

NORWAY LOBSTER

Nephrops norvegicus

INTRODUCTION

Fishery of Norway lobster (*Nephrops norvegicus*) started in the early 1950s and during the first two decades it was mainly conducted by Icelandic, Belgian and French vessels (Table 1). Since 1974 the fishery has been conducted by Icelandic vessels. In the beginning *Nephrops* was mainly fished during spring and summer and the fleet was large, up to 200 boats in the 1970s. In recent years, the season was longer, as the fishery starts in the middle of March and ends in November/December. There was a gradual decrease in the number of boats participating in the *Nephrops* fishery; prior to the moratorium beginning in 2022 seven boats participated. The species is entirely caught in *Nephrops* trawls, but there have been occasional creel trials (Eiríksson and Jónasson, 2018).

The *Nephrops* fishing grounds in Iceland are the northernmost part of the species distributional range. The high latitude of the species distribution impacts its biology. For example, female *Nephrops* in more southern stocks (e.g., in Scotland, Ireland, France, and Portugal) reproduce annually, while female *Nephrops* in Iceland reproduce biennially (Eiríksson, 2014). Further, female *Nephrops* in Iceland experience slower post-maturity growth than their more southern counterparts. These differences decrease the productivity of the Icelandic stock relative to the more southern stocks and warrants lower exploitation rates.

COMMERCIAL FISHING

LANDINGS

After the fishery began in the 1950s, landings peaked in 1963 at 6000 tonnes (Eiríksson and Jónasson, 2018). Landings periodically fluctuated until the mid-2010s after which they declined (Table 1, Figure 1). A monitoring fishery was conducted from 2019 – 2021, to sample and map *Nephrops* distribution, but with areas closed in Jökuldjúp (southwest of Iceland) and Lónsdjúp (southeast of Iceland). Landings in 2020 and 2021 were 194 tonnes and 107 tonnes, respectively. A complete moratorium has been in place since 2022.

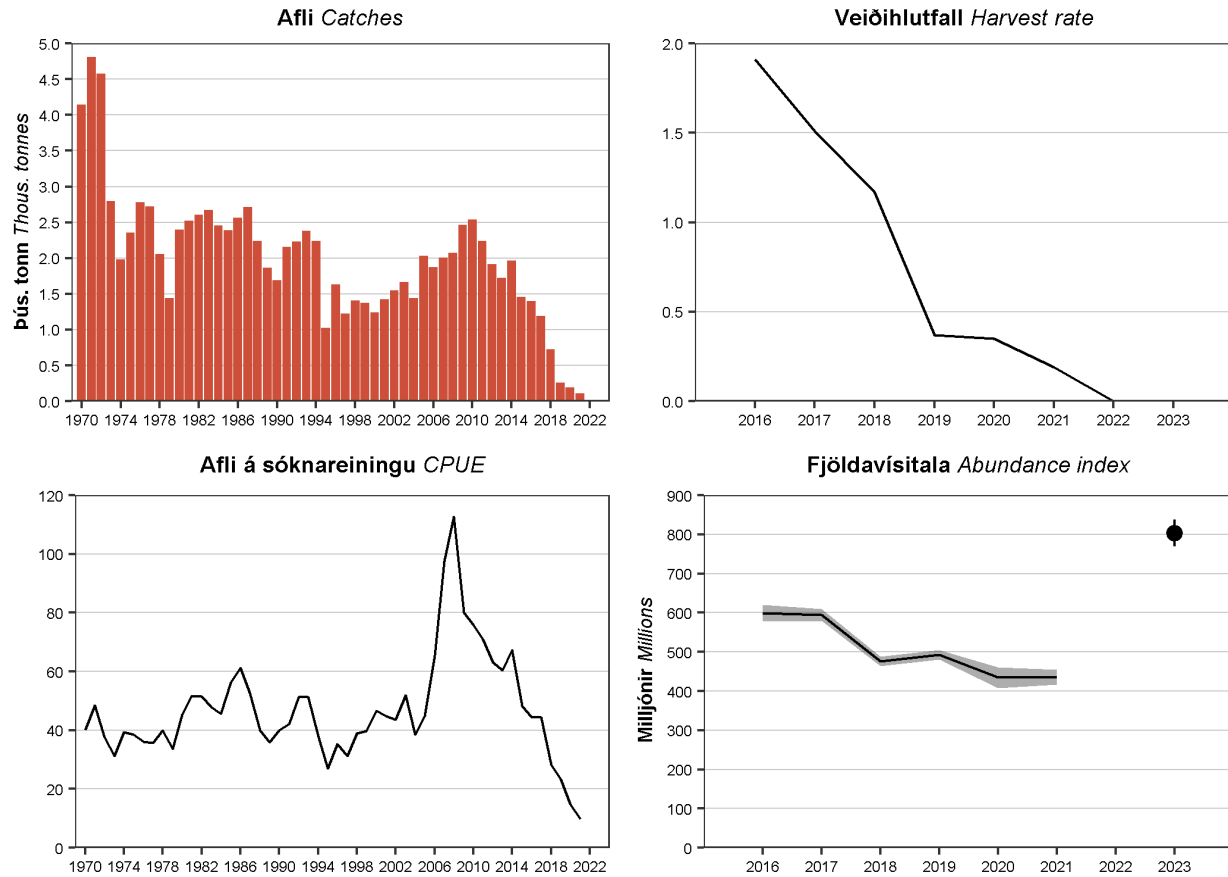


Figure 1. Norway lobster. Catches, harvest rate (sum of landings in numbers, divided by total abundance), catch per unit effort (CPUE), stock abundance (Underwater TV, millions; SSB proxy, 95% confidence intervals).

