

LUMPFISH – HROGNKELSI

Cyclopterus lumpus

GENERAL INFORMATION

Juvenile lumpfish are non-shoaling, mainly pelagic and are distributed in open water throughout the Norwegian Sea, Denmark Strait and Irminger Sea. When they mature, lumpfish migrate to coastal areas around Iceland to spawn with males arriving January-February and females arriving February-March. During the migration, females exhibit a mix of pelagic and demersal behaviour. The weight of the roe close to spawning can account for 25-35% of female body weight. Lumpfish show pronounced sexual dimorphism, with the males maturing at a smaller size and have an intense red colouration during the spawning season (Fig. 1). The females lay the eggs in nests in shallow water and the male will then guard the eggs until they hatch.



Fig. 1. Lumpfish Female (back) and male (front) lumpfish.

Mynd. 1. Hrognkelsi Grásleppa (aftan) og rauðmagi (framan).

COMMERCIAL FISHERY

There are two separate fisheries for lumpfish, a small scale male fishery for the flesh and a much larger female fishery where the primary target is the roe. The male fishery mainly takes place in a few locations on the north coast (Fig. 2) from January to March and uses gillnets with a mesh of between 178 and 203 mm. Approximately 20-60 tonnes of male lumpfish are landed each year with the directed fishery making up between 2 and 56%* of the total landings per year between 2003 and 2019 (Fig. 3). Other landings of males coming from the female fishery and from other gears (cod gillnets, demersal seine and bottom trawls).

*note: values differ slightly from previous report as calendar year is now used rather than fishing year (1st September to 31st August).

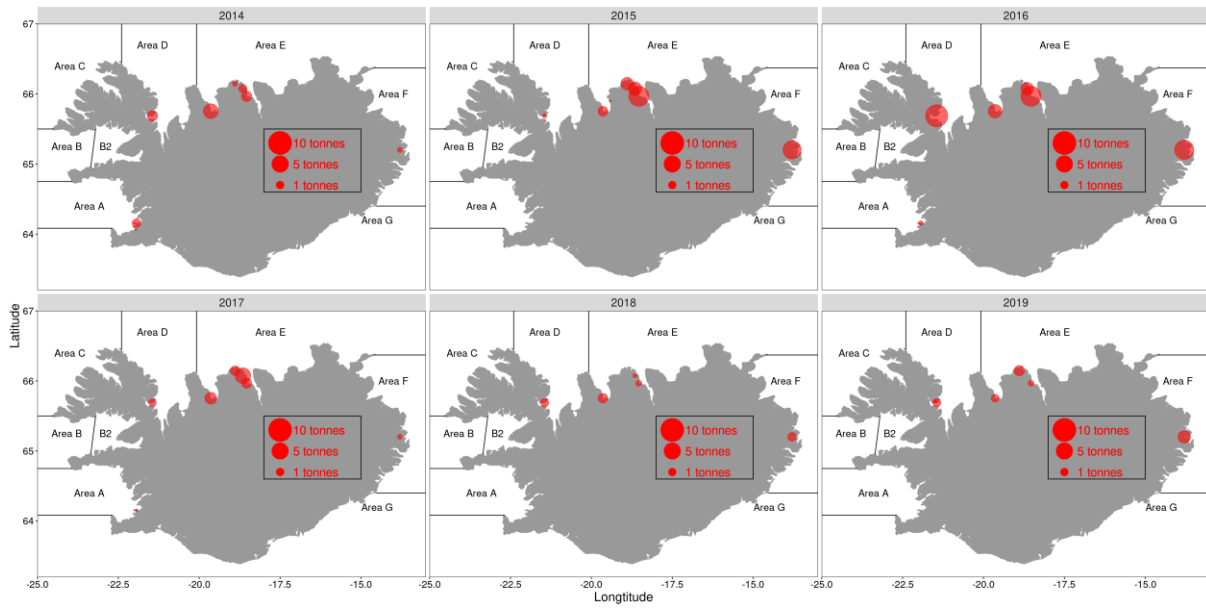


Fig. 2. Lumpfish. Landings of male lumpfish from the directed male fishery by harbour 2014-2019.

Mynd 2. Hrognkelsi. Landanir á rauðmaga úr rauðmaganetum árið 2014-2019.

