GREEN SEA URCHIN – SKOLLAKOPPUR
Strongylocentrotus droebachiensis

COMMERCIAL FISHING

Dredge fishing for the green sea urchin started in 1993. Landings peaked in 1994, when they reached 1500 tonnes but decreased drastically thereafter until 1997 when the fishery stopped. Decreased catches can be attributed to market factors, but the main fishing areas were severely affected by the effort in those years. The fishery was widely distributed around Iceland, but Breiðafjörður was always the main fishing area. In 2004, fishing started again in Breiðafjörður with minor landings (30–40 tonnes) until 2007 when it reached 134 tonnes. In 2007–2014, landings were 126–146 tonnes but have increased since then. In 2022, 200 tonnes were landed from Breiðafjörður, 23 t from Húnaflói, 91 tonnes from Ísafjörður and 36 t from several fjords in Austfirðir (Fig. 1 and 2).

Standardized CPUE index in Breiðafjörður was 1.81 in 2022 and fluctuated between 1.08 and 1.89 in the years from 2006-2022 (Fig. 1). Fishing has always mainly been conducted in Breiðafjörður and one boat has been active since 2004, although in recent years several boats have participated in the fishery. Fishing is conducted from August/September to March/April, partly depending on the quality of the roes.

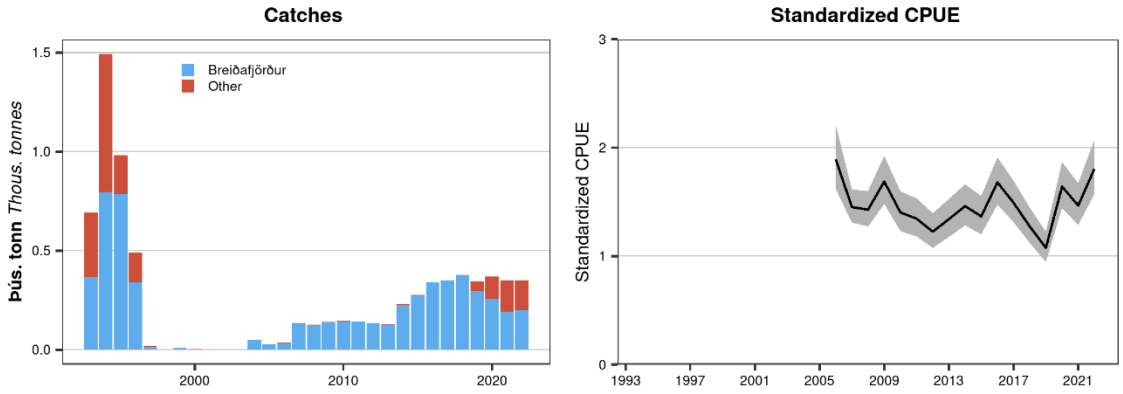

Figure 1. Green sea urchin. Catches from Breiðafjörður and other areas 1993-2022 and a standardized CPUE from Breiðafjörður 2006-2022.

Southern Breiðafjörður has always been the main fishing area for the green sea urchin. In 2016, an advice for total allowable catch (TAC) was given for the first time for a market area in the southeast but fishing outside the area was unlimited and the fishery expanded west and north (Hafrannsóknastofnun 2016). The following two years the same advice was given but now the fishing area in the southeast was divided and TAC given for each area to spread the fishing pressure inside the area (Hafrannsóknastofnun 2017 and 2018). In 2019 and 2020, advice for the fishery in the whole fjord was given and the TAC was divided between two different fishing areas, north-west and south-east. Landings in each area are given in table

3. From 2019-2022 experimental fishing was conducted in Húnaflói. Experimental fishing license is needed to fish outside Breiðafjörður.

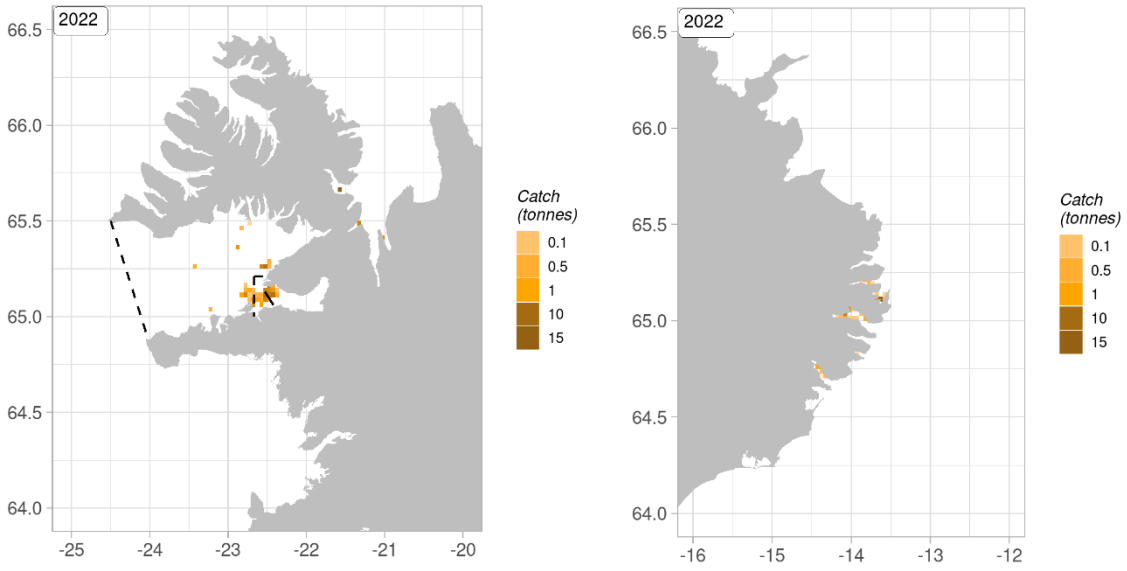

Figure 2. Green sea urchin. Distribution of catches and division of fishing grounds in 2022.

