SEA URCHIN – ÍGULKER
Strongylocentrotus droebachiensis

COMMERCIAL FISHING

Dredge fishing for sea urchin started in 1993. Landings peaked in 1994 at about 1500 tonnes, decreased drastically 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. In 2004, fishing started again 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, reaching 381 tonnes in 2018 (Fig. 1).

CPUE has fluctuated between 340–483 kg/hour in 2007-2018 (with a mean of 390 kg/hour) (Fig. 1). Fishing has mainly been conducted in Breiðafjörður and mainly one boat has been active in the fishery since 2004, although in recent years, several boats have participated in the fishery with small landings. The fishing is conducted from September to March/April, depending on the quality of the roes.

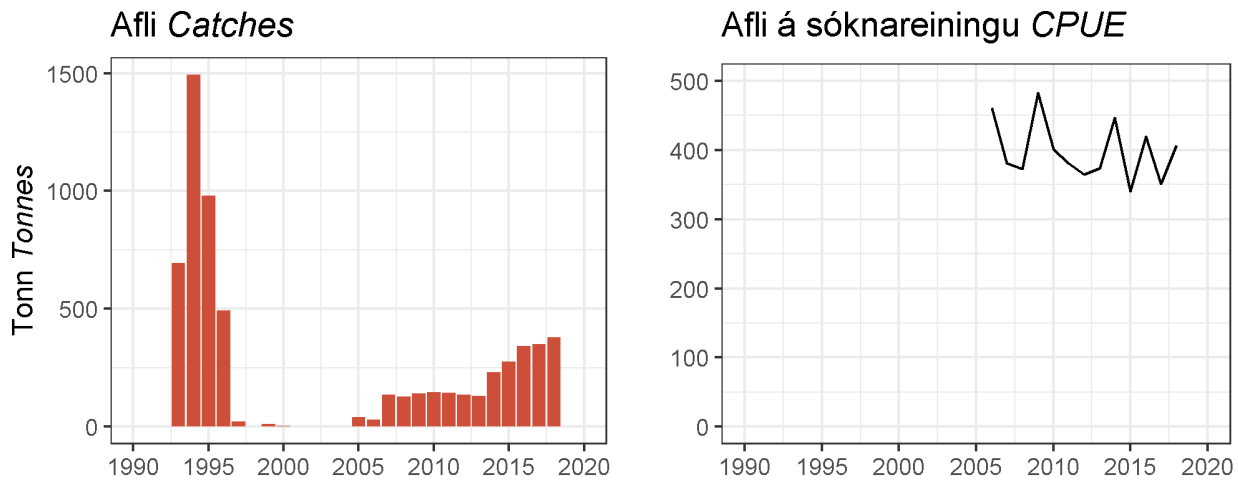

Figure 1. Sea urchin. Catches and CPUE 1993-2018.
Mynd 1. Ígulker. Afli og afli á sóknareiningu 1993-2018.

In recent years, the fishery in Breiðafjörður has expanded to north and west (Fig. 2 and 3), after the total allowable catch has been taken in the main fishing area in southern Breiðafjörður.

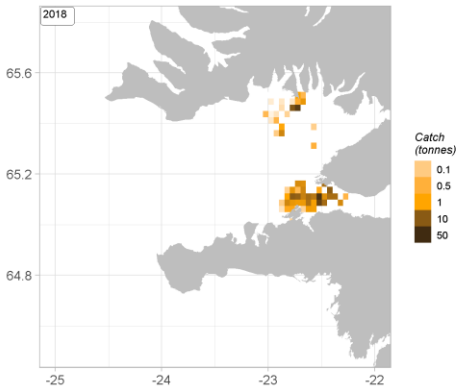

Figure 2. Sea urchin. Distribution of catches in 2018.

Mynd 2. Ígulker. Útbreiðsla veiða 2018.