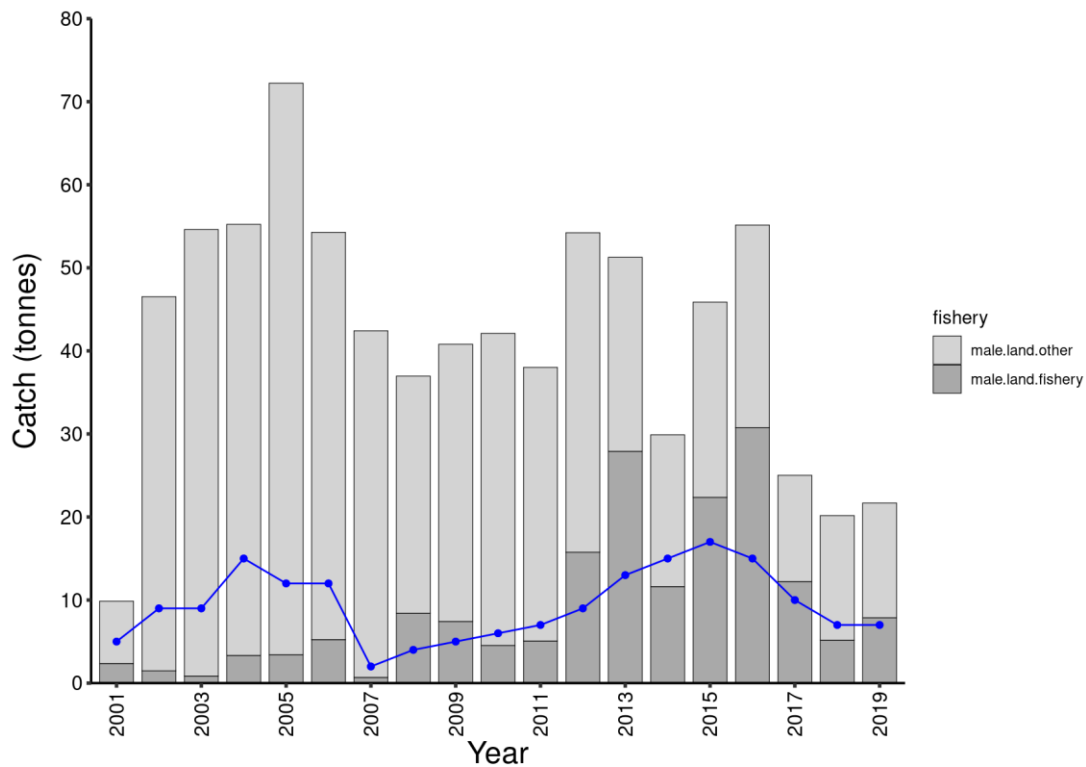


Fig. 3. Lumpfish. Landings of males between 2002 and 2019 from the directed male fishery (dark grey bars) and other fisheries (light grey bars). Blue line shows the number of boats which participated in the male fishery.

Mynd 3. Hrognkelsi. Landanir á rauðmaga 2002-2019 úr rauðmaganetum (dökkar súlur) og öðrum veiðum (ljóskar súlur). Bláa línan sýnir fjölda bát sem tóku þátt í rauðmaganetaveiðum hvert ár.

The female fishery takes place from March until August, and uses gillnets with a mesh between 267 and 292 mm. More than 99% of the landings of females are from the directed female fishery. The female fishery takes place close to shore and is located in Faxaflói Bay, Breiðafjörður and along the northern coast (Fig 4). Landings from the female fishery peaked between late 1970's and 1980's (Fig. 5). Between 1980 and 2019, landings have fluctuated between 2 and 13 thousand tonnes. Pre 2008, landings have been estimated from the number of barrels of roe produced with the numbers being provided by the National Small Boat Owners Association. From 2008, it became mandatory that all landings are recorded in a similar manner to all other fisheries in Iceland, however it was still legal to dispose of the bodies at sea so the majority of landings consisted of only roe. In 2012, it became mandatory to land the bodies. As there is currently no TAC on either of these fisheries, there is no incentive to discard lumpfish, however as of 2019, it is legal to release male lumpfish caught while targeting females.

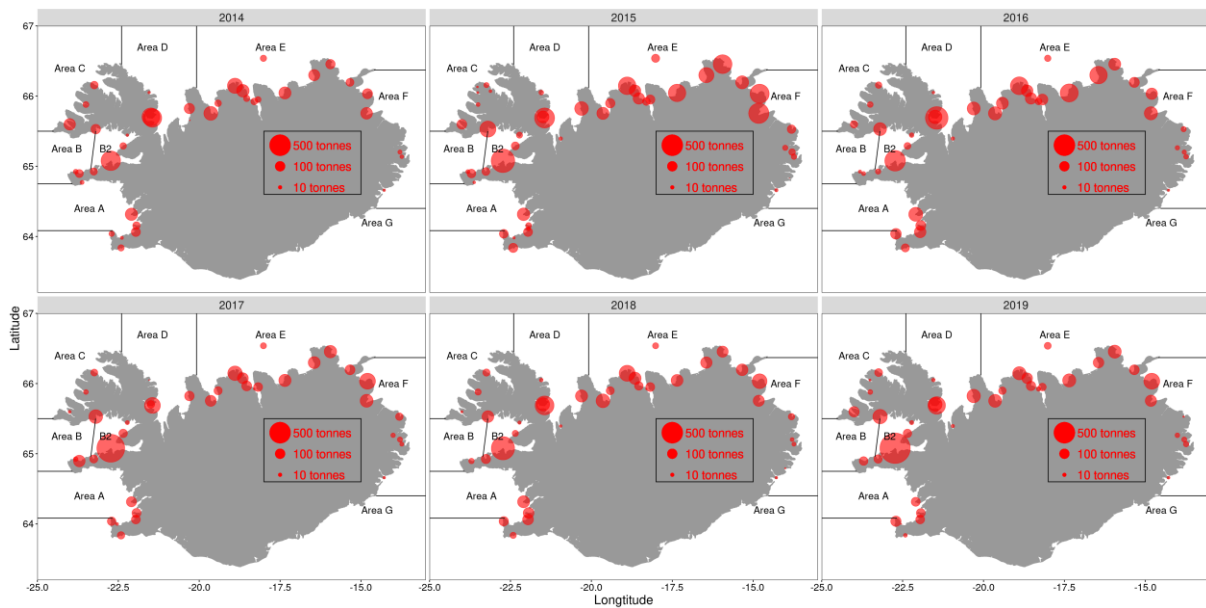


Fig. 4. Lumpfish. Landings of female lumpfish by harbour 2014-2019. Lumpfish management areas are shown.

Mynd 4. Hrognkelsi. Landanir á grásleppu árin 2014-2019 eftir löndunarhöfn. Stjórnunarsvæði grásleppuveiða eru afmörkuð.