SEA URCHIN SURVEY

Surveys were conducted in September 2015, April 2016 and September 2018 to assess biomass of sea urchin in the main fishing area in southern Breiðafjörður south of 65°10'N and east of 22°40'W at depths of 8–60 m, by swept area method and underwater photography. Most of the tows (88%) were at depths of 8–35 m. The surveys were conducted by a commercial sea urchin fishing vessel (Fjóla SH-7). The dredge used is 250 cm in width and with a 150 cm long catch–bag. The mesh size of the catch–bag is 100 mm.

To determine the density/abundance of urchins, each catch was weighed, and the distance covered by the dredge was calculated. The total catch weight was divided by the size of the area covered in each tow to give biomass in kg/m^2. Biomass estimates for any given area were calculated from the mean biomass in that area multiplied by the total size of the area. The density (ind./m^2) was calculated by dividing the mean wet weight of the individuals in an area into the abundance (kg/m^2) of the area (swept area method).

An underwater camera was used to estimate the density of urchins in April 2016. Photographs were taken at 19 sites within four of the seven investigated subareas. At each site photographs were taken at several locations, with a total of 160 photos taken. Later, sea urchins from the photos were counted and the density observed (no/m^2). The results from the dredge survey from the same area at the same time were compared to the density observed from the photos before dredging to assess the efficiency of the dredge. The results showed that the distribution of the green sea urchin in Breiðafjörður is very patchy, showing smaller fishing areas, ranging in size from 0.3–3.4 km^2. The mean combined abundance in all areas investigated in September 2015 and April 2016 (91 stations) was 0,28 kg/ m^2. The stock size was assessed to be about 2700 tonnes in the area investigated. The average efficiency of the dredge was estimated at 29% (Thorarinsdóttir and Guðlaugsdóttir 2018).

A survey was conducted on 3-4. September 2018 to estimate the biomass of sea urchin in the main fishing area in Breiðafjörður. Data was collected and handled in the same way as in the years before. In this survey, 40 stations were investigated, and 15 samples were taken from the catch to estimate the size and weight of sea urchins as well as the number and weight of species in bycatch. The results indicated abundance of 0,24kg/ m^2 when corrected for the average efficiency of the dredge, 29%. The stock size was assessed to be about 2300 tonnes in the area investigated.

An underwater camera survey was conducted on 24 August 2018. Photographs were taken in 30 different sites at 10 stations within each site with approximately 8 repetitions in each station. Processing of this data is still underway.

To investigate the reproductive cycle (gametogenesis and spawning), 30 samples were collected monthly from September 2016-August 2017 (except June and July), from two different fishing areas at 60 and 32 m depth, respectively. A total of 300 urchins were collected at each site. For each sample, test diameter for each urchin was measured to the nearest 0.1 mm with Vernier calipers and the total weight to the nearest 0.1 mg. The urchins were opened and drained and weighted again and the water content in each individual estimated. The gonads were removed, blotted dry, their wet weights determined, and GI was calculated as percentage of the total wet weight of the total body mass.

EXPERIMENTAL FISHING

Experimental fishing licenses have been granted since 2019. In 2019, Þórishólmi ehf. looked for fishable green sea urchin stock in Ísafjarðardjúp (Guðrún G. Þórarinsdóttir and Steinunn H. Ólafsdóttir 2019), and Húnaflói (Guðrún G. Þórarinsdóttir and Steinunn H. Ólafsdóttir 2020). In 2020, they investigated Eyjafjörður/Skagafjörður (Guðrún G. Þórarinsdóttir et al. 2020a) and Húnaflói again (Hrútafjörður, Bitrufjörður, Steingrímsfjörður) (Steinunn H. Ólafsdóttir et al. 2021). In 2021, Jökulfirðir (Guðrún G. Þórarinsdóttir et al. 2021b) were investigated, Seyðisfjörður/Hestfjörður (Guðrún G. Þórarinsdóttir, et al. 2022a) and Álftafjörður (Guðrún G. Þórarinsdóttir et al. 2022b).

Experimental licenses were also granted in the east-fjords. In 2020 Emel ehf. looked for fishable green sea urchin in Reyðarfjörður (Guðrún G. Þórarinsdóttir et al. 2020b) and Fáskrúðsfjörður (Guðrún G. Þórarinsdóttir et al. 2021b). In 2021 they investigated Reyðarfjörður (Guðrún G. Þórarinsdóttir et al. 2021) and Fáskrúðsfjörður (Guðrún G. Þórarinsdóttir et al. 2021b) again as well as Norðfjarðarflói/Mjóifjörður (Guðrún G. Þórarinsdóttir et al. 2021c). Fishable stock was observed in Húnaflói and Ísafjarðardjúp. From Húnaflói 50 tonnes were landed in 2019, 85 tonnes in 2020, 27 tonnes in 2021 and 23 tonnes in 2022. From Ísafjarðardjúp 85 tonnes were landed in 2021 and 91 tonnes in 2022. From the Eastfjords, 26 tonnes were landed in 2020, 46 tonnes in 2021, and 36 tonnes in 2022.

LENGTH DISTRIBUTION OF THE GREEN SEA URCHIN

A survey was conducted in September 2018 and the mean size was 50.0 ± 13 mm (Fig. 4). The minimal landings size of sea urchin shall not be less than 45 mm in test diameter.