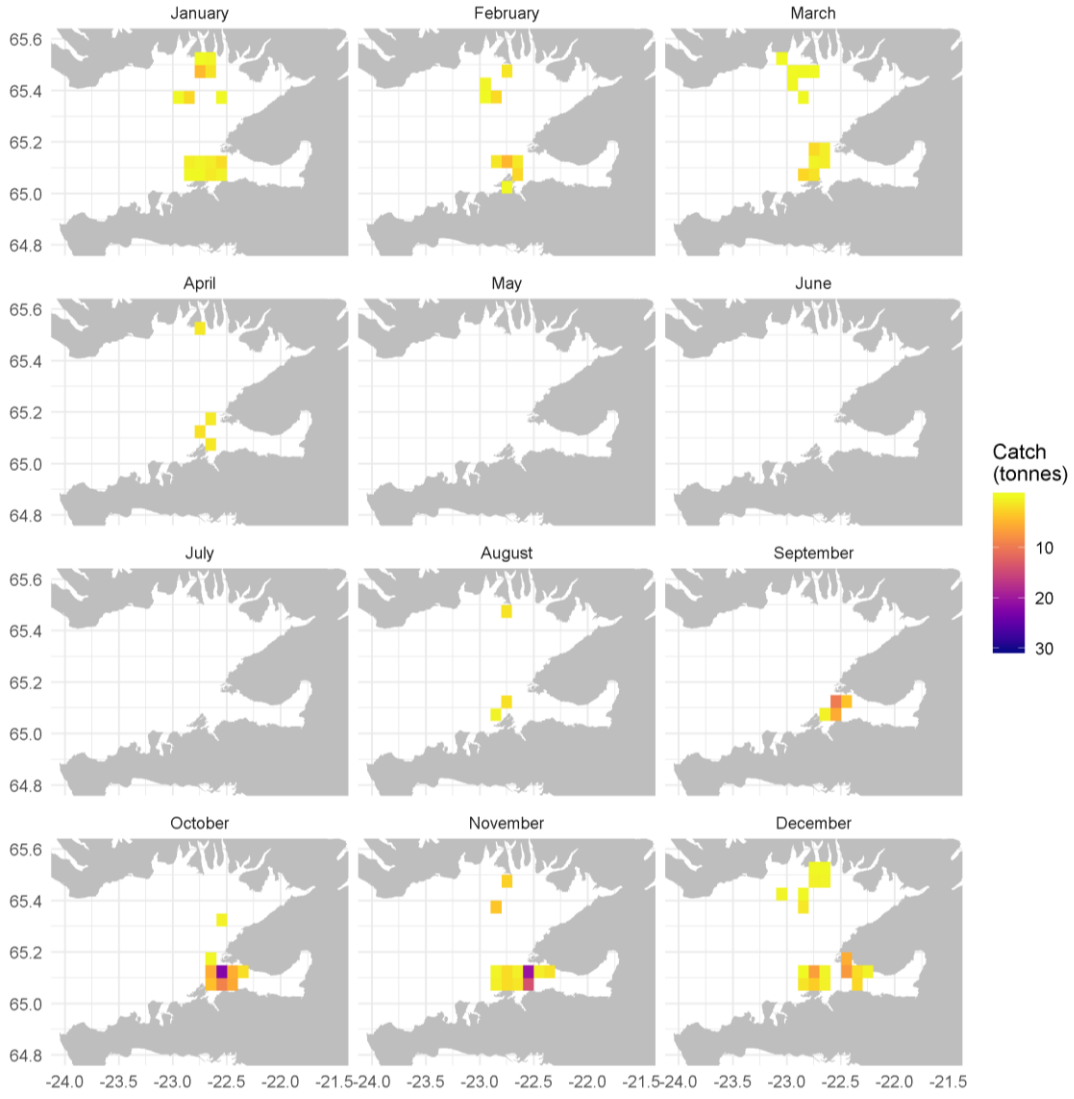

Figure 3. Sea urchin. Distribution of catches (tonnes) by months in 2018.

Mynd 3. Ígulker. Útbreiðsla veiða frá janúar til desember 2018.

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 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 29% (Guðrún Þórarinsdóttir, Anika 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 the years before. Now 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.

LENGTH DISTRIBUTION OF SEA URCHIN

A survey was conducted in September 2018 then the mean size was 50.0 ± 13 mm (Fig. 5). 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. 4). 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. 5).

