

# STARRY RAY

## *Amblyraja radiata*

### GENERAL INFORMATION

Starry ray is by far the most abundant elasmobranch species in Icelandic waters. It has a widespread distribution over the Icelandic shelf and upper slope at depths from 20-1000 m but is most common at 30-200 m. In Icelandic surveys the starry ray is rarely caught larger than 70 cm but most commonly at 30-50 cm. Reproduction is believed to occur to some extent throughout the year, however mainly during summer.

### THE FISHERY

Starry ray is abundant in Icelandic waters and is a common bycatch in variety of fishing gears. Catches of starry ray are taken all around Iceland but mostly within Faxaflói in the southwest (Figure 1). The increased landings since the 1990s are partly related to an increased retention, compensating for a lower abundance of the *D. batis* complex. However, fishing regulations are likely responsible for the high proportion of landings from Danish seine in the nineties (Figure 2). In the last decade landings are mainly reported from the longline fishery (Figure 2). Reported landings increased from 500 tonnes in 2007 to more than 1700 tonnes in 2012. Thereafter, landings declined and in 2017 and 2018 they did not exceed 700 tonnes. A large proportion of the landings is for local consumption linked to the yule season. This is reflected in the strong seasonality in landings; most landings are reported from September-November each year (Figure 3).

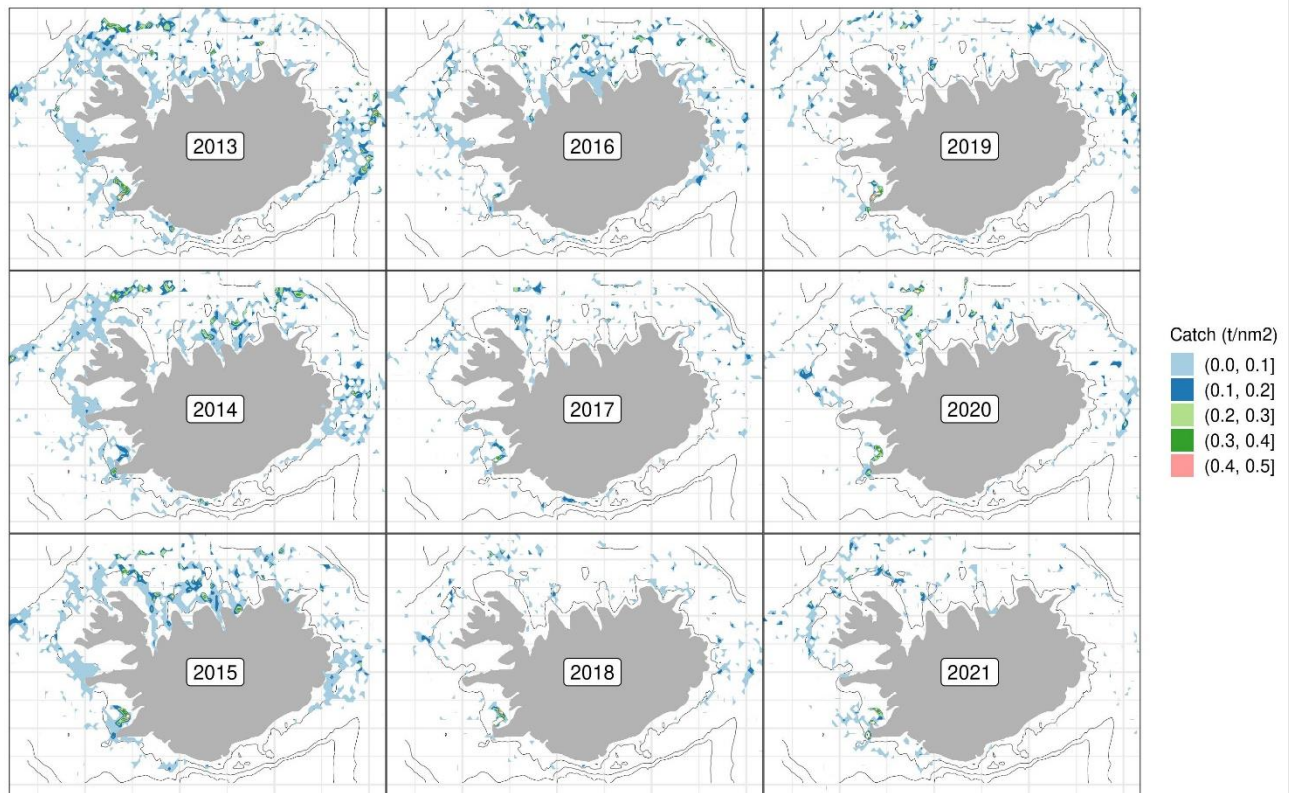


Figure 1. Starry ray. Geographical distribution of the Icelandic fishery since 2013 as reported in logbooks.