The mean size (diameter) distribution for the area investigated in 2015 and 2016 combined showed that the highest proportion of the stock is 56-60 mm in diameter, ranging from 17 to 85 mm. The mean size in

the catch from all fishing areas investigated in 2015 and 2016 combined was 59.3 ± 10.5 mm (Fig. 3). In the survey carried out in 2018 the highest proportion of the stock is 55-64 mm in diameter but ranged in size from 5 to 79 mm (Fig. 4).

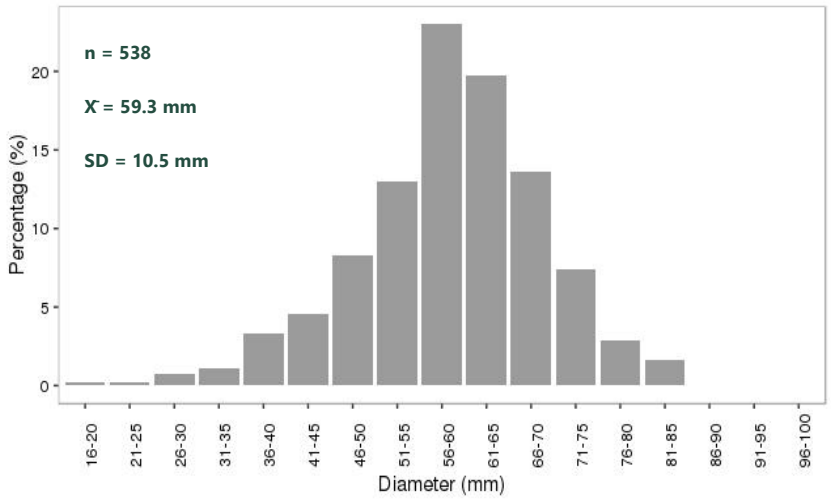

Figure 3. Green sea urchin. Size (diameter in mm) frequency distribution for all areas combined in the study areas in Breiðafjörður in September 2015 and April 2016.

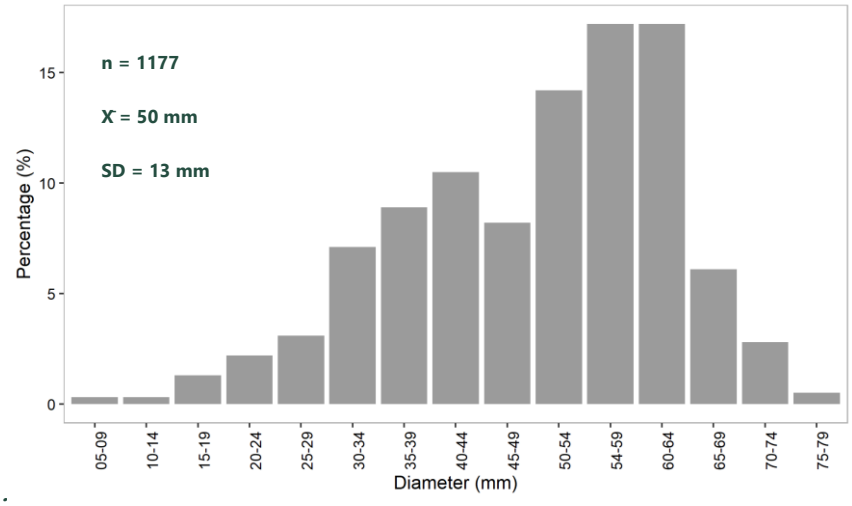

Figure 4. Green sea urchin. Size (diameter in mm) distribution in study areas in Breiðafjörður in September 2018.

REPRODUCTIVE CYCLE OF SEA URCHIN

The green sea urchin displays a distinct annual cycle of reproduction as indicated by temporal changes in gonad index through the year.

An investigation was carried out from September 2016-August 2017 at 32 m (65°06N73-22°32W0) and 60 m depths (65°05N46-22°33W75) in Breiðafjörður. The results indicate a relatively high gonad index (GI) at both depths throughout the whole investigation period, however the gonad index was always lower at greater depth. One spawning season in April was observed at both sites, but minor spawning continued into May at 32 m depth (Fig. 5).