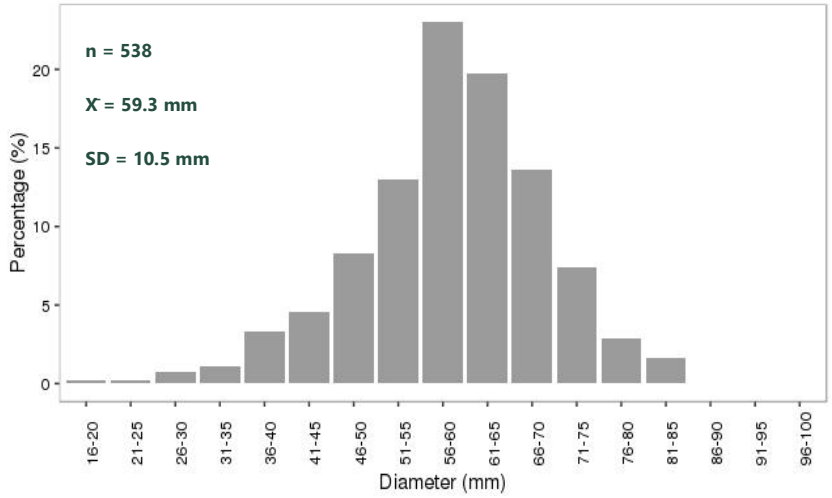

Figure 4. Sea urchin. Size (diameter in mm) frequency distribution for all areas combined in the study areas in Breiðafjörður in September 2015 and April 2016.

Mynd 4. Ígulker. Stærðardreifing (þvermál í mm) á rannsóknarsvæðum í Breiðafirði árin 2015 og 2016.

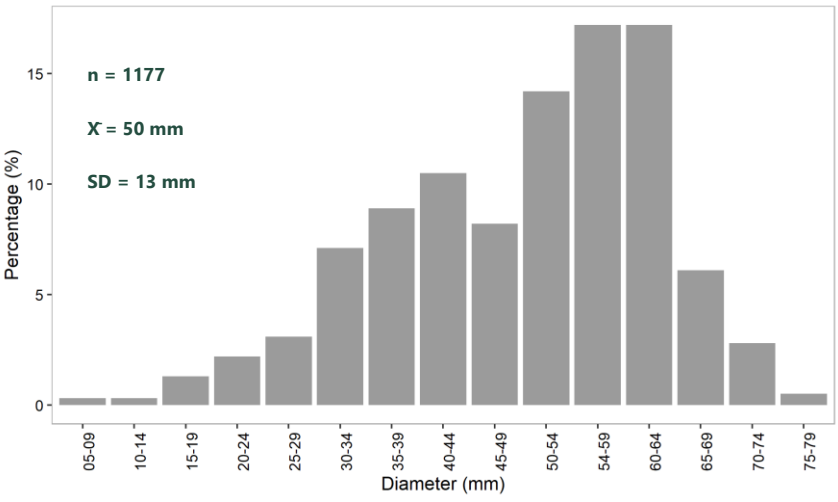

Figure 5. Sea urchin. Size (diameter in mm) distribution in study areas in Breiðafjörður in September 2018.

Mynd 5. Ígulker. Stærðardreifing (þvermál mm) á rannsóknarsvæðum í Breiðafirði í 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 32m (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.

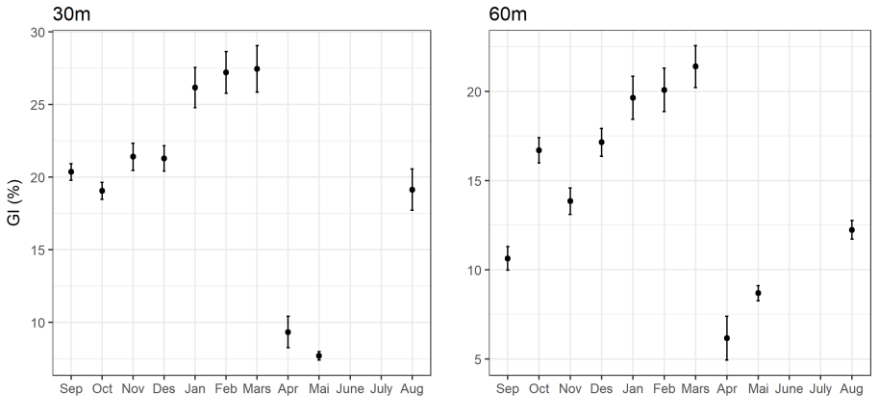

Figure 6. Sea urchin. Gonad index ± SE from September 2016 to August 2017 at two fishing sites in Breiðafjörður (32 and 60 m depth) in September 2016-August 2017.