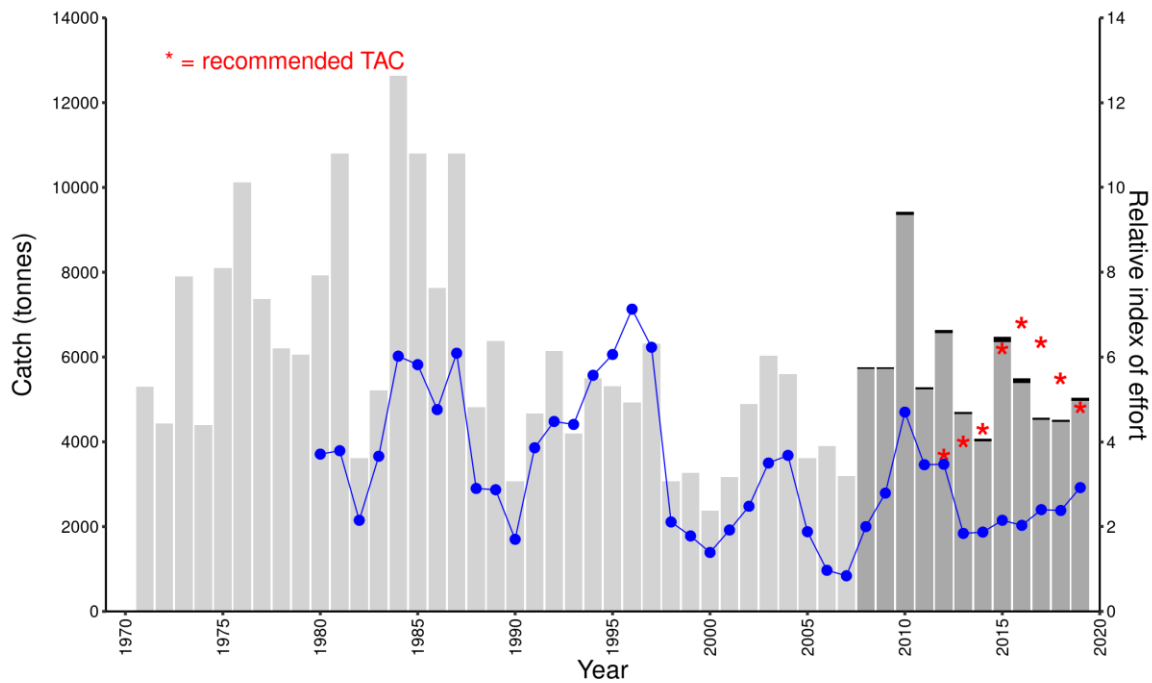


Fig. 5. Lumpfish. Landings of females between 1970 and 2019 (bars) and lumpfish gillnet effort index for the female fishery (blue line). Light grey represents landings estimated from barrels of roe. Dark grey and black represents landings from the lumpfish and other fisheries respectively as reported by the Directorate of Fisheries. The recommended TAC for each year is shown with red asterisks.

Mynd 5. Hrognkelsi. Landanir á grásleppu (gráar súlur) og sóknarvísitala grásleppuneta (blá lína) árin 1970–2019. Ljósgráar súlur sýna ár þar sem afli var metinn út frá fjölda tunna af hrognum, dökkgráar súlur sýna landanir úr grásleppuveiðum skv. Fiskistofu, svartar úr öðrum veiðum. Ráðlögð heildarveiði er sýnd með rauðum stjörnum.

ESTIMATION OF HISTORICAL LANDINGS

As landings data was not routinely collected before 2008, historical landings need to be estimated from number of barrels of roe produced per year as provided by the National Association of Small Boat Owners. The method used to do this is described in Kennedy and Jónsson (2020). In summary, information from fishers logbooks are used to estimate the average weight of roe in a fish and the amount of fresh roe that is needed to fill one barrel of roe. The values currently used are 29.4% of the weight for the average amount of roe per fish and that it takes 139 kg of fresh roe to fill one barrel. This equates to 472 kg of ungutted lumpfish per barrel of roe, thus the weight of the landings of lumpfish (kg) = 0.472 * number of barrels.

MANAGEMENT AND PREVIOUS ADVICE

The female lumpfish fishery is an effort controlled fishery with limits placed on the total length of nets, total number of fishing days and total number of boats. The total number of boats is limited as boats must have "Grásleppuréttindi", a permit which allows the boat to fish for lumpfish. In 2019 there were 448 boats with Grásleppuréttindi. No new permits are issued and a permit can only be obtained by transferring it from one boat to another. However, there is currently no system which can prevent all 448 boats taking part in the fishery of one particular year. In order to participate in the fishery for the current year, a boat with a permit to fish lumpfish must obtain a licence for that year. Up until 2019, the coastline around Iceland was divided into 7 areas (Fig 4), each area was open for lumpfish fishing

for approximately 2.5 months. Each boat had to select an area for that year and could not fish in another. The licence allowed fishing for female lumpfish for the number of allocated days within the time period in which that area was open. The area system was abolished in 2020 and boats are free to move between areas, except for the inner Breiðafjörður area (B2) which opens later (20th May) than the other areas. However, there are a number of areas which are closed for lumpfish fishing to lower the bycatch of marine mammals (Fig. 6). The primary method to limit catches is by altering the total number of days that each boat can fish for. The number of days is set annually by the Minister of Fisheries and Agriculture and is based upon an advised TAC from MFRI and discussions with the Small Boat Owners Association. MFRI have been advising on a TAC since 2012 (Table 1, Fig. 5), which is given in tonnes (see Advice section below).