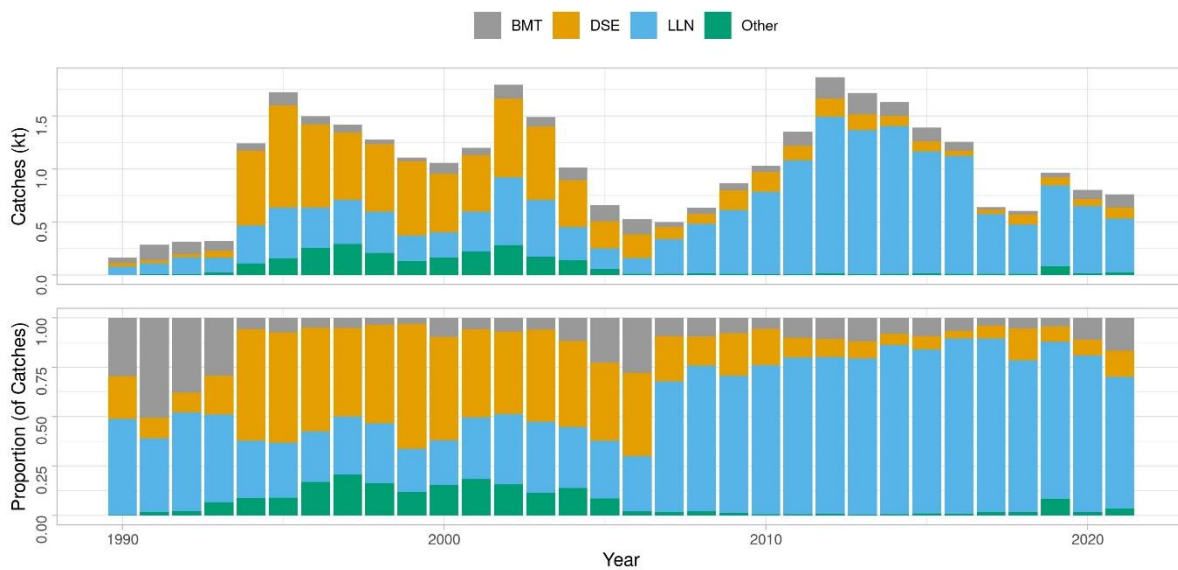
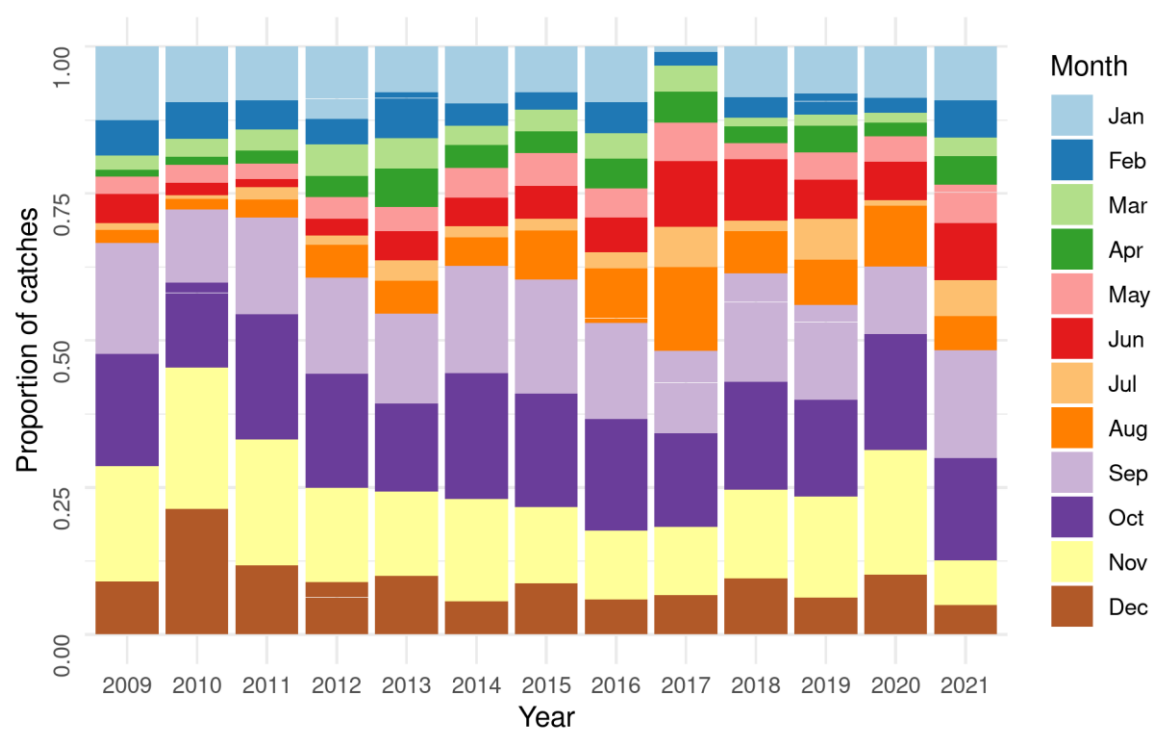


Figure 2. Starry ray. Landings by fishing gear since 1990 according to statistics from the Directorate of Fisheries.

