_{2019} * \text{UWTV abundance}_{2018} * \text{mean weight}_{2018}$$

$$TAC_{2019} = 0.376\% * 482 \text{ million} * 0.130 \text{ g} = 235 \text{ tonnes}$$

Scaling the harvest rate with biomass level when the biomass level is suspected to be below B_{pa}/MSY $B_{trigger}$ is a standard procedure in many harvest control rules approved by ICES. Given that, MFRI recommends that the monitoring fishing should be limited to 235 tonnes to provide data to support assessment for the stock.

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Table 1. Norway lobster. Landings from Icelandic waters.

Tafla 1. Humar. Afli á Íslandsmiðum.

Year	Icelandic	Others	Total
1951	0	26	26
1952	0	53	53
1953	0	144	144
1954	0	236	236
1955	0	203	203
1956	0	138	138
1957	0	312	312
1958	728	593	1321
1959	1404	602	2006
1960	2081	451	2532
1961	1490	322	1812
1962	2662	154	2816
1963	5550	512	6062
1964	3487	586	4073
1965	3706	409	4115
1966	3465	546	4011
1967	2731	208	2939
1968	2489	157	2646
1969	3512	189	3701
1970	4026	119	4145
1971	4657	155	4812
1972	4321	260	4581
1973	2791	5	2796
1974	1983	6	1989
1975	2357	0	2357
1976	2780	0	2780
1977	2723	0	2723
1978	2059	0	2059
1979	1440	0	1440
1980	2398	0	2398
1981	2520	0	2520
1982	2603	0	2603
1983	2672	0	2672
1984	2459	0	2459
1985	2385	0	2385
1986	2564	0	2564
1987	2712	0	2712
1988	2240	0	2240
1989	1866	0	1866
1990	1692	0	1692
1991	2157	0	2157
1992	2230	0	2230
1993	2381	0	2381
1994	2238	0	2238
1995	1027	0	1027
1996	1633	0	1633
1997	1228	0	1228

1998	1411	0	1411
1999	1376	0	1376
2000	1239	0	1239
2001	1420	0	1420
2002	1548	0	1548
2003	1666	0	1666
2004	1437	0	1437
2005	2030	0	2030
2006	1875	0	1875
2007	2006	0	2006
2008	2070	0	2070
2009	2464	0	2464
2010	2540	0	2540
2011	2240	0	2240
2012	1914	0	1914
2013	1724	0	1724
2014	1965	0	1965
2015	1454	0	1454
2016	1398	0	1398
2017	1194	0	1194
2018	728	0	728

Table 2. Norway lobster. Landings (in tonnes) and CPUE (kg/hour trawled) by area.

Tafla 2. Humar. Afli (tonn) og afli á togtíma (kg/klst) eftir svæðum.