CPUE AND EFFORT

During the last years of fishing prior to the 2022 moratorium catch per unit effort (CPUE, where the unit of effort is trawls from May to August) declined greatly from the peak in 2007 and 2008 when more than 100 kg of *Nephrops* were caught per hour towed. CPUE in 2021 was 9.8 kg per hour towed (Table 2). There have been similar fluctuations among areas regarding CPUE (Figures 2 and 3). CPUE had on average been higher in the southeast area, and in recent years it was the lowest in the southern area.

Effort generally decreased from 1970 to 2008 in all areas (Figure 4). Since 2008, effort decreased in the Vestmannaeyjar area, increased in the southwestern area, and was relatively constant in the southeastern area. A small uptick in effort can be observed in the southeastern area from 2019 to 2021 as a result of the monitoring fishery.

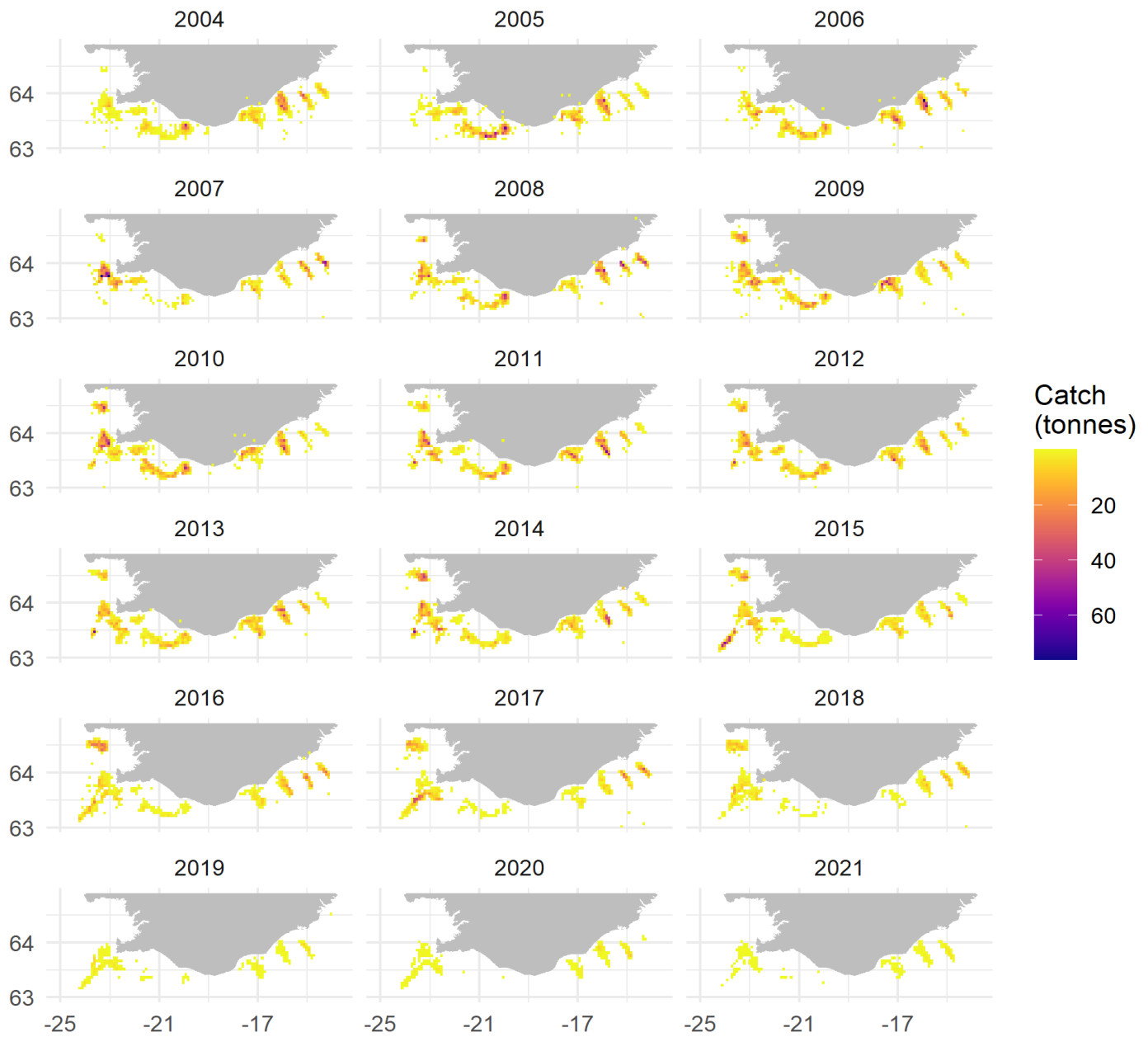


Figure 2. Norway lobster. Catch distribution 2004-2021.