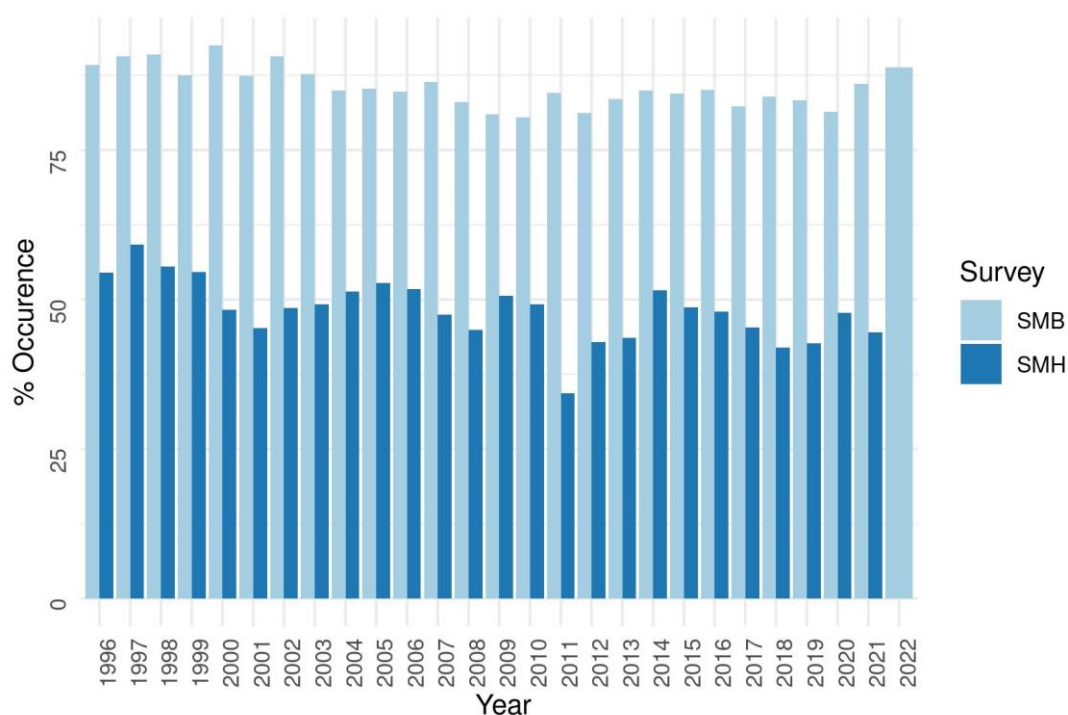


**Figure 3. Starry ray. Proportion of monthly catch to each year since 2009 according to statistics from the Directorate of Fisheries.**

## SURVEY DATA

### DISTRIBUTION AND BIOMASS INDICES

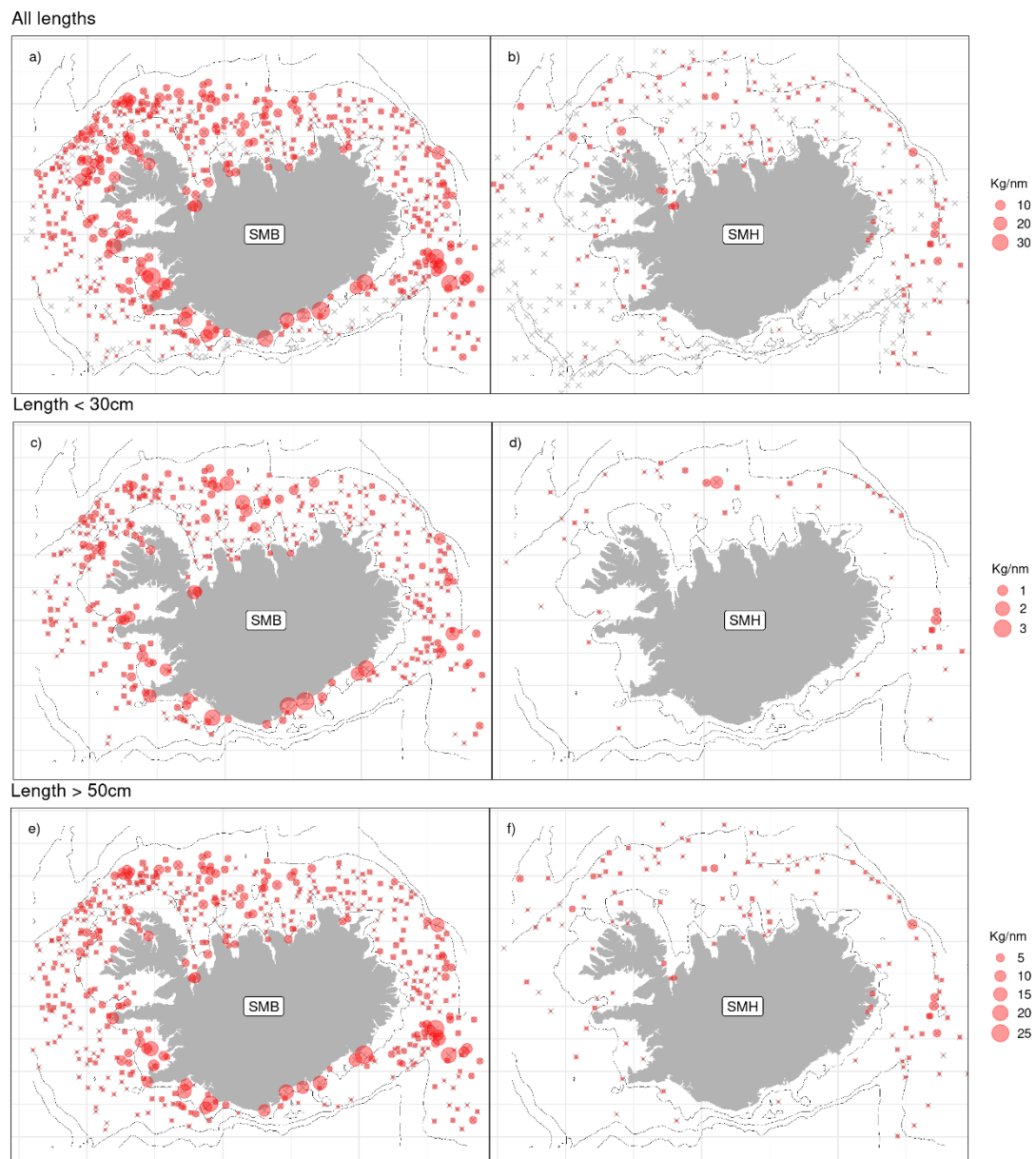
Starry ray is a frequent catch in MFRI spring (IS-SMB) and autumn surveys (IS-SMH). Seasonal differences in distributional patterns have been noted, with starry ray much less abundant on the shelf in IS-SMH than in IS-SMB. In IS-SMB, starry ray is found at 86% of all stations, but at about 50% of stations in the IS-SMH (Figure 4).