Year	swLandings	swCPUE	sLandings	sCPUE	seLandings	seCPUE	Landings	CPUE
1970	1517	35.9	916	34.7	1593	51.1	4026	40.2
1971	1393	46.9	1446	43.0	1818	55.5	4657	48.4
1972	1500	36.8	1370	35.9	1451	40.8	4321	37.7
1973	1130	30.9	535	31.6	1126	31.9	2791	31.3
1974	408	32.0	492	32.2	1083	48.5	1983	39.4
1975	527	33.6	717	35.6	1113	43.9	2357	38.5
1976	817	32.4	608	31.5	1355	42.1	2780	36.2
1977	571	27.5	663	32.8	1489	42.5	2723	35.7
1978	395	31.2	290	28.6	1374	47.9	2059	40.0
1979	700	33.9	445	32.8	295	34.2	1440	33.6
1980	734	43.8	540	34.4	1124	55.5	2398	45.5
1981	398	44.0	627	44.1	1495	58.8	2520	51.8
1982	640	44.0	509	42.8	1454	60.2	2603	51.5
1983	572	42.5	710	45.8	1390	51.6	2672	47.8
1984	422	36.1	722	47.9	1315	48.5	2459	45.6
1985	522	46.9	583	57.1	1280	60.8	2385	56.4
1986	495	49.0	454	56.2	1615	68.2	2564	61.3
1987	615	43.5	599	57.4	1498	55.6	2712	52.6
1988	625	39.3	965	42.7	650	36.8	2240	39.9
1989	394	32.8	645	35.7	827	38.0	1866	36.0
1990	217	29.3	304	29.0	1171	48.1	1692	40.0
1991	374	35.0	361	29.0	1422	51.0	2157	42.1
1992	400	40.8	414	40.0	1417	60.5	2230	51.3
1993	446	42.1	435	38.3	1500	61.6	2381	51.4
1994	539	30.8	493	35.4	1205	43.8	2238	38.0
1995	510	26.0	325	28.0	192	26.0	1027	27.0
1996	514	30.0	721	37.8	398	39.2	1633	35.2
1997	371	25.2	533	30.5	324	46.2	1228	31.3
1998	145	22.2	746	39.1	520	49.0	1411	38.9
1999	131	25.5	669	38.2	576	47.9	1376	39.7
2000	107	25.8	454	38.2	678	64.3	1239	46.6
2001	258	26.6	296	29.2	866	73.5	1420	44.9
2002	288	25.6	265	29.9	995	64.8	1548	43.7
2003	133	30.5	357	32.9	1176	69.9	1666	52.0
2004	126	16.8	341	25.9	970	58.4	1437	38.5
2005	218	30.6	953	48.2	860	46.9	2030	44.9
2006	316	47.6	490	46.4	1069	93.7	1875	65.5
2007	1200	93.0	53	59.1	753	111.5	2006	97.6
2008	599	87.5	477	102.8	994	144.5	2070	112.7
2009	1130	70.0	472	99.8	862	86.9	2464	80.0
2010	1173	76.8	652	71.6	715	82.1	2540	75.8
2011	846	65.7	474	65.9	920	89.1	2240	71.0
2012	791	62.9	439	57.2	684	75.7	1914	63.0
2013	647	59.7	341	46.3	736	73.5	1724	60.5
2014	1093	74.8	234	43.6	638	68.1	1965	67.4
2015	956	52.6	83	25.6	415	51.2	1454	48.3
2016	812	44.9	57	23.6	529	51.7	1398	44.5
2017	711	47.8	10	15.4	472	40.8	1194	44.4
2018	402	28.5	10	19.0	316	28.9	728	28.3

Table 3. Norway lobster. Catch in numbers at age (in millions)

Tafla 3. Humar. Skipting aflans í fjölda eftir aldri (í milljónum).