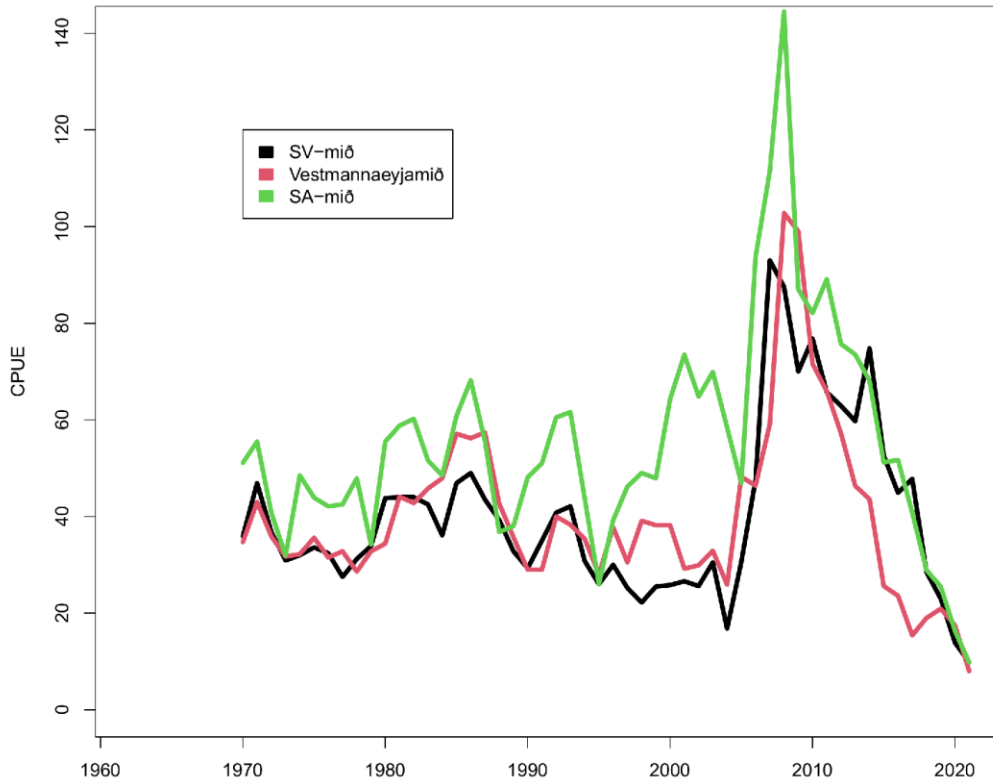


Figure 3. Norway lobster. Standardized CPUE in 1970–2021 in the southwest (SV-mið, black), Westman Islands (Vestmannaeyjarnir, red) and southeast (SA-mið, green) areas.

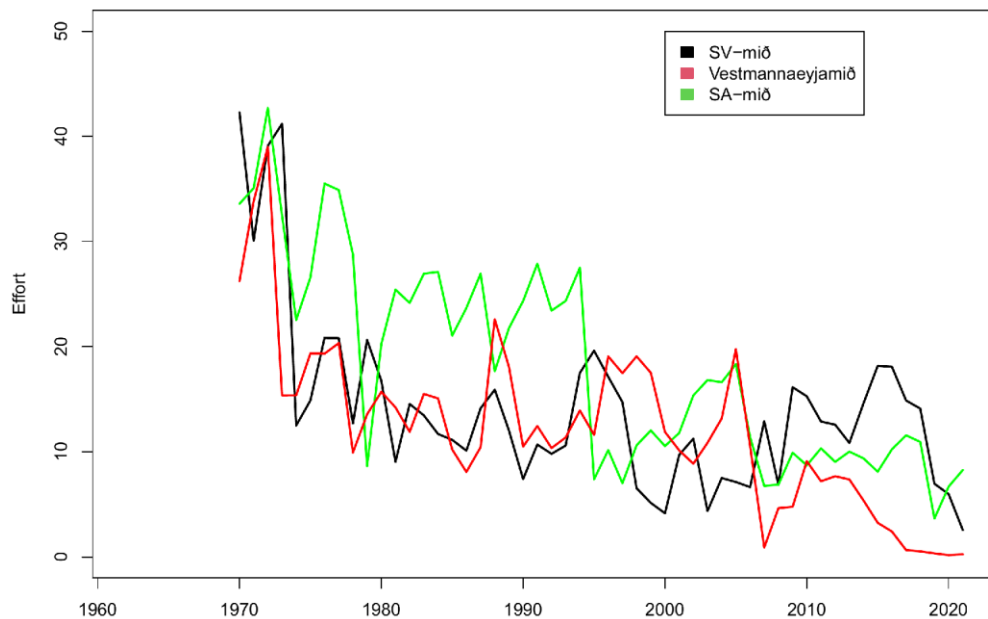


Figure 4. Norway lobster. Standardized effort in 1970–2021 in the southwest (SV-mið, black), Westman Islands (Vestmannaeyjarnir, red) and southeast (SA-mið, green) areas.

LENGTH DISTRIBUTIONS

In 2022 and 2023, 22 and 17 samples were obtained during surveys, respectively. The most frequent sizes (carapace length, CL) of males in the samples in 2022 and 2023 were between 50 and 65 mm (Figure 5). During the last decade fewer small *Nephrops* (smaller than 40 mm CL) and more large *Nephrops* (larger than 70 mm CL) were observed, suggesting poor recruitment.