Mynd 6. Ígulker. Kynþroskastuðull (GI) ± SE á tveimur veiðisvæðum í Breiðafirði (32 og 60 m dýpi) frá september 2016-ágúst 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 91.49 and 94.48% of all specimen 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. 7).

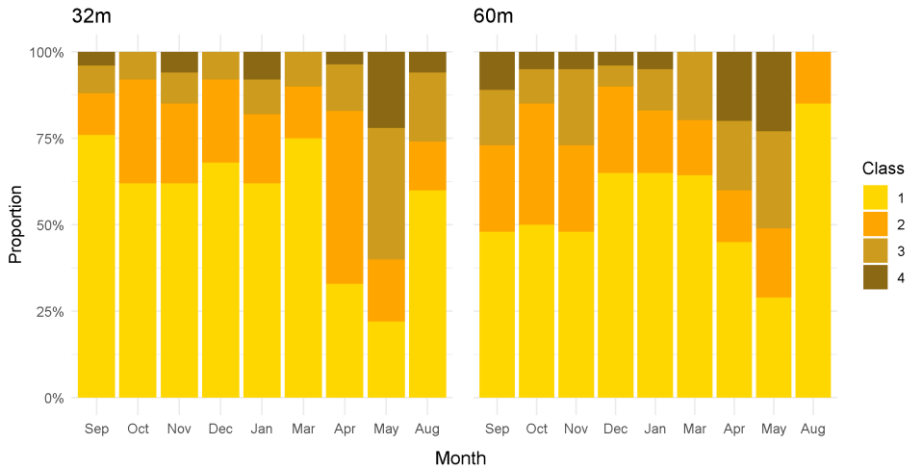

Figure 7. Sea urchin. Stacked plot of green sea urchin roe coloration ranked visually at 32 and 60m depth. Class one is the highest quality, class 2 and 3 are acceptable and class 4 is unacceptable.

Mynd 7. Ígulker. Gæði ígulkerahrogna flokkuð eftir lit á 32 og 60 m dýpi. Flokkur 1 er með hæstu gæði, flokkur 2 og 3 er með meðal gæði og flokkur 4 er óásættanleg gæði.

ADVICE

The sea urchin stock in Breiðafjörður should be considered a data limited stock and thus, follow the ICES framework for such (Category 3.2). The advice is based on the ratio of the mean of the last two CPUEs (Index A) and the mean of the three preceding values (Index B) multiplied by the mean catches in the last three fishing years. In addition, a precautionary margin of –20% (precautionary buffer) has been applied, as it is the first time this advice is used.

The MFRI advices that the total allowable catch for the fishing year 2019/20 is set at 275 t (364*0.943*0.8). The fishing area is within Breiðafjörður from Bjargtangar (65°30´00"N 24°30´00"W) to Öndverðarnes (64°53´12"N 24°02´45"W) and the area is divided into two subareas i.e. north and south of line 65°13´00"N. The TAC is divided between areas, i.e. 75% south of the line, or 206 tonnes, and 25% north, or 69 tonnes. The width of the dredge should not exceed 2.5 m and maximum weight should be 700 kg. Only one dredge is allowed fishing onboard the same boat. The mask size (inside measurement) in the dredge should not be less than 80 mm. The minimum landing size of the sea urchins should be 45 mm in test diameter.

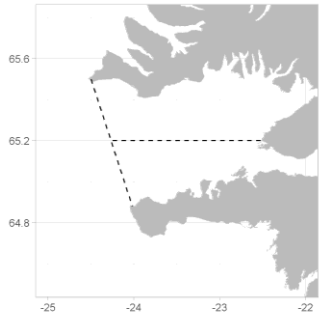

Figure 8. Sea urchin. Map of sea urchin fishing area in Breiðafjörður. The line divides the area into north and south

Mynd 7. Ígulker. Kort af veiðisvæði ígulkera. Línan skiptir svæðinu í norður og suðursvæði.

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.

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.

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.