Year	a3	a4	a5	a6	a7	a8	a9	a10	a11	a12	a13	a14	a15	a16	a17	a18	a19	a20
1977	0.312	3.224	9.773	10.27	10.39	8.687	5.053	3.808	2.348	1.128	0.850	0.539	0.292	0.149	0.051	0.047	0.016	0.014
1978	0.091	1.256	6.336	7.691	7.385	6.501	4.304	3.011	1.959	0.699	0.511	0.295	0.186	0.136	0.076	0.060	0.025	0.009
1979	0.019	0.319	2.391	4.493	5.195	4.731	2.911	2.458	1.445	0.551	0.401	0.209	0.104	0.053	0.015	0.005	0.004	0.004
1980	0.042	0.478	3.081	5.713	8.010	8.715	5.376	4.041	2.614	0.980	0.588	0.281	0.171	0.074	0.026	0.017	0.006	0.000
1981	0.070	0.639	2.749	4.912	6.885	8.001	5.815	4.869	3.392	1.215	0.698	0.411	0.171	0.076	0.013	0.005	0.000	0.000
1982	0.080	0.981	5.411	6.207	7.336	8.025	5.793	4.623	3.513	1.283	0.962	0.322	0.157	0.059	0.038	0.005	0.000	0.000
1983	0.105	0.733	4.493	6.814	6.641	6.646	4.741	5.005	3.790	1.774	1.161	0.629	0.336	0.146	0.046	0.015	0.002	0.000
1984	0.256	1.453	4.744	5.967	6.862	6.176	4.005	3.414	3.199	1.528	1.271	0.798	0.471	0.328	0.117	0.070	0.015	0.019
1985	0.049	0.890	3.703	5.216	5.777	6.589	5.147	4.016	3.262	1.331	0.998	0.568	0.333	0.130	0.054	0.029	0.007	0.000
1986	0.006	0.440	3.253	6.387	8.609	7.511	5.254	4.130	3.298	1.202	0.961	0.523	0.225	0.066	0.045	0.000	0.000	0.000
1987	0.054	0.423	2.437	5.290	7.339	8.308	5.429	4.454	3.328	1.621	1.063	0.610	0.379	0.171	0.107	0.048	0.017	0.016
1988	0.088	0.726	2.698	4.531	6.035	6.182	5.252	3.993	2.526	1.187	0.885	0.473	0.371	0.136	0.044	0.053	0.013	0.001
1989	0.070	0.751	3.365	3.808	4.586	5.064	3.521	2.991	2.593	1.219	0.819	0.526	0.344	0.147	0.057	0.019	0.008	0.000
1990	0.085	1.094	5.436	7.147	5.927	4.424	2.777	2.133	1.571	0.828	0.633	0.423	0.333	0.158	0.087	0.041	0.013	0.009
1991	0.041	0.866	4.859	7.939	9.021	6.951	3.811	2.847	1.902	0.836	0.610	0.364	0.258	0.107	0.058	0.022	0.019	0.001
1992	0.014	0.444	3.113	6.303	8.338	8.279	4.889	3.120	2.014	0.904	0.551	0.302	0.184	0.078	0.021	0.015	0.006	0.006
1993	0.049	0.348	2.492	4.652	6.347	6.940	5.159	3.898	3.110	1.407	0.896	0.515	0.309	0.147	0.073	0.043	0.005	0.001
1994	0.120	0.895	2.267	4.053	5.450	6.089	4.471	3.793	3.126	1.641	1.013	0.492	0.342	0.129	0.039	0.022	0.003	0.000
1995	0.057	0.529	1.709	2.071	2.258	2.577	1.889	1.780	1.370	0.705	0.436	0.378	0.236	0.087	0.036	0.014	0.002	0.000
1996	0.072	0.728	3.104	4.229	4.194	4.134	2.814	2.277	1.994	1.009	0.831	0.629	0.379	0.159	0.077	0.033	0.005	0.003
1997	0.028	0.510	2.482	3.569	3.590	2.878	1.812	1.583	1.455	0.795	0.642	0.471	0.288	0.171	0.064	0.027	0.008	0.003