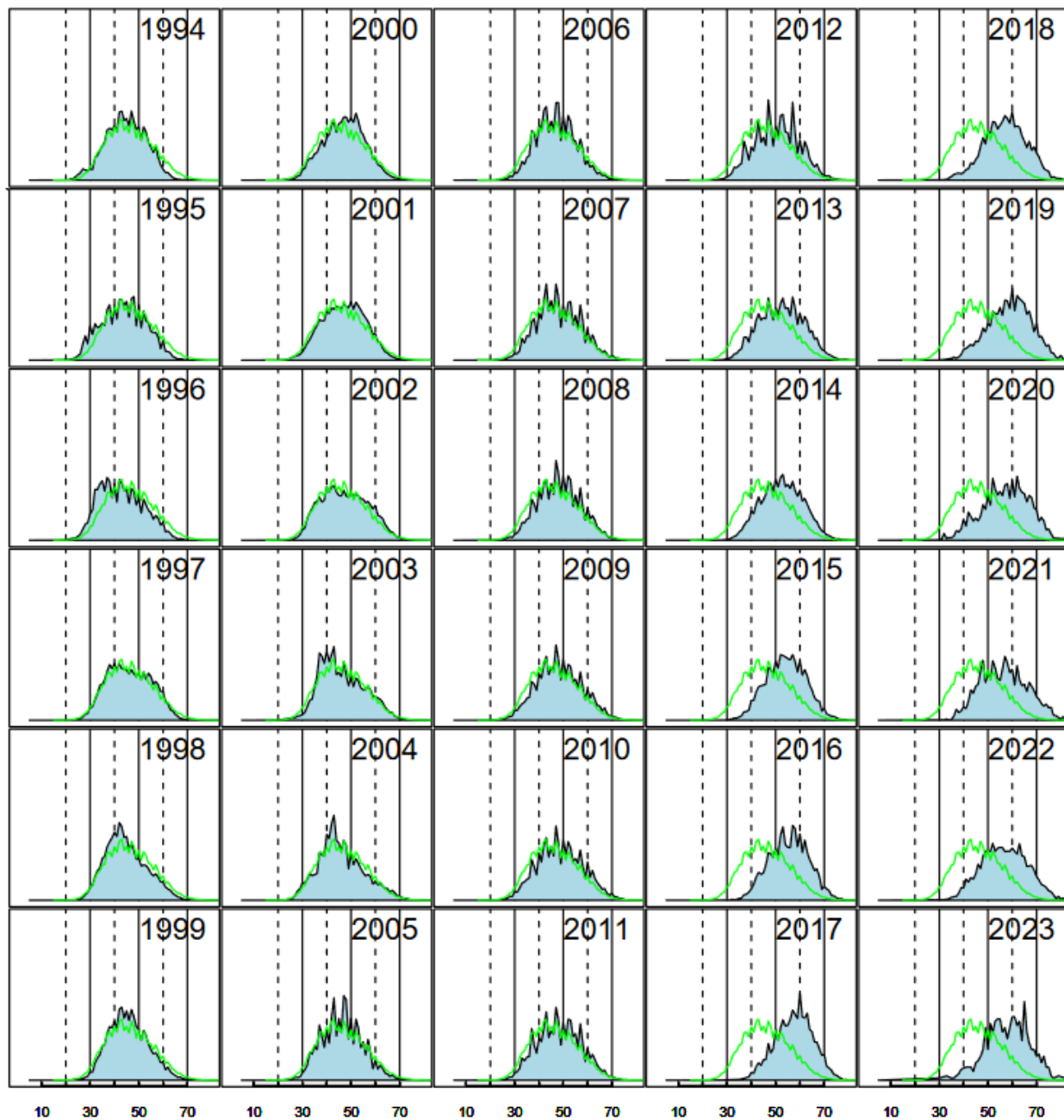


Figure 5. Norway lobster. Length frequency distribution (shaded area) of all samples 1994–2023. The green line shows the average of the years 1970–2023.

SURVEYS



Figure 6. Norway lobster. Polygons of *Nephrops* grounds (see Figure 2) based on VMS data. See name of grounds marked by the red number in Table 4.

UWTV SURVEY

The first underwater TV (UWTV) survey in Icelandic water was conducted in April and June 2016. In total, 86 UWTV-stations on a roughly 4.5 nautical mile grid were completed on all known *Nephrops* grounds. 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 includes approximately 99% of the pings. Adjoining grids were combined and fishing grounds smaller than 4 km² were excluded. The total size of the fishing grounds was estimated to be 5989 km² 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 km² (Table 4, Figure 6). In total there were nine distinct areas ranging from 247 km² to 1400 km². 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 the survey conducted in 2023 was estimated to be 804 million animals, compared to 435 million animals in 2021 (Figure 1). Average density in 2023 was 0.12 burrows/m² (Table 4, Figure 7). The highest density of burrows was in Breiðamerkurdjúp; 0.20 and Hornarfjarðardjúp, 0.19 burrows/m² respectively (Figure 8). The lowest density (slightly below 0.09 burrows/m²) was on the Vestmannaeyjar ground in the southern part. Results from 2016–2021 and 2023 are shown in Figure 9.

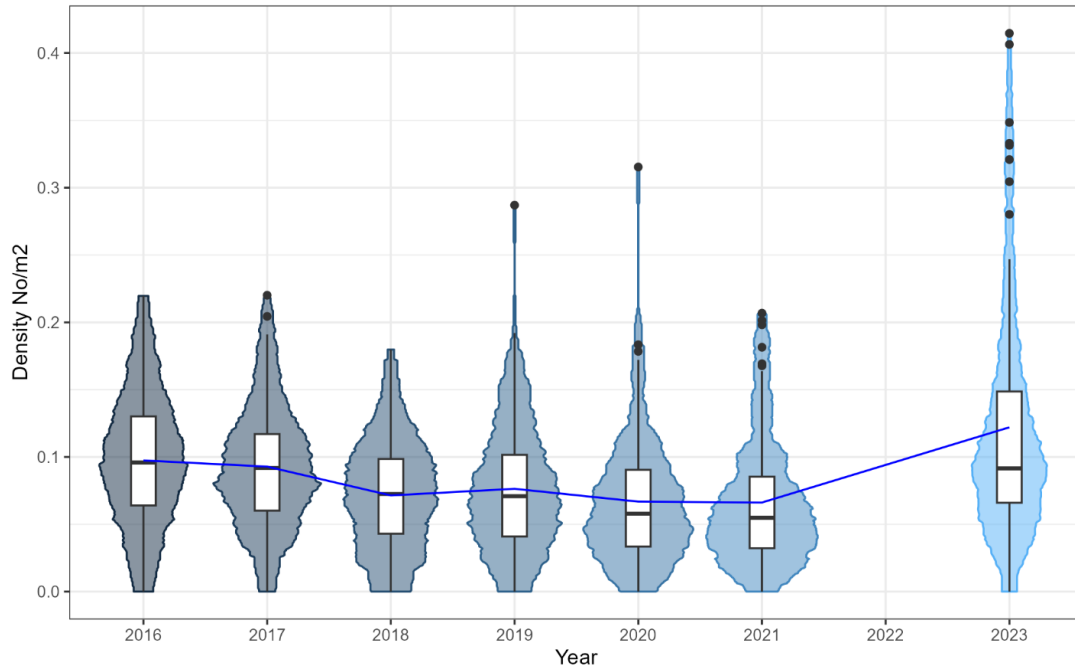


Figure 7. Norway lobster. Violin and boxplots of adjusted burrow density distributions by year 2016–2021 & 2023. The blue line indicates the mean density over time. The horizontal black lines represent the median, white boxes are the inter quartile ranges, the black vertical lines show the range, and the black dots are outliers.