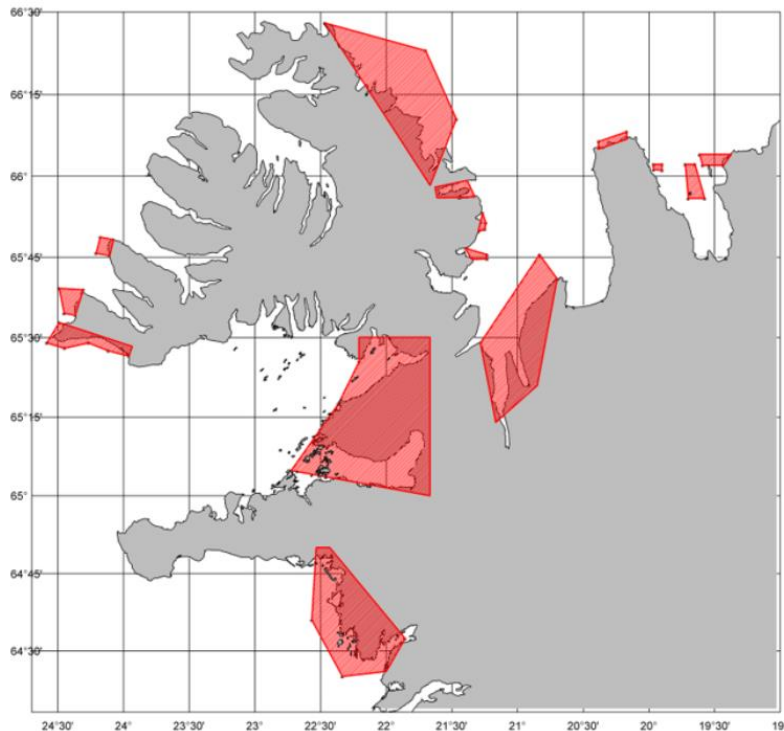


Fig. 6. Lumpfish. Areas closed to lumpfish fishing in the 2020 season to reduce the risk of marine mammal bycatch.

Mynd 6. Hrognkelsi. Kort sem sýnir svæðin sem lokuð verða fyrir veiðum með hrognkelsanetum vertíðina 2020 til að draga úr meðafla sjávarspendýra.

EFFORT

The number of boats participating in the female fishery is influenced by the market price of the roe. The number of boats participating was highest before 1996; the number of boats generally varied between approximately 290 and 450 (Table 1). Post 1996, the number of boats has varied from 144 to 363. However, the number of nets per boat has increased between these two periods, while the number of days for which each boat can fish has decreased (Table 1). An index of effort is calculated from the total landings each year and the average CPUE calculated from logbooks (Effort = landings/CPUE) and is currently below the average of the period 1980-2019, which 3.09 (Fig. 5). The number of boats participating in the male fishery has varied between 2 and 17 between 2001 and 2019.

LENGTH COMPOSITION

Pre 2012, obtaining length measurements from the female fishery was difficult due to the removal of roe before landing and disposing of the bodies at sea. Due to a change in regulations in 2012, the majority of landings are now ungutted lumpfish. The landings are aggregated at a small number of locations for processing making it more straightforward to sample from the fishery. Mean length of fish caught in the female fishery is around 38-41 cm with limited variation between years (Fig.7).