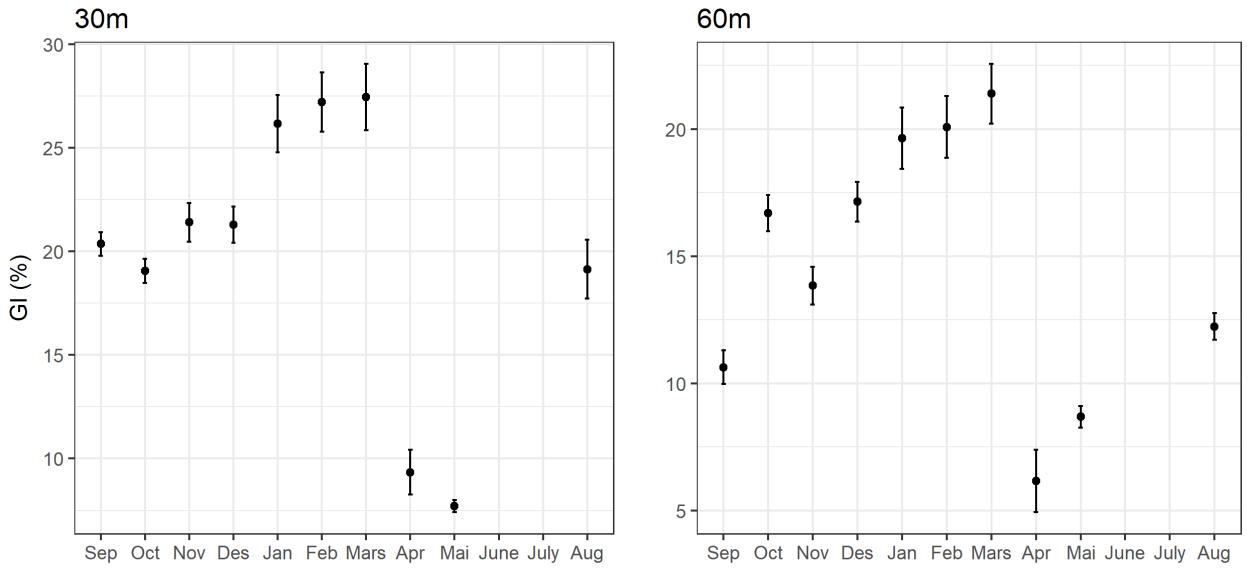

Figure 5. Green sea urchin. Gonad index ± SE from September 2016 to August 2017 at two fishing sites in Breiðafjörður (32 and 60 m depth) in September 2016-August 2017.

Gonad quality was visually ranked by comparing color of roes from photos taken in the laboratory to a Pantone color chart developed for previous urchin research (Ásbjörnsson, 2011). Images were taken of each gonad sample and matched to colors on the chart. The percentages of each rank each month at each depth were then plotted in a stacked bar chart using Excel. Ranks were classified accordingly by market value into 4 ranks:

1st class- Yellow, Light Yellow, Orange, Light Orange

2nd class- Dark Yellow, Dark Orange

2nd-3rd class- Light Red, Red, Curry Yellow, Curry, Curry Brown

Unacceptable - Dark Red, Light Brown, Brown, Dark Brown, Curry Grey

At both sites, gonads were found to have a high proportion of acceptable (1st, 2nd, and 2nd-3rd rank) and a very low proportion of unacceptable colors. Roes from 60 and 32 m depth exhibited acceptable colors in 91.5 and 94.5% of all specimens respectively throughout the year. The highest proportion of unacceptable gonad colors were observed post-spawning in May at both sites, and additionally in April at 60 m. Overall,

the lower depth consistently exhibited a higher percentage of 1st class roe, and a smaller percentage of unacceptable quality roe than the higher depth, with few exceptions (O´Hara, 2019) (Fig. 6).

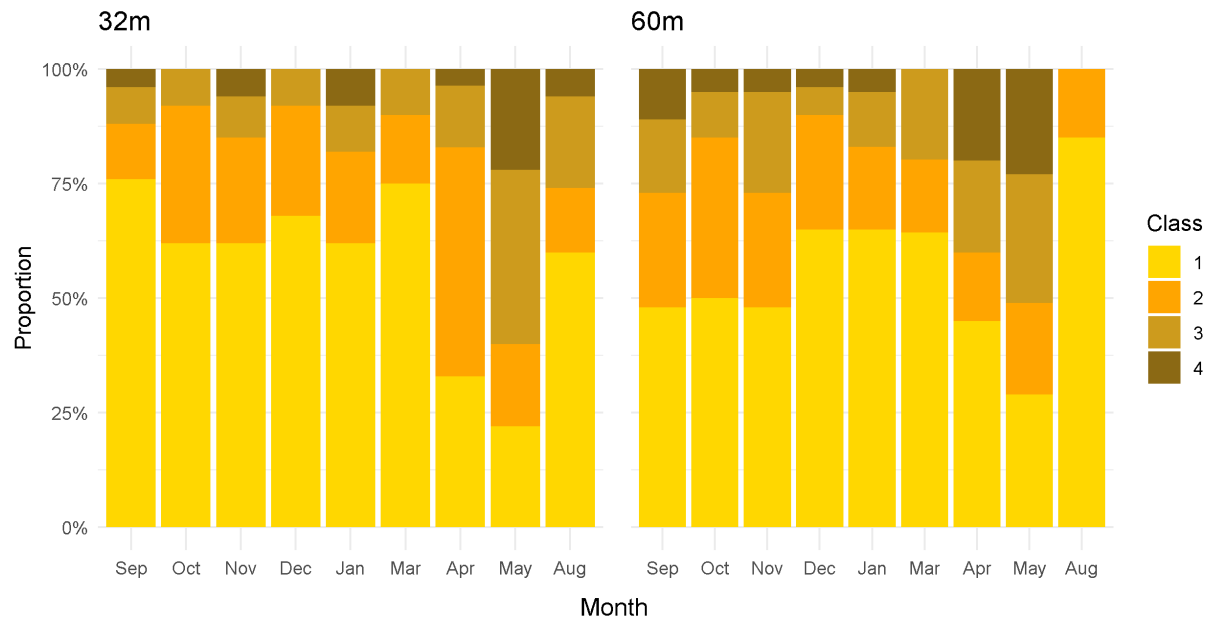

Figure 6. Green sea urchin. Stacked plot of green sea urchin roe coloration ranked visually at 32 and 60m depth. Class one is the highest quality, class 2 and 3 are acceptable and class 4 is unacceptable.

DIAGNOSTIC ON GENERALIZED LINEAR MODEL

The stock assessment is based on trends in biomass indicators and catches and the input data are catches and catch per unit effort. As the CPUE does not reflect the abundance or changes in stock size (the CPUE does not account for differences in fishing effort between amount of fishing vessels nor spatial and temporal fishing patters), the CPUE was standardized by applying month and ship factors with Generalized Linear Model (GLM).