1998	0.003	0.186	1.400	2.536	3.494	3.319	2.244	1.881	1.712	0.962	0.787	0.621	0.428	0.242	0.116	0.042	0.018	0.002
1999	0.029	0.179	1.257	2.645	3.631	4.012	2.827	2.104	1.652	0.775	0.536	0.369	0.283	0.135	0.075	0.037	0.008	0.006
2000	0.030	0.194	1.176	1.606	2.213	2.748	2.232	2.223	1.872	0.944	0.658	0.446	0.290	0.142	0.075	0.030	0.013	0.003
2001	0.017	0.221	0.874	1.550	2.345	2.847	2.229	2.345	2.144	1.230	0.900	0.634	0.401	0.212	0.109	0.043	0.012	0.005
2002	0.006	0.170	1.770	2.213	2.230	2.522	1.979	2.098	1.982	1.224	1.058	0.934	0.713	0.408	0.227	0.099	0.037	0.016
2003	0.065	0.264	1.042	3.308	3.606	3.016	2.143	1.897	1.767	1.131	1.035	0.883	0.778	0.459	0.292	0.131	0.041	0.014
2004	0.030	0.557	1.994	2.595	4.647	4.532	2.320	1.737	1.246	0.666	0.517	0.430	0.393	0.277	0.207	0.126	0.073	0.031
2005	0.025	0.217	1.762	3.445	3.937	5.161	4.612	3.540	2.648	1.382	0.770	0.559	0.445	0.204	0.123	0.047	0.024	0.011
2006	0.010	0.223	1.191	2.825	4.135	4.290	3.587	3.311	2.603	1.286	0.883	0.581	0.417	0.198	0.131	0.051	0.030	0.020
2007	0.019	0.122	0.799	1.821	2.929	3.880	2.821	2.580	2.487	1.617	1.140	0.989	0.844	0.448	0.376	0.210	0.188	0.110
2008	0.018	0.237	1.213	2.421	3.501	3.994	3.650	3.432	2.691	1.569	1.014	0.949	0.733	0.371	0.254	0.112	0.063	0.036
2009	0.043	0.256	1.294	2.381	3.356	4.276	3.716	3.431	2.956	1.815	1.214	1.220	1.156	0.681	0.553	0.268	0.179	0.125
2010	0.019	0.240	1.394	2.551	3.547	4.343	3.552	3.556	2.860	1.891	1.220	1.369	1.142	0.744	0.521	0.303	0.265	0.166
2011	0.017	0.252	1.495	2.845	3.274	4.172	3.415	3.193	2.930	1.832	1.081	0.990	0.901	0.528	0.427	0.178	0.113	0.084
2012	0.001	0.088	0.695	1.539	2.108	2.889	2.817	2.561	2.406	1.703	1.075	1.017	1.018	0.558	0.419	0.233	0.132	0.156
2013	0.002	0.025	0.294	0.884	1.615	2.405	2.208	2.180	2.300	1.451	1.125	1.013	0.970	0.599	0.420	0.242	0.131	0.135
2014	0.000	0.014	0.203	0.729	1.573	2.391	2.302	2.432	2.477	1.569	1.291	1.185	1.062	0.793	0.536	0.330	0.169	0.170
2015	0.000	0.007	0.144	0.472	1.010	1.609	1.564	1.713	1.702	1.113	0.993	0.865	0.881	0.612	0.481	0.267	0.137	0.114
2016	0.000	0.006	0.016	0.131	0.491	0.994	1.279	1.458	1.735	1.173	1.174	0.914	0.928	0.574	0.481	0.254	0.153	0.166
2017	0.000	0.004	0.009	0.04	0.193	0.484	0.693	0.903	1.179	0.929	0.971	0.967	0.838	0.626	0.459	0.344	0.227	0.199
2018	0.000	0.001	0.015	0.082	0.137	0.315	0.451	0.605	0.646	0.493	0.476	0.498	0.429	0.342	0.285	0.226	0.184	0.201