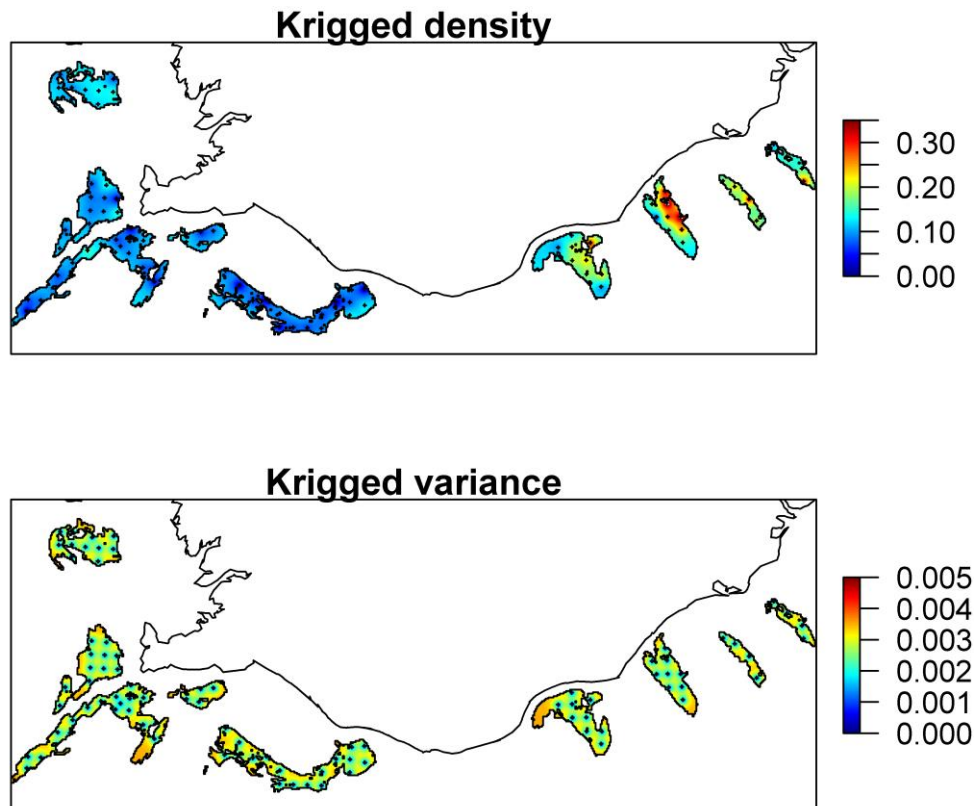


Figure 8. Norway lobster. Density of burrows (krigged density/m², gaussian model) on *Nephrops* grounds from the UWTV surveys conducted in 2023 above and krigged variance of burrow density below. The crosses represent the stations.