Table 1. Green sea urchin. Analysis of deviance table. Response variable is log of catch per unit effort (CPUE).

	DF	DEVIANCE	RESID. DF	RESID. DEV	F	Pr(>F)
NULL			3067	54.69		
factor(Year)	17	178.49	3050	676.21	89.521	< 2.2e-16 ***
factor(Month)	10	119.97	3040	556.24	102.294	< 2.2e-16 ***
factor(Ship)	4	200.17	3036	354.06	426.696	< 2.2e-16 ***

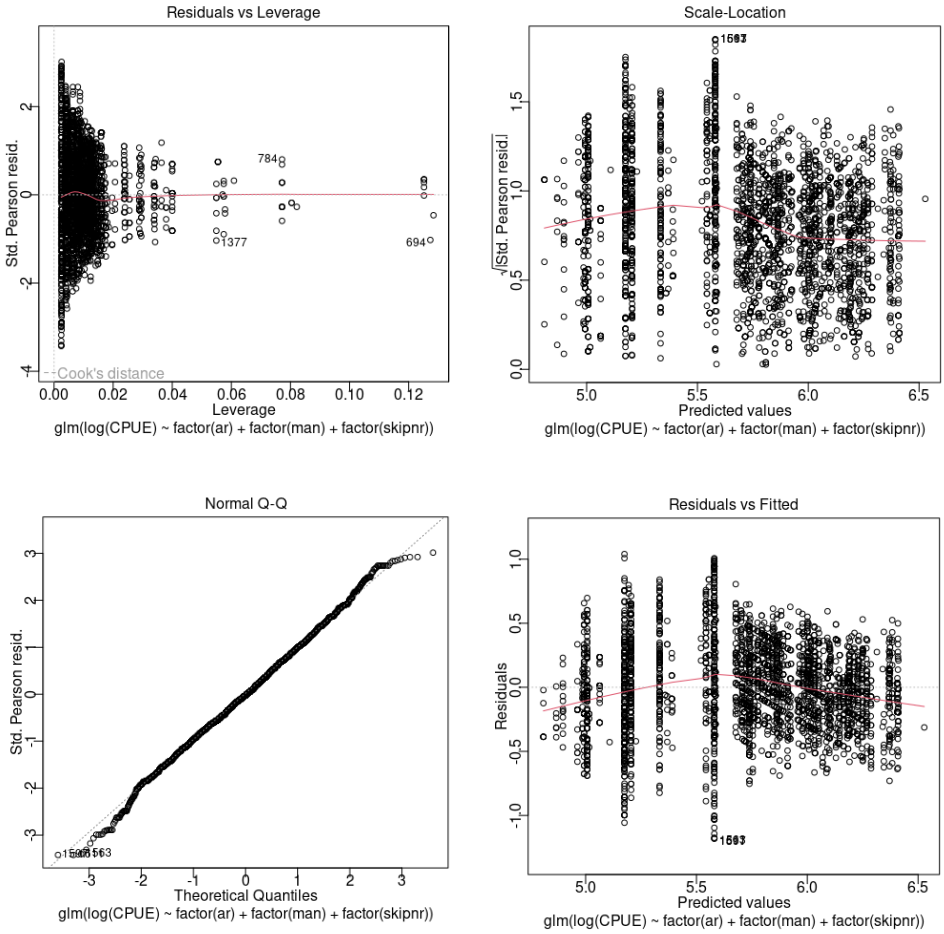

Figure 7. Green sea urchin. Diagnostics plots from the Generalized linear model (glm).

OTHER SPECIES

Two species of bigger sized sea urchins are found around Iceland, i.e the green sea urchin (*Strongylocentrotus droebachiensis*) and the European edible sea urchin (*Echinus esculentus),* both utilized for human consumption. The market prefers the green sea urchin, and no fishery or landings are documented for the common sea urchin in Iceland. However, caution should be taken regarding landings from Breiðafjörður as some European edible sea urchin might have been landed as the green sea urchin. These species look similar as the European edible sea urchin has a violet colour (Fig. 8, left) that is sometimes observed in the green sea urchin stock. The colour of the green sea urchin may vary between green, brownish and violet (Fig. 8, right). The maximum size of these species is however not the same, 8-10 cm for the green sea urchin but 16 cm for the European edible sea urchin.

Figure 8. Left: European edible sea urchin (*Echinus esculentus*). Right: Green sea urchin (*Strongylocentrotus droebachiensis*) showing colour variations. Photos: Karl Gunnarsson.

COMMENTS ON THE ASSESSMENT AND ADVICE

The assessment is based on ICES rfb-rule for data limited stocks for the first time in 2022, where life history traits, exploitation characteristics and other relevant parameters for data-limited stocks are considered (ICES 2021). The rfb-rule has the following form:

$$A_{y+1} = A_{y-1}\, r\, f\, b\, m$$

where $Ay{+}1$ is the advised catch, $Ay{-}1$ is last year´s advice, r corresponds to the trend in biomass index (as in the current ICES "2 over 3" rule), f is a proxy for the exploitation (mean catch length divided by an MSY reference length) and b a biomass safeguard (reducing the catch when biomass index drops below a trigger value). The advice is biennial and thus applies to the next two fishing years (ICES 2023).