Table 4. Norway lobster. Recruitment as 5-year-olds in millions, fishable (6+) and large category (10+) stock in tonnes, landings in tonnes, and fishing mortality (average for ages 6–13).

Tafla 4. Humar. Fjöldi fimm ára nýliða i milljónum, veiðistofn (6 ára og eldri) og stofn stórhumars (10 ára og eldri) í upphafi árs í tonnum, afli í tonnum og fiskveiðidánartala (meðaltal fyrir 6–13 ára).

Year	Rec	B6plus	B10plus	Landings	Fbar
1980	89.3	13674	3596	2398	0.25
1981	88.5	13662	4077	2520	0.26
1982	90.1	13462	4284	2603	0.28
1983	86.1	13098	4382	2672	0.30
1984	86.4	12587	4031	2459	0.30
1985	76.4	12300	3887	2385	0.28
1986	75.0	11872	3789	2564	0.31
1987	76.2	11182	3626	2712	0.36
1988	85.3	10388	3206	2240	0.32
1989	94.7	10389	2914	1866	0.30
1990	89.1	11101	2738	1692	0.23
1991	77.6	11798	3051	2157	0.25
1992	70.8	11657	3431	2230	0.25
1993	67.5	11223	3775	2381	0.30
1994	69.0	10532	3587	2238	0.31
1995	76.2	10052	3274	1027	0.14
1996	75.8	11070	3667	1633	0.20
1997	77.0	11451	3863	1228	0.14
1998	76.6	12339	4345	1411	0.15
1999	88.1	13036	4717	1376	0.13
2000	92.3	13999	5300	1239	0.11
2001	106.6	15238	5728	1420	0.12
2002	110.6	16688	6199	1548	0.12
2003	117.0	18120	6591	1666	0.10
2004	111.6	19621	7345	1437	0.08
2005	103.0	21123	8499	2030	0.11
2006	92.7	21675	9254	1875	0.10
2007	82.2	22023	9992	2006	0.10
2008	72.5	21847	10775	2070	0.10
2009	63.9	21257	11273	2464	0.11
2010	53.2	19977	11224	2540	0.12
2011	38.6	18163	10688	2240	0.13
2012	27.9	16240	10134	1914	0.12
2013	19.4	14274	9380	1724	0.12
2014	11.8	12304	8588	1965	0.16
2015	6.2	9934	7366	1454	0.15
2016	2.8	8030	6312	1398	0.17
2017	1.8	6126	5052	1194	0.15
2018	0.8	4466	3845	727	0.13
2019	0.3	3263	2942		

Table 5. Norway lobster. Input parameters for stock projection. Natural mortality coefficient, M=0.2.
Tafla 5. Humar. Forsendur í framreikningum á þróun stofnsins. Náttúrulegur dánarstuðull M=0.2.

Age	Stock size	Selectivity	Mean weight (g)
5	0.30	0.05	23
6	0.67	0.12	34
7	1.16	0.22	46
8	1.36	0.35	60
9	2.18	0.42	75
10	2.95	0.60	89
11	3.29	0.80	104
12	2.93	0.85	119
13	2.57	1.00	131
14	2.59	1.00	145
15	2.05	1.00	159
16	1.22	1.00	175
17	0.97	1.00	217
18	0.82	1.00	238
19	0.64	1.00	268
20	0.53	1.00	284

Stock size: Stock size in millions in 2019.
Selectivity: Relative fishing mortality on each age group in 2018.
Mean weight: From length-weight regression.

Stofnstærð: Stofnstærð í milljónum 2019.
Veiðimynstur: Hlutfallsleg veiðidánartala hvers aldursflokks 2018.
Meðalþyngd: Út frá sambandi lengdar og þyngdar.

Table 6. Norway lobster. Recommended TAC, National TAC set by the Ministry and landings (tonnes). *Includes also autumn catches in 2018.

*Tafla 6. Humar. Tillögur Hafrannsóknastofnunar um hámarksafla, ákvörðun stjórnvalda um aflamark og landaður afli (tonn). *Afli haustsins 2018 meðtalinn.*

Year	Rec. TAC		TAC	Landings
1984	2400		2600	2500
1985	2300		2400	2400
1986	2500		2500	2600
1987	2700		2800	2700
1988	2600		2600	2200
1989	2100		2100	1900
1990	2100		2000	1700
1991	2100		2100	2200
1991/92	2100		2100	2200
1992/93	2200		2400	2400
1993/94	2200		2400	2200
1994/95	2200		2200	1000
1995/96	1500		1500	1600
1996/97	1500		1500	1200
1997/98	1500		1200	1400
1998/99	1200		1200	1400
1999/00	1200		1200	1300
2000/01	1400		1400	1400
2001/02	1500		1500	1577
2002/03	1600		1600	1687
2003/04	1600		1600	1437
2004/05	1500		1500	2035
2005/06	1600		1800	1946
2006/07	1700		1800	1946
2007/08	1900		1900	2000
2008/09	2200		2200	1999
2009/10	2200		2200	2456
2010/11	2100		2100	2259
2011/12	2000		2100	2130
2012/13	1900		1900	1965
2013/14	1750		1750	1983
2014/15	1650		1650	1425
2015/16	1500		1500	1536
2016/17	1300		1300	1186
2017/18*	1150		1150	869
2019	235			

Table 7. Norway lobster. Summary of 2018 UWTV survey and information about the catch in 2018. Name of an area, id of area (see Figure 7), size of the area (km^2), number of burrows (million), mean number of burrows per meter square, catches per area, mean weight of *Nephrops* in catch, ratio of males in the catch (%), number of animals removed and harvest rate in 2018.