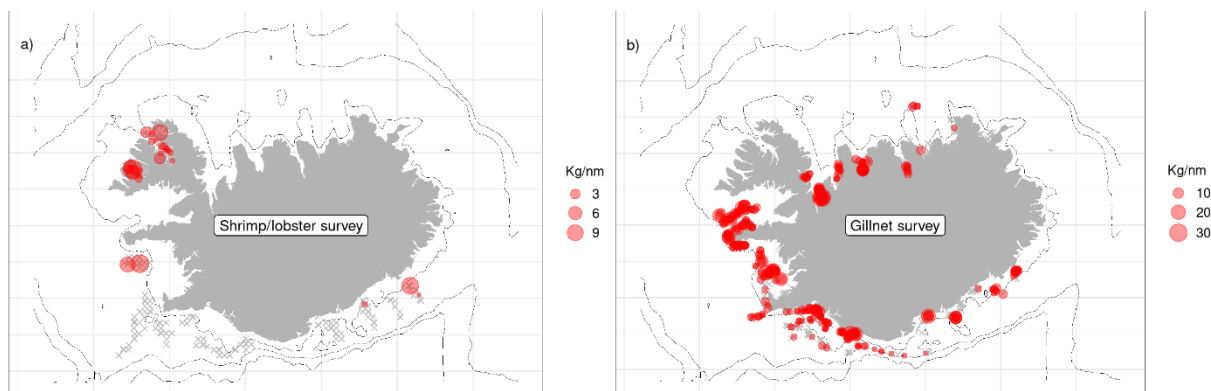
**Figure 4. Starry ray. Frequency (occurrence at % stations) in IS-SMB and IS-SMH.**

In MFRI groundfish surveys, starry ray is most abundant in the N and the NW (Figures 5, 6 and 7). In IS-SMB there is a high abundance on the shelf off N-Iceland and in near-shore areas in the south and southeast (Figure 5 a,c,e). In IS-SMH, the main distribution is on the shelf break and starry ray is almost absent from the southern area (Figure 5 b,d,f). Seasonal migration could to some extent explain these seasonal differences in distributional patterns. However, the large seasonal difference in occurrence and catches, especially in the smallest length groups (>30 cm, Figure 5c,d) could also be partly explained by differences in survey gear (size and weight).

Starry ray is a frequent bycatch in several other MFRI surveys. The offshore shrimp survey is conducted during summer off N-Iceland and the coastal shrimp survey occurs at various time periods in fjords and near coastal areas and starry ray is widely distributed within the survey areas (Figure 6 a). Similarly, starry ray is a frequent bycatch in the gillnet survey occurring early April each year (Figure 6b).