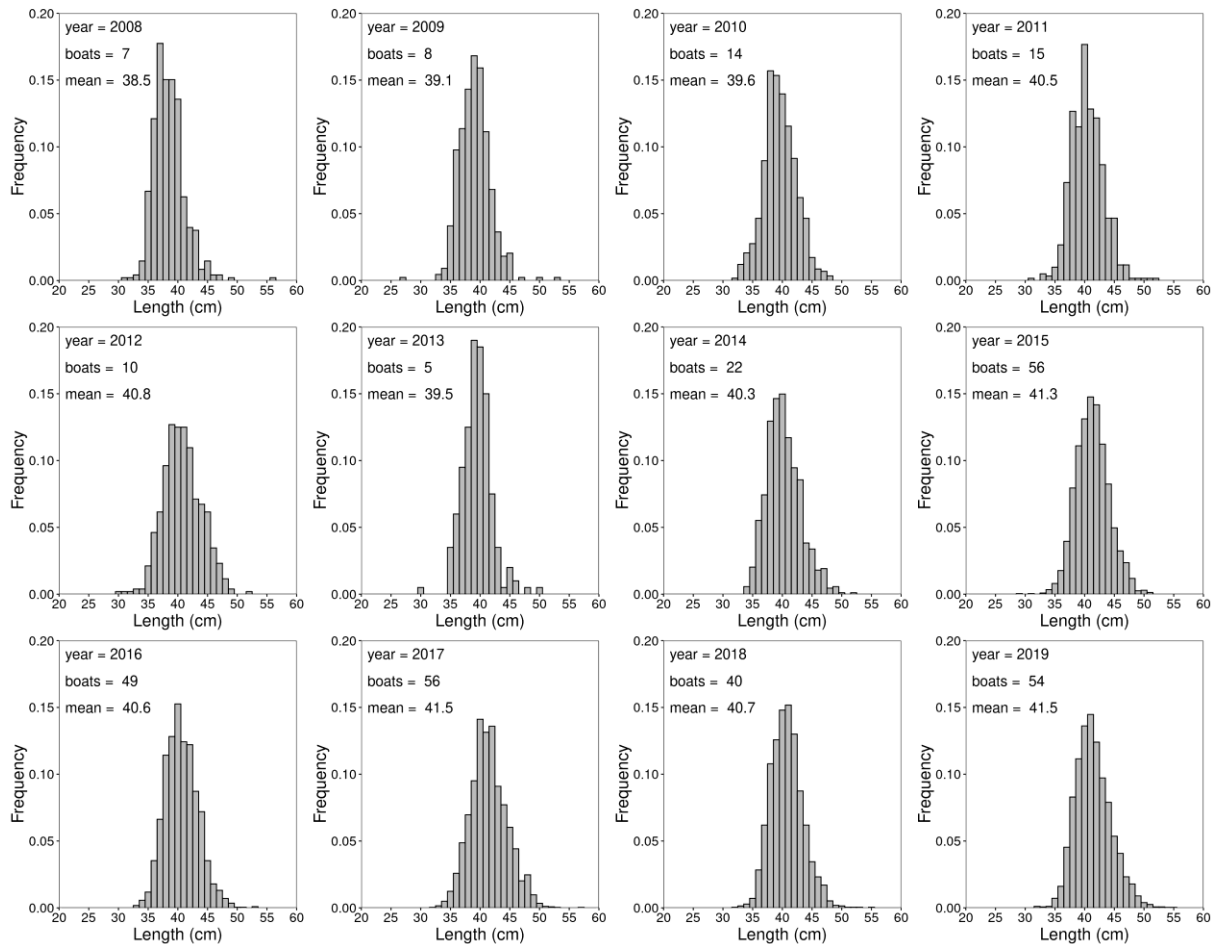


Fig. 7. Lumpfish. Length distribution of females from the female fishery from 2008-2019. The number of boats sampled and mean length is given. Forty fish are measured from each boat sample.

Mynd 7. Hrognkelsi. Lengdardreifing grásleppu í afla árin 2008-2019, ásamt fjölda báta og meðallengd hvert ár. Fjórutíu fiskar eru mældir í sýni úr afla hvers báts.

CATCH PER UNIT EFFORT

The CPUE of the female fishery has varied over time and is influenced both by the biomass of the population and by the effort itself (Fig. 8). The method used to calculate CPUE has been updated since the previous version of this report. Pre-2016, fishers would indicate the length of nets used (long or short) in their logbooks, due to inconsistencies in the data, this is no longer done. The index has therefore been recalculated without adjusting for the length of nets.

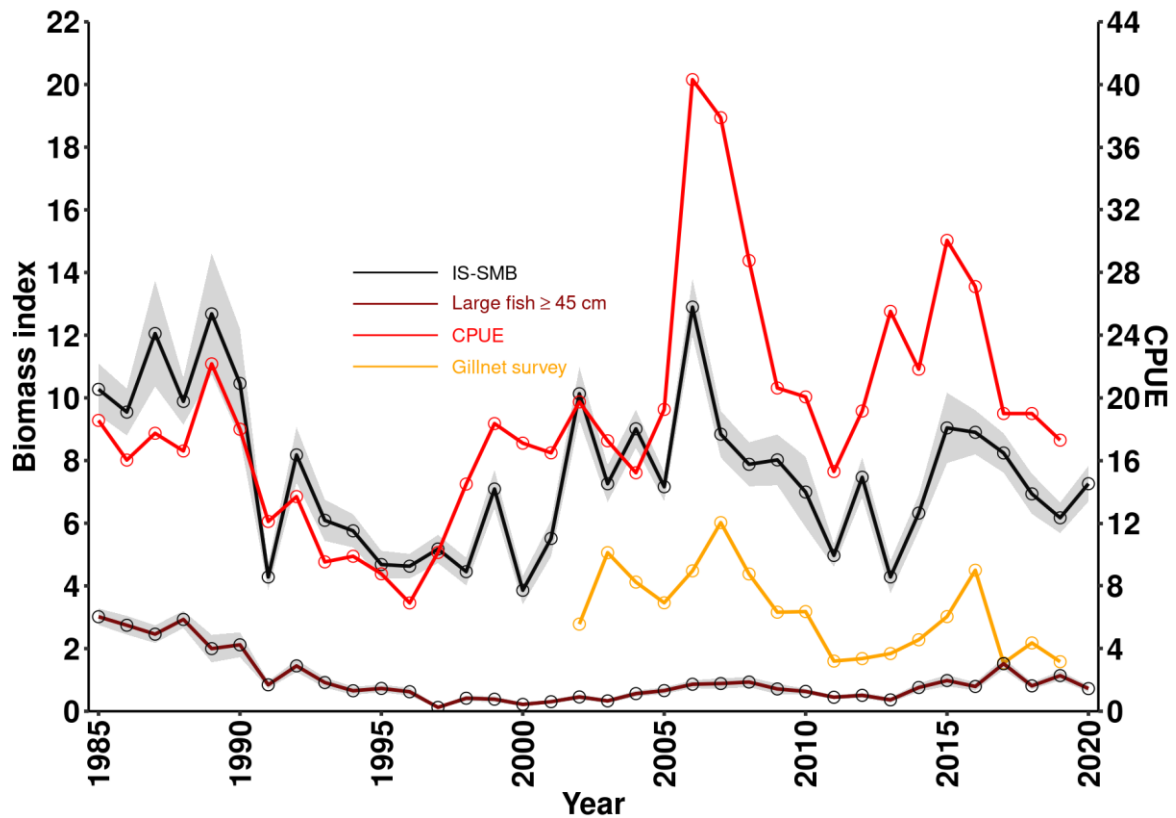


Fig. 8. Lumpfish. Biomass index of females from the IS-SMB, biomass index of females ≥ 45 cm from the IS-SMB, CPUE from the female fishery and biomass index from the gillnet survey.