Last year's advice was 188 t.

r is the ratio of the mean of the last two survey indices and the mean of the three preceding values or:

$$r = \frac{\sum_{i=y-2}^{y-1} I_1\,/2}{\sum_{i=y-3}^{y-5} I_1\,/3}$$

f is the length-ratio component where:

$$f = \frac{\overline{L}_{y-1}}{L_{F=M}}$$

where $\overline{L}$ is is the mean catch length above L_c. $L_{F=M}$ is calculated as:

$$L_{F=M} = 0.75L_c + 0.25L_{\infty}$$

where L_c is the length where frequency is half that of the modal value, and $L\infty$ is von Bertalanffy $L\infty$.

b is the biomass safeguard and is used to reduce catch advice when index falls below trigger,

$$b = min\left(1, I_y - 1/I_{trigger}\right)$$

where $I_{trigger} = i_{loss\omega}$

m is a multiplier based on stock growth. For slow growing species, m = 0.95 but for fast growing species, m = 0.9.

ANALYSIS ON THE ASSESSMENT AND ADVICE

Standardized CPUE index of green sea urchin is considered to reflect trends in stock size. The advice is in accordance to $A_{y+1} = A_{y-1}\ r\ f\ b\ m$ or 188 t * 1.2 * 0.885 * 1 * 0.95 which result is advice for 2023/2024 and for 2024/2025 set at 194 t (3 % increase from last year's advice). From 2019-2021, the advice was based on the ICES framework for data limited stocks (Category 3.2) where the ratio of the mean of the last two survey indices (Index A) to the mean of the three preceding values (Index B) is multiplied by the last years advice. In 2019, the precautionary buffer was applied and thus, it would have been applied this year, resulting in advice for 180 tonnes (4% reduction) (Table 3).

Table 3. Green sea urchin. Comparison between the *rfb*-rule and the "2 over 3" rule.

	RFB-RULE	OLD 2 OVER 3 RULE
PREVIOUS ADVICE	188	188
INDEX A	1.64	1.64
INDEX B	1.33	1.33
RATIO (A/B)	1.23	1.23
LENGTH RATIO	0.885	-
BIOMASS SAFEGUARD	1	-
MULTIPLIER	0.95	-
INITIAL ADVICE	194	-
STABILITY CLAUSE APPLIED	-	1.2
PRECAUTIONARY BUFFER*	-	0.8
FINAL ADVICE	194	180
ADVICE CHANGE	+3	-4

***Last applied in 2019.**

APPLICATION OF RFB-RULE

- r is calculated as the average of last two years values, divided by average of three preceding years values which results in r=1.21 (Figure 12, Table 4)

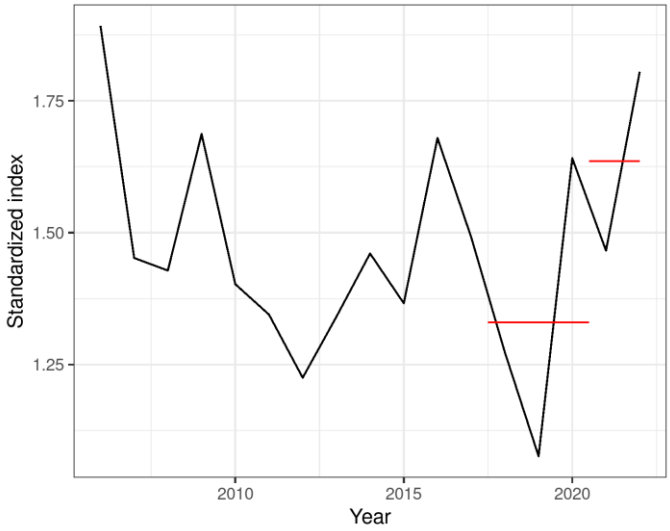

Figure 12. Green sea urchin. Standardized CPUE index from 2006. The red lines show the average of last two years values and the three preceding years.

- f is the length-ratio component. The mean length of last years´ catch was 6.32 cm and the target reference length (Lc, the length where frequency is half that of the modal value * 0.75 + $L\infty$ * 0.25) is **7.15** (Figure 13).

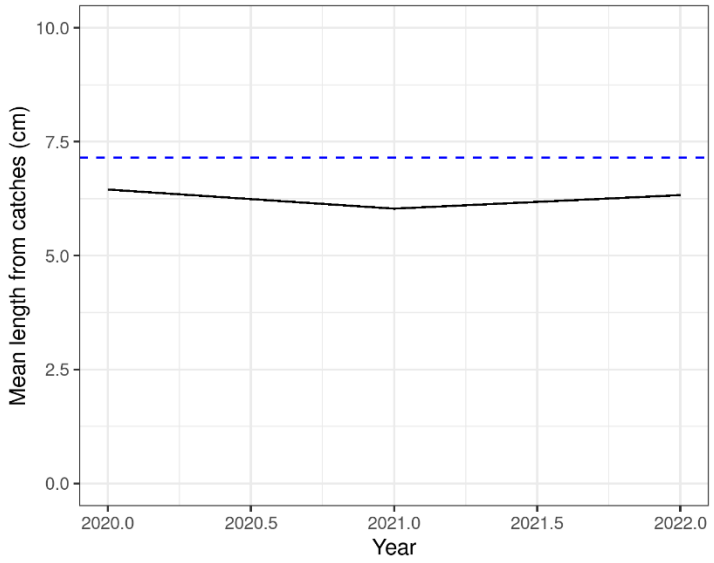

Figure 13. Green sea urchin. Mean length from catches from 2020. The blue dashed line shows the target reference length.