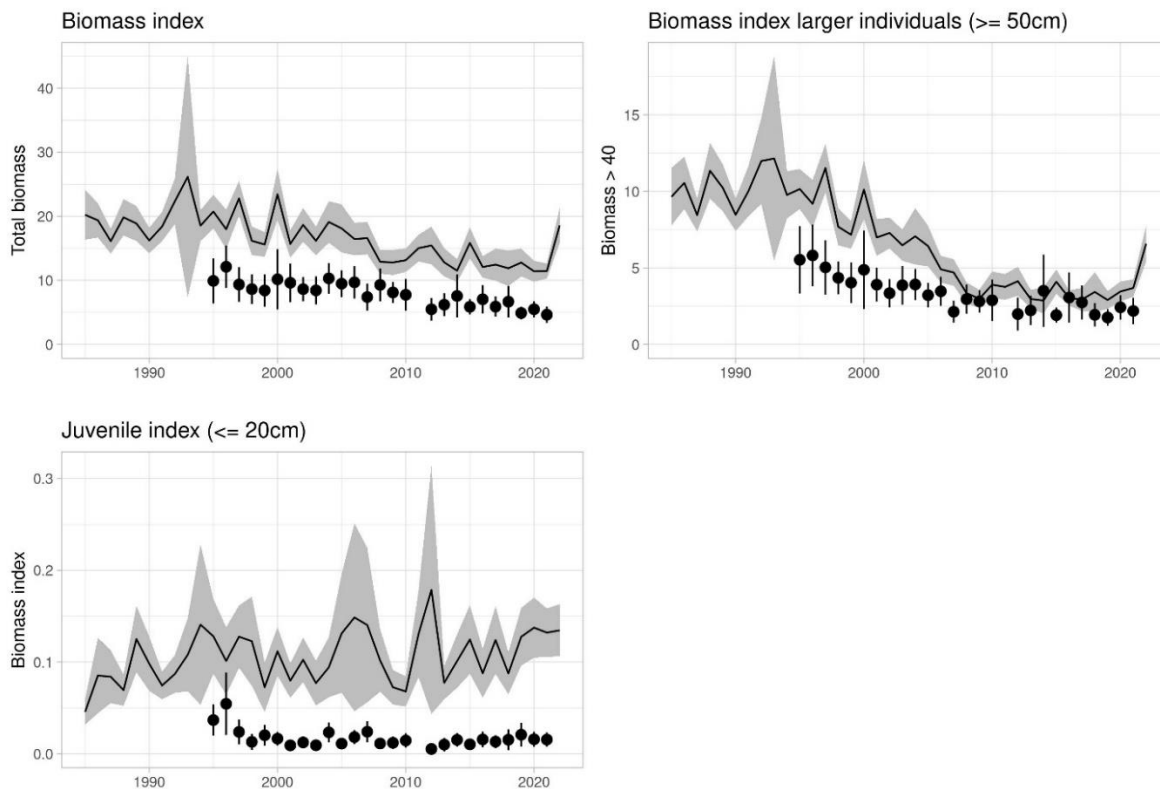


**Figure 5. Starry ray. Spatial distribution in IS-SMB 2022 (a,c,e) and in IS-SMH 2021 (b,d,f). The top panel shows all data, the middle panel shows individuals <30 cm, and the bottom panel shows larger individuals (>50cm).**



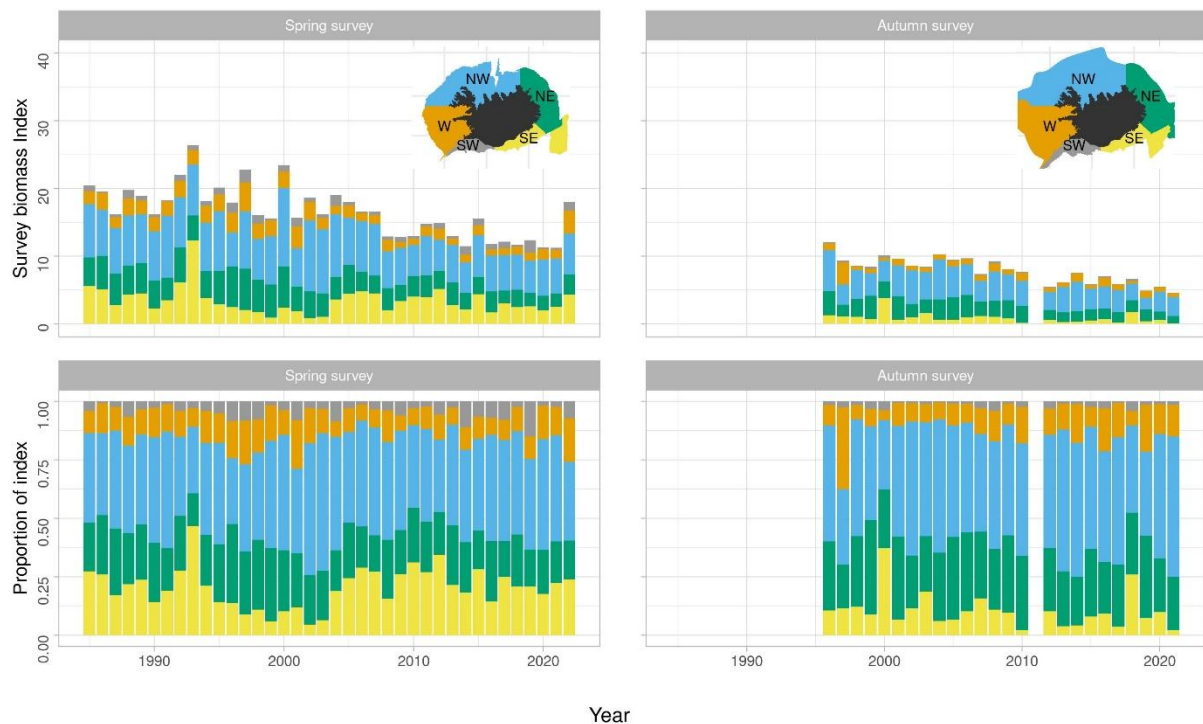
**Figure 6. Starry ray. Spatial distribution in a) shrimp and lobster surveys in 2021 and b) the gillnet survey (IS-SMN) 2021.**

In general, estimates of total biomass of starry ray in IS-SMB show a declining trend over the survey period with few exceptions such as the latest estimate (2022) which is the highest since 2004 (Figure 7 and 8). The biomass index in IS-SMB has decreased from 19000 (average 1985-2000) to 14000 (average 2001-2021). Decreasing trend is in particularly notable for large fish ( $\geq 50$  cm) in years 1993-2008. Estimated biomass of juveniles ( $\leq 20$  cm) appears to be stable despite large variations in years 2003-2013 and increasing trend since 2013 is noted. In IS-SMH, total biomass indices are lower than in IS-SMB and similarly to the IS-SMB the declining trend over the survey period is evident.