Mynd 8. Hrognkelsi. Lífmassavísitölur grásleppu og grásleppu ≥ 45 cm í stofnmælingu í mars (IS-SMB), afli á sóknareiningu (CPUE) við grásleppuveiðar og fjöldavísitala í netaralli.

BIOMASS INDICES

Data from the IS-SMB is currently used as the basis for tracking trends in biomass of the female lumpfish population. This survey covers the entire distribution of mature female lumpfish. Data from the annual gillnet survey is also taken into accounting as supporting information. In general, the biomass index for females from the IS-SMB was high between 1985-1990, low during the 1990's and at roughly at intermediate levels during the 2000's (Fig. 8). It decreased during the early 2010's but has recently increased to intermediate levels.

Catchability of male lumpfish in the IS-SMB seems to be very poor and the trends are not considered to reflect the real changes in the population (Fig. 9). Data from the gillnet survey is still under evaluation.

The length distribution has changed over time (Fig. 10), with females >44 cm being more abundant during 1985-1990 than in the years post 1990. The abundance of large females reached a minimum in 1997 but has gradually increased since then, with the abundance in 2017 being the highest since 1990 (Fig. 8).

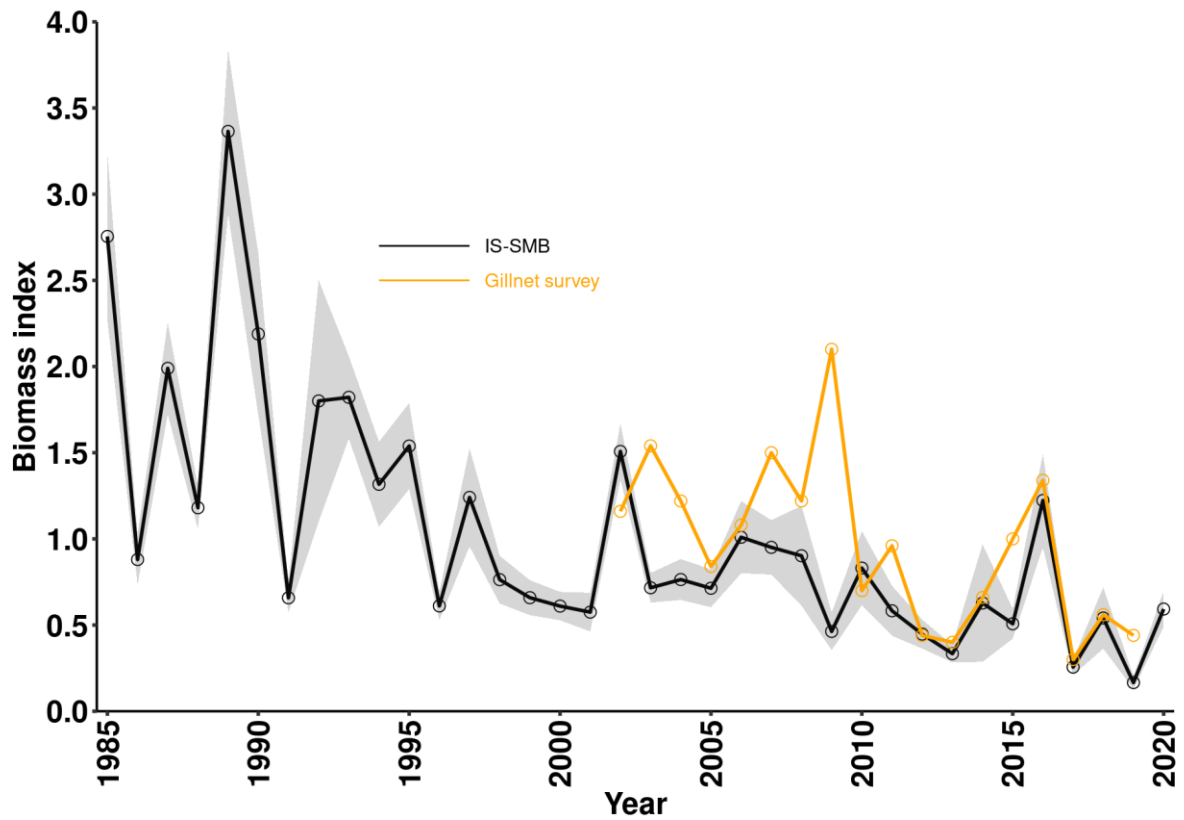


Fig. 9. Lumpfish. Biomass index of males from the IS-SMB and abundance index from the gillnet survey.

Mynd 9. Hrognkelsi. Lífmassavísitala rauðmaga í stofnmælingu í mars (IS-SMB) og fjöldavísitala í netaralli.