Tafla 7. Humar. Myndataka á humarholum og upplýsingar um afla 2018. Nafn á svæðum, merki svæðis (sjá mynd 7), stærð svæða (km^2), fjöldi hola (milljónir), fjöldi hola á hvern fermeter, afli hvers svæðis, meðalþyngd veiddra humra, hlutfall karldýra í afla, fjöldi veiddra humra og veiðihlutfall á hverju svæði 2018.

Area	id	km²	Burrows	Burrows m²	Catch (t)	M.weight (g)	M%	Removals	Harvest rate
Jökuldjúp	3	737	73	0.100	187.0	0.109	0.91	1.72	2.34%
Eldey	5	845	63	0.075	128.7	0.140	0.99	0.92	1.46%
Grindav.-/Skerjadjúp	7	1307	77	0.059	99.3	0.138	0.91	0.72	0.93%
Selvogur	8, 11, 12	296	22	0.076	0.1	0.139	0.92	0.00	0.00%
Vestmannaeyjar	1, 10	1400.0	76	0.054	10.8	0.129	0.92	0.08	0.11%
Skeiðarárdjúp	9	859	66	0.076	10.9	0.143	0.82	0.08	0.12%
Breiðamerkurdjúp	6	638	66	0.104	84.3	0.109	0.60	0.77	1.16%
Hornafjarðardjúp	2	259	20	0.076	84.9	0.159	0.93	0.53	2.73%
Lónsdjúp	4,13	247	18	0.074	121.8	0.156	0.93	0.78	4.27%
Total		**6588**	**482**	**0.073**	**727.8**	**0.130**		**5.60**	**1.16%**

Table 8. Summary of the average (2014-2018) annual bottom trawl effort on *Nephrops* grounds and all areas south of 65°N. Effort is in hours, E / km^2 is the effort per km^2 on *Nephrops* ground. Cod, haddock and ling is the average tonnes caught per species with bottom trawl and CPUE is the tonnes caught per hour for given species.

Tafla 8. Yfirlit yfir árlega meðalsókn (2014-2018) með botnvörpu á humarslóð og alls suður af 65°N. Sóknin er í klukkustundum, E / km^2 er sókn á ferkílómeter á humarsvæði. Dálkarnir Cod, Haddock og Ling sýna meðal ársafla í tonnum fyrir þorsk, ýsu og löngu á hverju svæði og CPUE er afli á sóknareiningu fyrir gefna tegund (tonn á klukkustund).

Area	id	Effort	E / km²	Cod	C CPUE	Haddock	H CPUE	Ling	L CPUE
South of 65°N		47371		23784	0.50	7068	0.15	772	0.02
Jökuldjúp	3	53	0.07	18	0.35	3	0.06	1	0.02
Eldey	5	317	0.38	239	0.75	44	0.14	10	0.03
Grindav.-/Skerjadjúp	7	468	0.36	106	0.22	17	0.04	13	0.03
Selvogur	8	13	0.04	7	0.51	1	0.07	0	0.01
Vestmannaeyjasvæði	1	3387	2.42	3970	1.17	821	0.24	408	0.12
Skeiðarárdjúp	9	360	0.42	44	0.12	66	0.18	18	0.05
Breiðamerkurdjúp	6	1619	2.54	488	0.30	67	0.04	57	0.04
Hornafjarðardjúp	2	237	0.91	72	0.31	14	0.06	3	0.01
Lónsdjúp	4	172	0.70	60	0.35	15	0.09	2	0.01