**Figure 7. Starry ray. Total biomass indices (upper left), biomass indices of large individuals ( $\geq 50$  cm, upper right) and juvenile abundance indices ( $\leq 20$  cm, lower left), from IS-SMB (black line) and IS-SMH (black dots).**

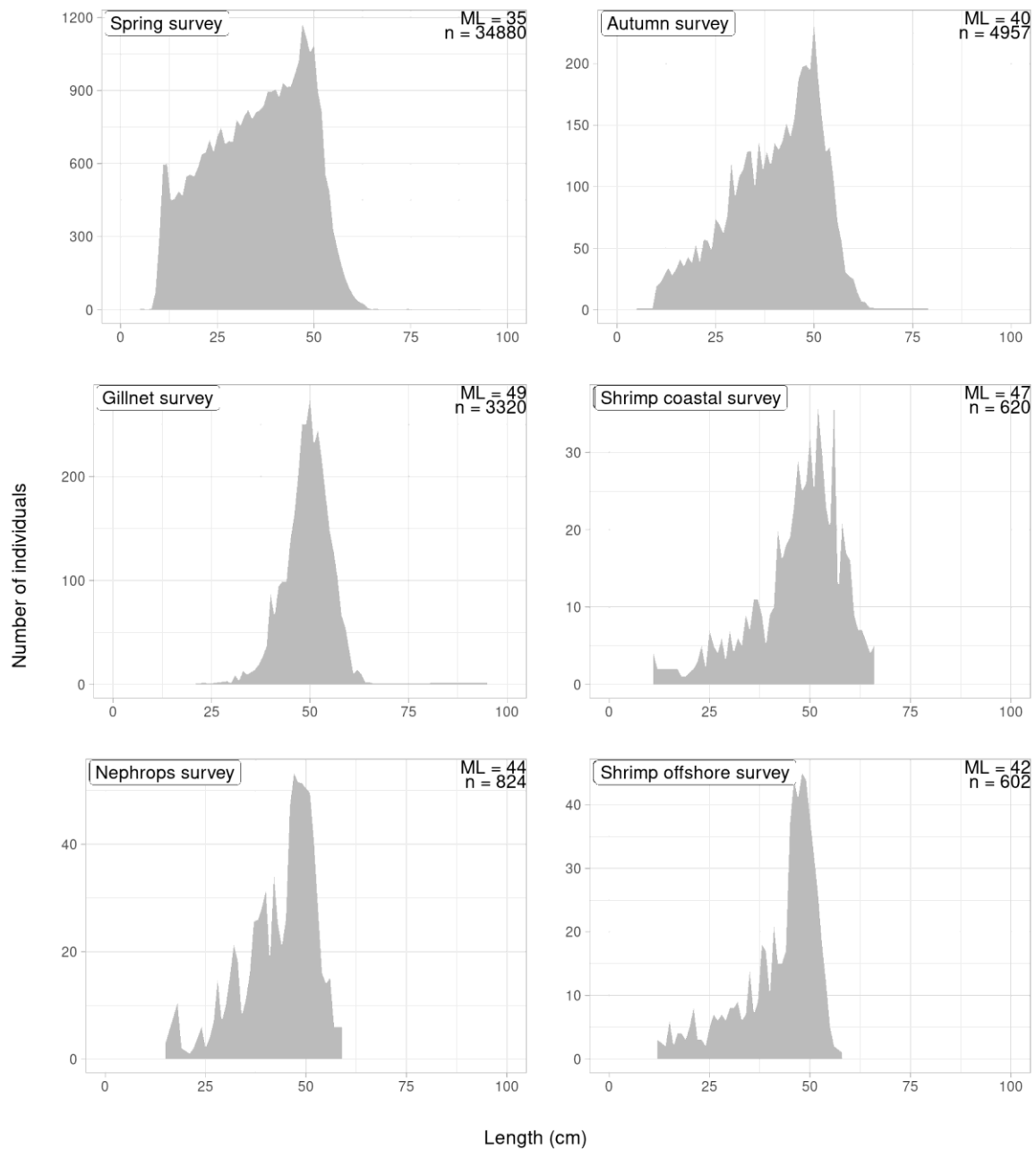
In IS-SMB the highest proportion of catch is taken in areas off NW-, NE- and SE- Iceland and the reduction in biomass is most prominent in these areas. In IS-SMH, the highest proportion of catch is taken in areas off NW- and NE-Iceland; the areas where a reduction in abundance has taken place (Figure 8).