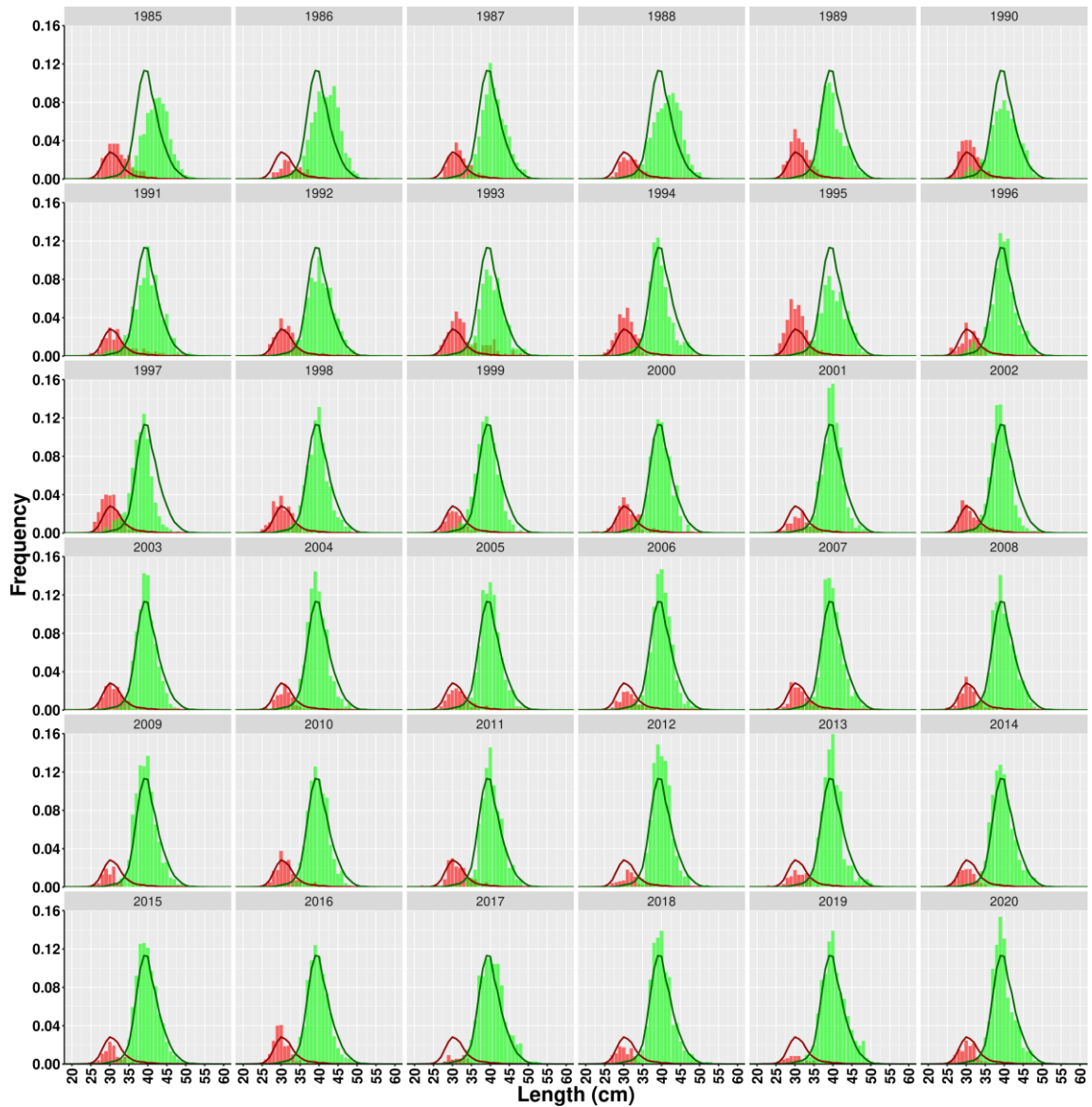


Fig. 10. Lumpfish. Length distribution of male (red) and female (green) lumpfish caught in the IS-SMB. Lines represent the average length distribution for the whole study period.

Mynd 10. Hrognkelsi. Lengdardreifing rauðmaga (rautt) og grásleppa (grænt) sem veiddust í stofnmælingu í mars. Línur tákna meðal lengdardreifingu á rannsóknartímanum.

F_{PROXY}

An index of relative fishing mortality for lumpfish is derived from the IS-SMB and landings of whole lumpfish ($F_{\text{proxy}} = \text{Yield}/\text{Survey biomass}$).