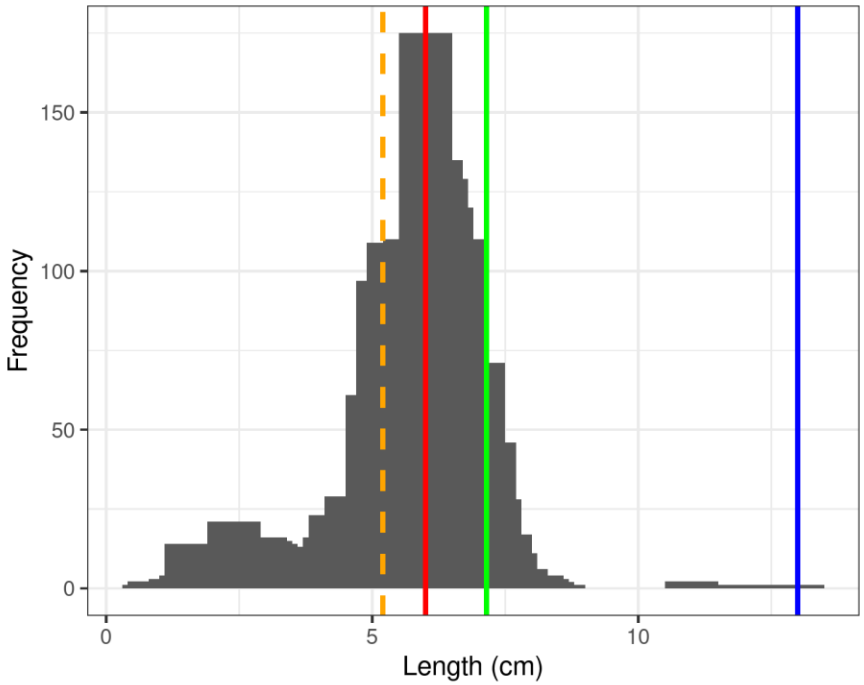

Figure 14. Green sea urchin. Length frequency distribution from catches. Red line is the length of modal abundance, orange is the length where frequency is half that of the modal value, orange line is the length at first capture, green line is the target reference length, and the blue line is the L∞ or the max length.

- *b* is the biomass safeguard and is used to reduce catch advice when index falls below trigger. The lowest index or the I_{loss} for green sea urchin is 1.07 and was recorded in the year 2019. $I_{trigger}$ is I_{loss} *1.4 or 1.50 (Figure 14). Biomass index this year is 1.81 and above $I_{trigger}$ and *b* is therefore 1.

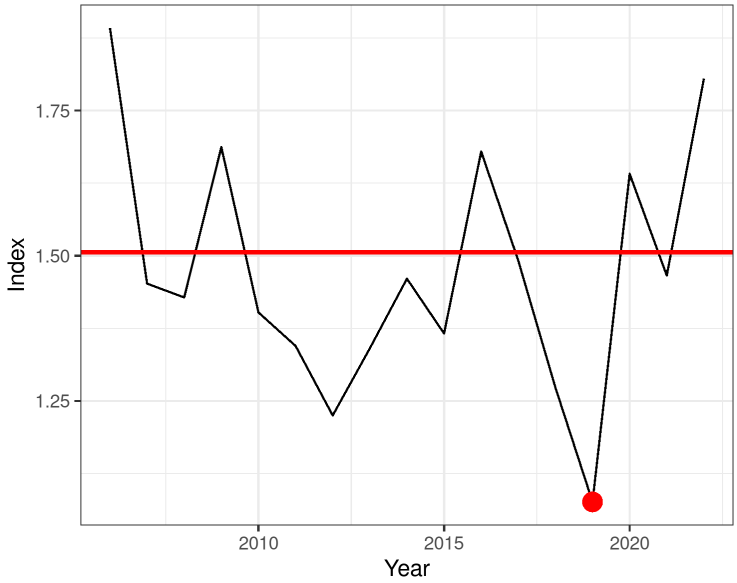

Figure 15. Green sea urchin. Biomass index values since 2000. The red line is the $I_{trigger}$ and the red dot is the lowest observed value (I_{loss}).

Green sea urchin is a slow growing species (Blicher et al. 2007) and thus, m=0.95.

MANAGEMENT

Table 3. Green sea urchin. Recommended TAC in Breiðafjörður, total landings, the standardized CPUE index and CPUE (kg/ hour).

YEAR / FISHING YEAR	ADVICE	LANDINGS	CPUE INDEX[1)]	CPUE[2)*]
2006/07	-	109	1.89	461.3
2007/08	-	112	1.45	381.4
2008/09	-	119	1.43	372.3
2009/10	-	150	1.69	482.7
2010/11	-	141	1.40	400.6
2011/12	-	152	1.34	381.9
2012/13	-	129	1.22	364.6
2013/14	-	149	1.34	402.2
2014/15	-	264	1.46	438.7
2015/16	-	295	1.37	339.9
2016/17	250	315	1.68	359.1
2017/18	250	376	1.49	349.5
2018/19	250	411	1.27	339.4
2019/20	275	357	1.08	349.2
2020/21	220	341	1.64	350.0
2021/22	196	368	1.47	384.2
2022/23	188		1.81	452.2

[1)] CPUE from glm
[2)] Raw CPUE
[*)] Calendar year

Table 3. Green sea urchin. Landings divided by areas.

Year	Landings in A	Landings in B	Landings in C	Landings south	Landings north	Húnaflói	Ísafjörður	Austfirðir	Landings other	Total
2019	-	-	-	120	27	-	-	-	198	345
2020	36	55	30	94	43	85	-	26	-	369
2021	34	90	69	-	-	27	85	46	-	351
2022	55	82	63	-	-	23	91	36		351

REFERENCES

Ásbjörnsson, H.P. (2011). Management and Utilization of Green Sea Urchin (*Strongylocentrotus droebachiensis*) in Eyjafjörður, Northern Iceland. Unpublished master's thesis. University of Akureyri, School of Business and Science, Akureyri, Iceland.