**Figure 8. Starry ray. Spatial distribution of biomass indices from IS-SMB and IS-SMH.**

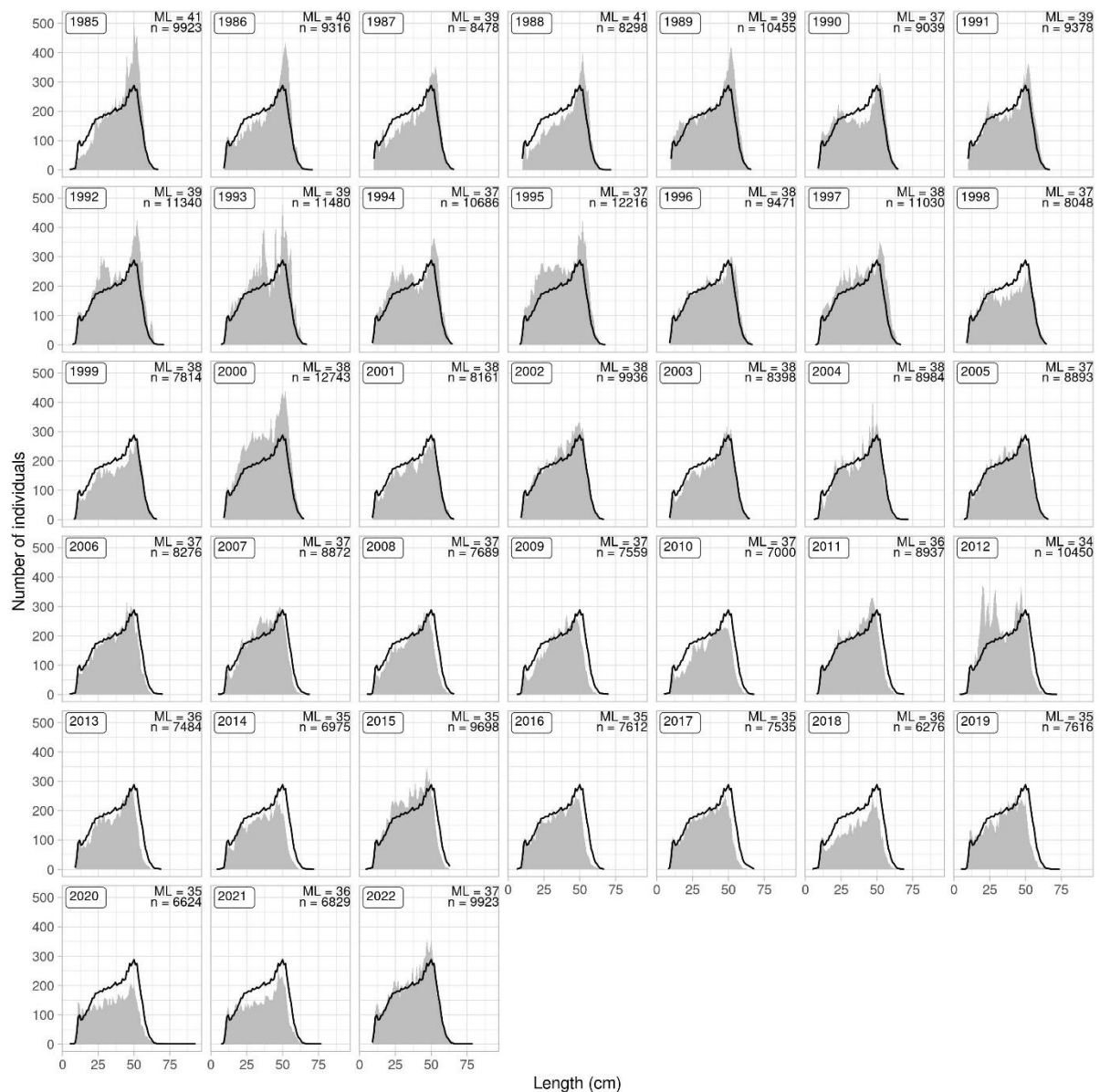
## LIFE HISTORY INFORMATION

Length distributions from surveys indicate that most specimens are <60 cm . Mean size varies from 35-49 cm depending on surveys (Figure 9). In spring survey (IS-SMB), autumn survey (IS-SMH) and shrimp offshore survey (IS-SMR), the length distribution is negatively skewed as the proportion of large fish decreases quite abruptly (Figures 9-11).