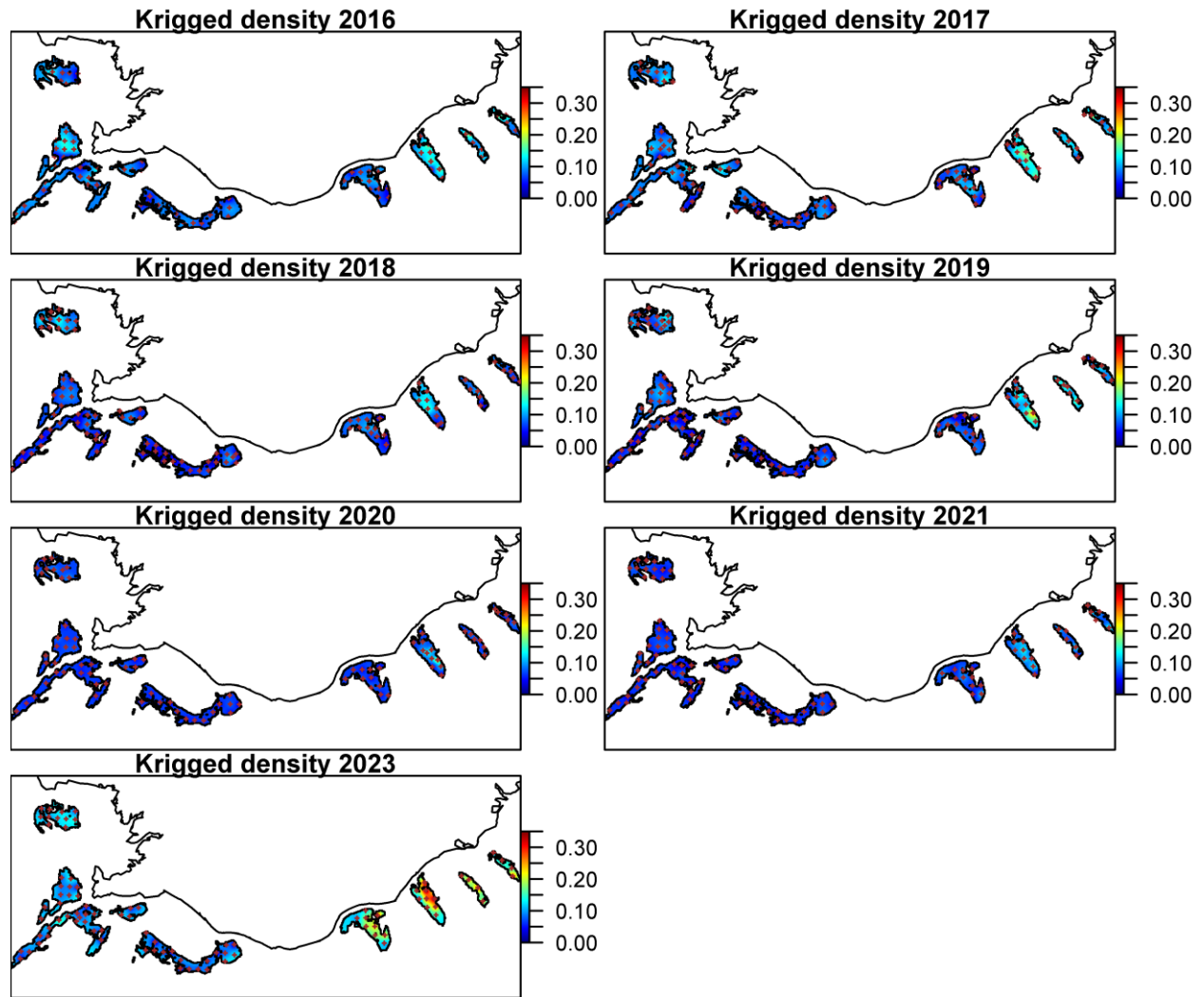


Figure 9. Norway lobster. Density of burrows (krigged density per m^2 , gaussian model) on *Nephrops* grounds from the UWTV surveys conducted in 2016–2021 & 2023. The crosses represent the stations.

LARVAE SURVEY

Starting in 2018, bongo net (500 μm mesh size) sampling was conducted after roughly every fourth UWTV station. The objective is to sample pelagic *Nephrops* larvae in order to estimate recruitment. The bongo net was towed in a V-shaped manner down to 40 m and up to the surface. During the 2018 UWTV survey, there were 23 bongo net stations. In 2019–2021 & 2023, between 25 to 28 stations were conducted. *Nephrops* larvae were found on 10 stations in 2018, 19 stations in 2019, 15 stations in 2020, 16 stations in 2021 and 10 stations in 2023 (Figure 10). The average density was 15.1 larvae/1000 m^3 in 2018, 24.8 larvae in 2019, 8.1 larvae in 2020, 11.0 larvae in 2021 and larvae 7.6 during the 2023 survey. The geographic distribution was wider in the 2019–2021 surveys, compared to the 2018 and 2023 surveys. Through the years, it was more common to find the Zoea stages II-III in the southeast region. The information from this sampling might be indicative of future recruitment.

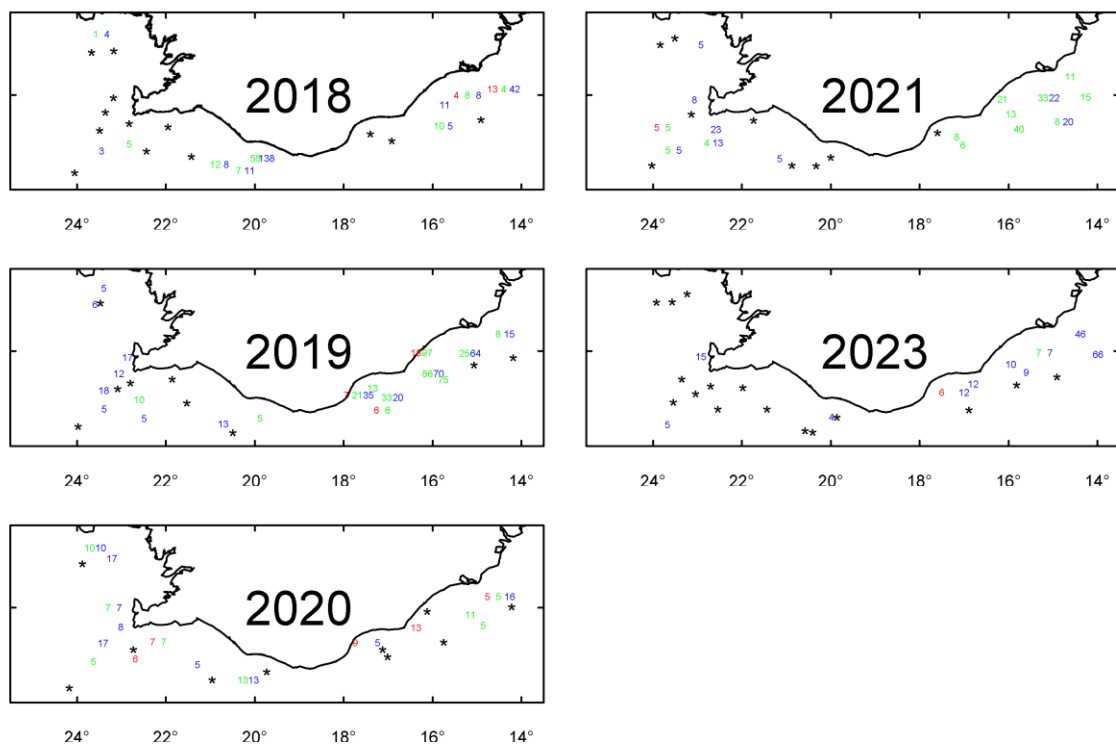


Figure 10. Norway lobster. Number of *Nephrops* larvae caught in bongo net per 1000 m^3 from surveys conducted in 2018–2021 & 2023 Zoea stage 1 (blue), Zoea stage 2 (green), and Zoea stage 3 (red). Black asterisks are stations where no *Nephrops* larvae were found.

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. *Nephrops* catchability is related to water clarity (higher catches in murkier waters) and groundfish density (lower catches when groundfish density is 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 the UWTV

survey in 2016 to assess stock development and provide management advice for the *Nephrops* stock in Icelandic waters (Campbell, *et al.*, 2009).