Blicher, M. E., Rysgaard, S., & Sejr, M. K. (2007). Growth and production of sea urchin *Strongylocentrotus droebachiensis* in a high-Arctic fjord, and growth along a climatic gradient (64 to 77 N). Marine Ecology Progress Series, 341, 89-102.

Guðrún G. Þórarinsdóttir and Steinunn H. Ólafsdóttir. (2019). Könnun á útbreiðslu skollakopps (*Strongylocentrodus droebachiensis*) í Ísafjarðardjúpi. Haf- og vatnarannsóknir HV 2019-60.

Guðrún G. Þórarinsdóttir and Steinunn H. Ólafsdóttir. (2020). Könnun á útbreiðslu skollakopps (*Strongylocentrodus droebachiensis*) í Húnaflóa. Haf- og vatnarannsóknir HV 2020-04.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2020a). Könnun á útbreiðslu skollakopps (*Strongylocentrotus droebachiensis*) í Eyjafirði og Skagafirði. Haf- og vatnarannsóknir HV 2020-12.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2020b). Könnun á útbreiðslu skollakopps *Strongylocentrotus droebachiensis* í Reyðarfirði. Haf- og vatnarannsóknir HV 2020-15.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2021). Könnun á útbreiðslu skollakopps Strongylocentrotus droebachiensis í Reyðarfirði 2021. Haf- og vatnarannsóknir HV 2021-28.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir & Jónas P. Jónasson. (2021b). Könnun á útbreiðslu skollakopps Strongylocentrotus droebachiensis í Fáskrúðsfirði 2021. HV 2021-43.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2021b). Könnun á útbreiðslu skollakopps (Strongylocentrotus droebachiensis) í Jökulfjörðum. Haf- og vatnarannsóknir, HV 2021-61.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2021c). Könnun á útbreiðslu skollakopps (Strongylocentrotus droebachiensis) í Norðfjarðarflóa og Mjóafirði. Haf- og vatnarannsóknir, HV 2021-48.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2021d). Könnun á útbreiðslu skollakopps (Strongylocentrotus droebachiensis) í Jökulfjörðum. Haf- og vatnarannsóknir, HV 2021-61.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2022). Könnun á útbreiðslu skollakopps (Strongylocentrotus droebachiensis) í Seyðis- og Hestfirði. Haf- og vatnarannsóknir, HV 2022-01.

Guðrún G. Þórarinsdóttir, Steinunn H. Ólafsdóttir og Jónas P. Jónasson. (2022). Könnun á útbreiðslu skollakopps (Strongylocentrotus droebachiensis) í Álftafirði. Haf- og vatnarannsóknir, HV 2022-07.

Hafrannsóknastofnun 2016. ÍGULKER – SEA URCHIN Strongylocentrotus droebachiensis. Ástand nytjastofna sjávar og ráðgjöf 2016. Hafrannsóknastofnun júní 2016. 2 bls.

Hafrannsóknastofnun 2017. ÍGULKER – SEA URCHIN Strongylocentrotus droebachiensis. Ástand nytjastofna sjávar og ráðgjöf 2017. Hafrannsóknastofnun júní 2017. 2 bls.

Hafrannsóknastofnun 2018. ÍGULKER – SEA URCHIN Strongylocentrotus droebachiensis. Ástand nytjastofna sjávar og ráðgjöf 2018. Hafrannsóknastofnun júní 2018. 2 bls.

Hafrannsóknastofnun 2019. ÍGULKER – SEA URCHIN Strongylocentrotus droebachiensis. Ástand nytjastofna sjávar og ráðgjöf 2019. Hafrannsóknastofnun júní 2019. 2 bls.

ICES. 2021. Tenth Workshop on the Development of Quantitative Assessment Methodologies based on LIFE-history traits, exploitation characteristics, and other relevant parameters for data-limited stocks (WKLIFE X). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.5985

ICES (2023): Eleventh Workshop on the Development of Quantitative Assessment Methodologies based on LIFE-history traits, exploitation characteristics, and other relevant parameters for data-limited stocks (WKLIFE XI). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.22140260.v1

O´Hara, T. E. H.P. (2019). A depth dependent assessment of annual variability in gonad index, reproductive cycle (gametogenesis) and roe quality of the green sea urchin (Strongylocentrotus droebachiensis) in Breiðafjörður, Iceland. Unpublished master's thesis. University of Akureyri, School of Business and Science, University Centre of Westfjords.

Blicher, Martin & Rysgaard, Søren & Sejr, Mikael. (2007). Growth and production of sea urchin Strongylocentrotus droebachiensis in a high-Arctic fjord, and growth along a climatic gradient (64 to 77° N). Marine Ecology Progress Series. 341. 89-102. 10.3354/meps341089.

Steinunn H. Ólafsdóttir, Guðrún G. Þórarinsdóttir og Jónas P. Jónasson. (2021). *Könnun á útbreiðslu skollakopps (*Strongylocentrotus droebachiensis) í Húnaflóa 2020. Haf- og vatnarannsóknir, (HV-2021-03).

Thórarinsdóttir, G. G., and Guðlaugsdóttir, A. (2018). Distribution, abundance, dredge efficiency, population structure and utilizations coefficient in catches of green sea urchin (Strongylocentrotus droebachiensis) in the southern part of Breiðafjörður, West Iceland (Vol. 2018-42, Tech.). Reykjavik: Marine and Freshwater Research Institute.