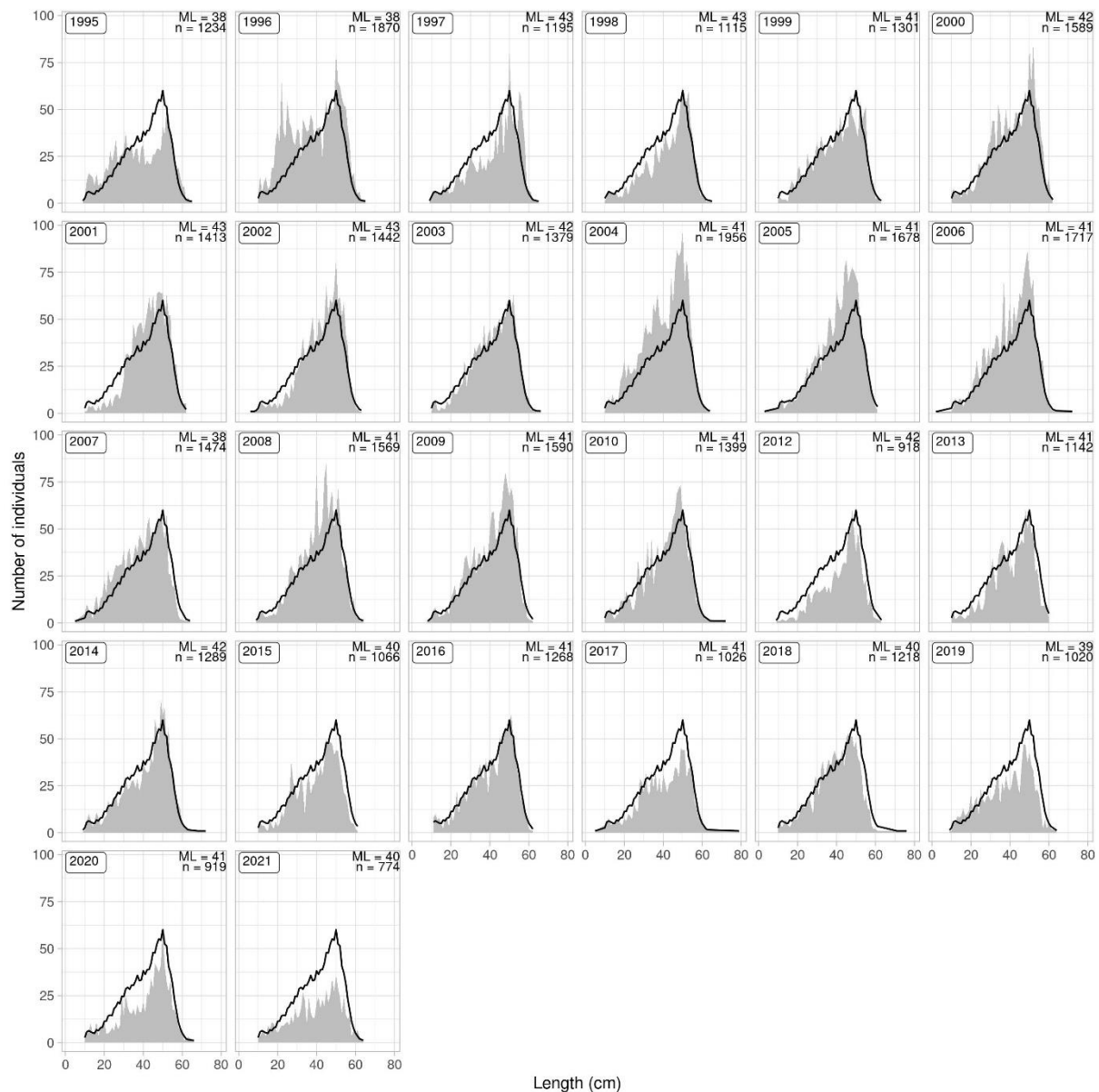


**Figure 9. Starry ray. Length distributions in several MFRI surveys in 2017-2021. All surveys use various form of bottom trawls except IS-SMN.**

Mean length in the spring survey is the lowest in all six surveys and considerably lower than mean length in IS-SMH (overall mean 35 and 40 cm, respectively). The proportion of larger fish decreases quite abruptly after reaching 50 cm (Figure 10 and 11). In IS-SMB, the mean length has decreased from 38 cm (average 1996-1998) to 35 cm (average 2017-2021) (Figure 10). On the other hand, in IS-SMH the mean length has varied (from 38 cm to 43 cm) over the period without any specific direction (Figure 11).



**Figure 10. Starry ray. Length distributions in IS-SMB 1985-2022. Mean length (ML, cm) is indicated for each year. Black line is the average mean for the period.**

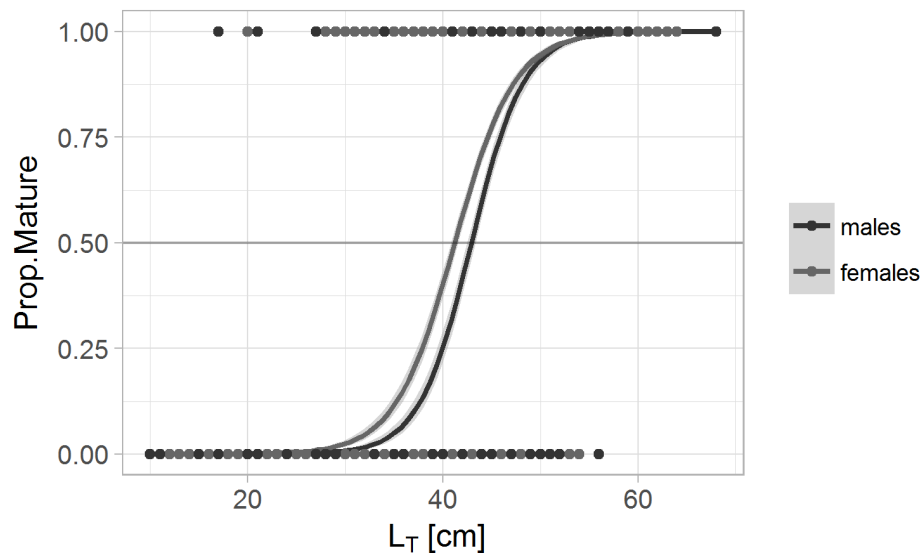


**Figure 11. Starry ray. Length distributions in IS-SMH 1995-2021. Mean length (ML, cm) is indicated for each year (upper, right). Black line is the average mean for the period. No survey was conducted in 2011.**

The sex ratio is 1:1 in the spring survey, but in the autumn survey the ratio is skewed towards females (male:female ratio 1:1.57). Males are on average larger than females (40.5 cm and 38.8 cm, respectively).

Data on maturity is sampled in the autumn survey allowing for calculations of maturity ogives. Length-at-50%-maturity ( $L_{50}$ ) is 42.9 cm and 41.0 cm for males and females, respectively (Figure 12).

Anecdotal information suggests that starry ray undertakes seasonal migrations related to egg-laying activity. Recently, both surveys have started to sample data on egg case distribution, but trawl survey data may provide useful information on catches of viable skate egg cases and/or nursery grounds.



**Figure 12. Starry ray. Length at maturity. Males:  $L_{50}$  = 42.9 cm ,  $L_{95}$  = 51.1 cm . Females:  $L_{50}$  = 41.0 cm,  $L_{95}$  = 50.0 cm.**

## REFERENCES

- McPhie, R. P., & Campana, S. E. (2009). Reproductive characteristics and population decline of four species of skate (Rajidae) off the eastern coast of Canada. *Journal of Fish Biology*, 75(1), 223–246. <https://doi.org/10.1111/j.1095-8649.2009.02282.x>
- Sulikowski, J. A., Kneebone, J., Elzey, S., Jurek, J., Danley, P. D., Howell, W. H., & Tsang, P. C. W. (2005). Age and growth estimates of the thorny skate (*Amblyraja radiata*) in the western Gulf of Maine. *Fishery Bulletin*.