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 were around 6600 towed hours annually (2014–2018) on *Nephrops* grounds (Table 5). Most of the activity was on the Vestmannaeyjar *Nephrops* ground or almost 4000 towed hours (2.4 hours annually/km²). Slightly higher trawling activity was in Breiðamerkurdjúp or 2.5 h/km² and high trawling activity was also in Hornafjarðardjúp (0.9 h/km²) and Lónsdjúp (0.7 h/km²). On average, the CPUE of cod (*Gadus morhua*), the most important demersal fish species, south of 65°N was 0.5 tonnes per hour (t/h) 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 11, Table 5). CPUE of haddock (*Melanogrammus aeglefinus*) and ling (*Molva molva*) was also higher within the Vestmannaeyjar region compared to other areas south of 65°N (Table 5).

Because of poor state of the *Nephrops* stock, the core *Nephrops* areas southeast of Iceland were closed from additional disturbance of groundfish bottom trawling in 2022 (Figure 11, Table 5). Those areas had relatively high trawling activity but are of less importance for groundfish than the Vestmannaeyjar grounds.

Current boundaries of closures for all 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°05' 00'' V
4. 64°10' 00'' N - 14°30' 00'' V
5. 64°10' 00'' N - 14°42' 00'' V

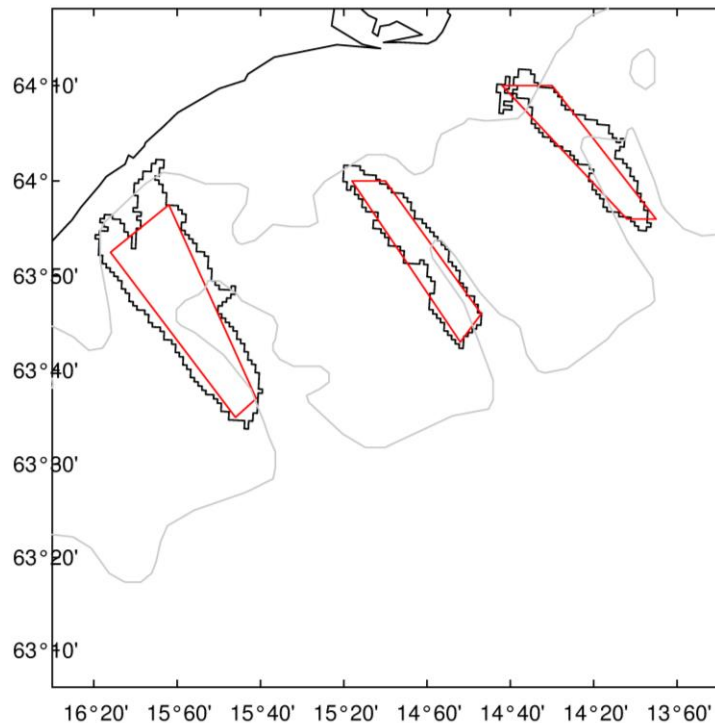


Figure 11. Norway lobster. Polygons of *Nephrops* grounds based on VMS data in southeastern Iceland. Closed areas for all bottom trawling within *Nephrops* areas are plotted (red lines) and depth contours (100 and 200 m, grey lines).

HARVEST RATE

In 2021, prior to the moratorium, the harvest rate varied from 0–1.1% between grounds, with an average harvest rate of 0.19% (Table 4). Limited fisheries were on Vestmannaeyjar and Selvogsbanki with subsequently low harvest rate. The highest harvest rate was in Hornafjarðardjúp, followed by Breiðamerkurdjúp. The ratio of males in the catches was estimated to be 76–100%.

With declining catches, the harvest rate declined from 1.91% in 2016 to 0.19% in 2021 (Figure 1). Despite the disjointed nature of the *Nephrops* ground in Iceland and therefore relatively small number of stations on each ground, the relative abundance shows similar fluctuations on different grounds (Figures 9 and 12). The trends are similar on the grounds Jökuldjúp and Lónsdjúp, which closed two years earlier than others, or in 2019. The eastern grounds; Skeiðarárdýpi, Breiðamerkurdýpi, Hornafjarðardýpi and Lónsdýpi, experienced the greatest relative increase in abundance between the surveys conducted in 2021 and 2023 as well as the highest density (Table 4, Figure 12).