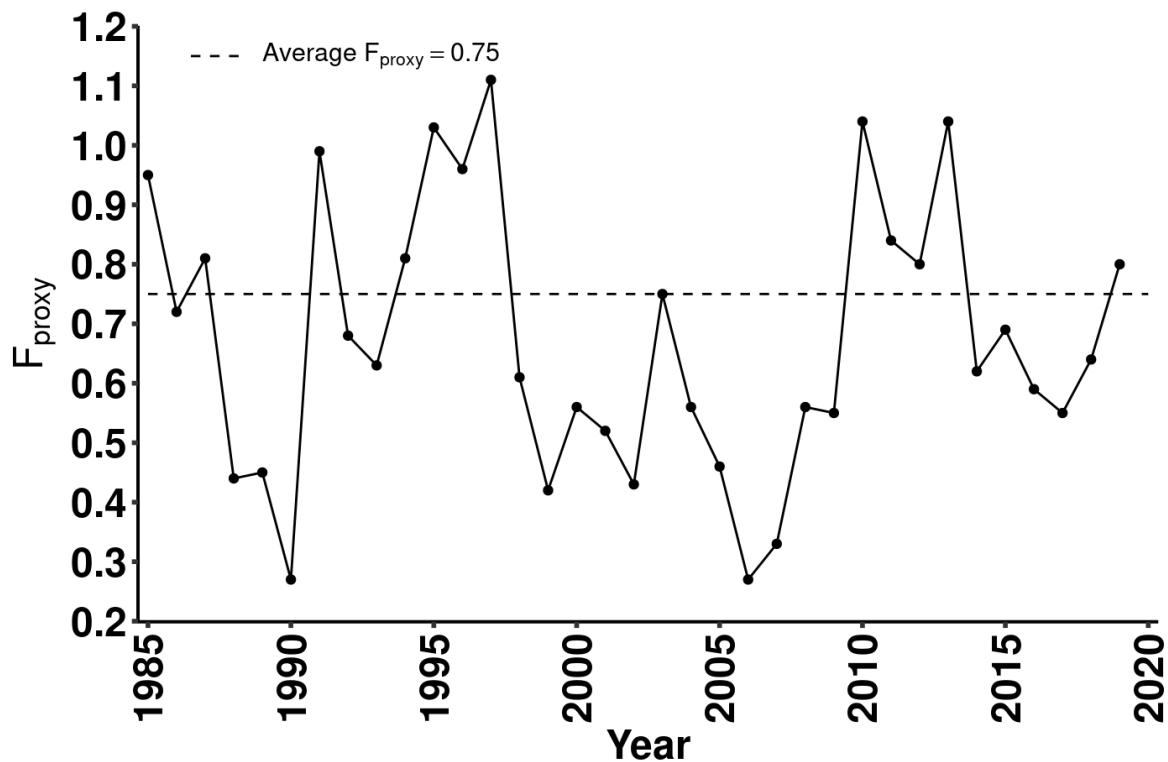


Fig. 11. Lumpfish. F_{proxy} of females 1985-2019. The mean of the reference period (1985-2019) is shown.

Mynd 11. Hrognkelsi. Vísitala veiðihlutfalls hrygna 1985-2019. Sýnt er meðaltal viðmiðunarára (1985-2019).

ADVICE

The target F_{proxy} value for 2020 is 0.75 and is based on mean F_{proxy} for 1985–2019. Historical landings have been revised on several occasions which are documented in Kennedy and Jónsson (2020). From 2012-2019, a target F_{proxy} was used but this was revised to 0.67 in 2020, but was subsequently reconsidered and 0.75 continues to be used.

The lumpfish biomass index fluctuates considerably between years, therefore, the index from the current fishing year rather than that of the previous year is taken into account when considering the advice. In order to compensate for uncertainty in the measurements, the previous year's index is also taken into account. The current year's and previous year's survey are giving a weighting of 70 and 30% respectively. The advice from the MFRI based on target F_{proxy} is thus given in two stages. For the 2020 season, preliminary TAC is calculated as the IS-SMB (2019) biomass index multiplied by 0.225. To this is added the biomass index from the IS-SMB (2020) multiplied by 0.525. If the female biomass index falls below the historical minimum of IS-SMB, then that year will represent a value of zero in the calculation of TAC. Recommendations for a final TAC are delivered after the IS-SMB is completed.

Table 1. The number of boats which participated in the female lumpfish fishery, the maximum number/total length of nets (the maximum number per crew member and the maximum per boat, in brackets, is shown for years 1980-2012), the maximum number of consecutive fishing days for each boat, the advised TAC and total catch from the directed female fishery (Landings.DF) and from other fisheries (Landings.other) between 1980-2019. In 2017, the number of fishing days was increased from 36 to 46 days during the season.

Tafla 1. Yfirlitstafla fyrir árin 1980-2020 um fjölda báta á grásleppuveiðum, hámarks fjöldi/heildarlengd neta (hámarksfjöldi neta á áhafnar meðlim og á bát, innan sviga, er gefin fyrir árin 1980-2012), hámarksfjöldi veiðidaga á bát, ráðlagður aflí, heildaraflí í beinum veiðum og heildaraflí í óbeinum veiðum.

Year	Boats	Nets	Fishing.days	Advice	Landings.DF	Landings.other
1980	343	50 (150)			7926	
1981	347	50 (150)			10798	
1982	219	50 (150)			3615	
1983	292	50 (150)			5214	
1984	384	50 (150)			12637	
1985	401	50 (150)			10798	
1986	298	50 (150)			7624	
1987	350	50 (150)			10798	
1988	334	50 (150)			4815	
1989	353	50 (150)			6372	
1990	234	50 (150)			3068	
1991	356	50 (150)			4673	
1992	393	50 (150)			6137	
1993	326	50 (150)			4200	
1994	401	100 (300)			5504	
1995	417	100 (300)			5315	
1996	447	100 (300)			4922	
1997	372	100 (300)			6313	
1998	277	100 (300)			3065	
1999	258	100 (300)			3266	
2000	266	100 (300)			2380	
2001	197	100 (300)			3167	
2002	222	100 (300)			4887	
2003	272	100 (300)			6033	
2004	353	100 (300)			5599	
2005	256	100 (300)	60		3613	
2006	163	100 (300)	50		3898	

2007	144	100 (300)	50		3196	
2008	205	100 (300)	50		5717	47
2009	265	100 (300)	62		5726	27
2010	338	100 (300)	62		9357	71
2011	363	100 (300)	50		5240	50
2012	334	100 (300)	50	3700	6558	83
2013	282	200	32	4000	4652	57
2014	221	200	32	4300	4011	63
2015	316	7500m	32	6200	6357	117
2016	239	7500m	32	6800	5385	119
2017	246	7500m	36	6350	4513	52
2018	218	7500m	46	5487	4469	48
2019	240	7500m	44	4805	4967	77
2020		7500m		5200		

REFERENCES

James Kennedy og Sigurður Þ. Jónsson 2020 .Umreikningur á fjölda tunna af grásleppuhrognum yfir í óslægðan afla byggður á veiðdagbókum. Haf- og vatnarannsóknir. HV- 2020-32. 9 bls. <https://www.hafogvatn.is/static/research/files/hv2020-32.pdf> [in English: Converting number of barrels of lumpfish roe to ungutted landings based on logbook data. HV- 2020-33, 9 pp. <https://www.hafogvatn.is/static/research/files/hv2020-33.pdf>]