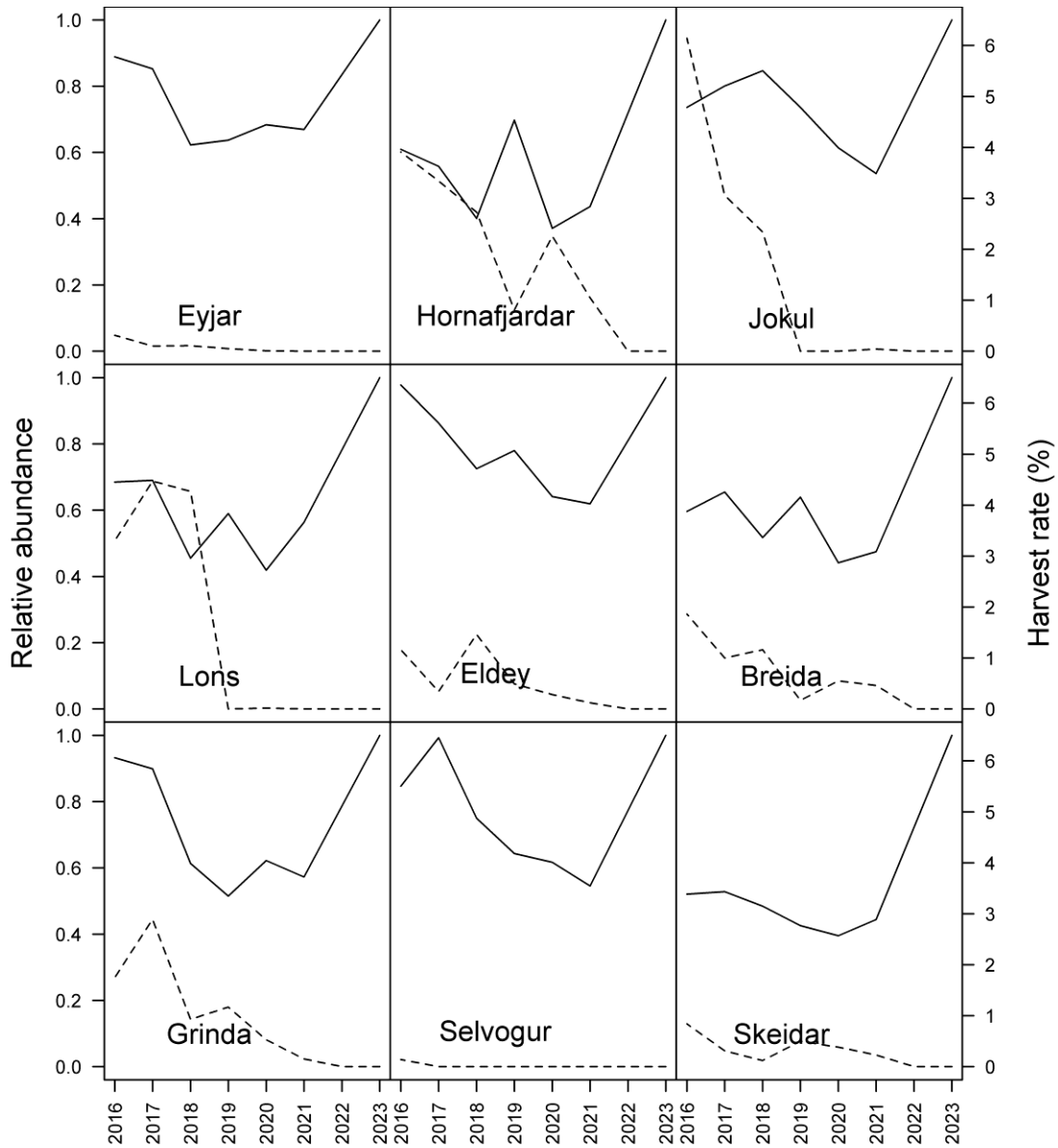


Figure 12. Norway lobster. Relative burrow abundance (solid line) and harvest rate (dotted line) in individual areas (Eyjar–area 1, Hornafjardar – area 2, Jokul – area 3, Lons – area 4, Eldey – area 5, Breida area 6, Grinda – area 7, Selvogur – area 8 and Skeidar – area 9) during 2016–2021 & 2023 (See Figure 6 for area id locations).

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Table 1. Norway lobster. Landings from Icelandic waters.

Year	Iceland	Other nations	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

Year	Iceland	Other nations	Total
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
2019	259	0	259
2020	194	0	194
2021	107	0	107
2022	0	0	0
2023	0	0	0

Table 2. Norway lobster. Landings (in tonnes) and CPUE (kg/hour trawled) by region (southwest, sw; south, s; and southeast, se) and for the entire fishery.

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	38.2
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
2019	160	23.0	6	20.9	93	25.5	259	23.4
2020	84	13.9	1	17.5	109	16.3	194	14.8
2021	25	9.8	2	8.0	81	9.8	107	9.8
2022	0	-	0	-	0	-	0	-
2023	0	-	0	-	0	-	0	-

Table 3. Norway lobster. Recommended TAC, National TAC set by the Ministry and landings all reported in tonnes.
 *Includes autumn catches in 2018. #No TAC was issued in 2019 but harvesters were allowed to fish quota transfers from previous years.

Year	Recommended TAC	National 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	2401
1993/94	2200	2400	2261
1994/95	2200	2200	1043
1995/96	1500	1500	1632
1996/97	1500	1500	1226
1997/98	1500	1200	1400
1998/99	1200	1200	1312
1999/00	1200	1200	1256
2000/01	1400	1400	1403
2001/02	1500	1500	1577
2002/03	1600	1600	1688
2003/04	1600	1600	1466
2004/05	1500	1500	1908
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	820
2019	235	#	259
2020	214	214	194
2021	143	143	107
2022	0	0	0
2023	0	0	0

Table 4. Norway lobster. Summary of 2023 UWTV survey. Name of an area, area ID (see Figure 6), size of the area (km²), number of burrows (million), mean (M.) burrow density (N/m²), catch (tonnes, t), mean (M.) weight, males in catch (%), and harvest rate. Due to the moratorium starting in 2022, catch and harvest rate were both 0 and no individuals were sampled from the fishery for mean weight and sex ratio.

Area	ID	km ²	N burrows	M. burrow density (N/m ²)	Catch (t)	M. weight	M%	Harvest rate
Jökuldjúp	3	737	87	0.12	0	NA	NA	0
Eldey	5	845	86	0.10	0	NA	NA	0
Grindav.-/Skerjadjúp	7	1307	126	0.10	0	NA	NA	0
Selvogur	8, 11, 12	296	30	0.10	0	NA	NA	0
Vestmannaeyjar	1, 10	1400	122	0.09	0	NA	NA	0
Skeiðarárdjúp	9	859	136	0.16	0	NA	NA	0
Breiðamerkurdjúp	6	638	128	0.20	0	NA	NA	0
Hornafjarðardjúp	2	259	49	0.19	0	NA	NA	0
Lónsdjúp	4,13	247	40	0.16	0	NA	NA	0
Total		6588	804	0.12	0	NA	NA	0

Table 5. Summary of the average (2014-2018) annual conventional bottom trawl effort on *Nephrops* grounds and all areas south of 65°N (inclusive of the *Nephrops* grounds). Effort is in hours, effort density is hours/km² (h/km²), catch for fod, haddock and ling is the average catch in tonnes/year (t/yr), and CPUE is the tonnes per hour for each species (cod, C; haddock, H; ling, L). Areas 10, 11, 12, and 13 are not included as they are small (Figure 6).

Area	ID	Effort	h/km ²	Cod (t/yr)	C CPUE	Haddock (t/yr)	H CPUE	Ling (t/yr)	L CPUE
South of 65°N	NA	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