

# SPOTTED WOLFFISH – HLÝRI

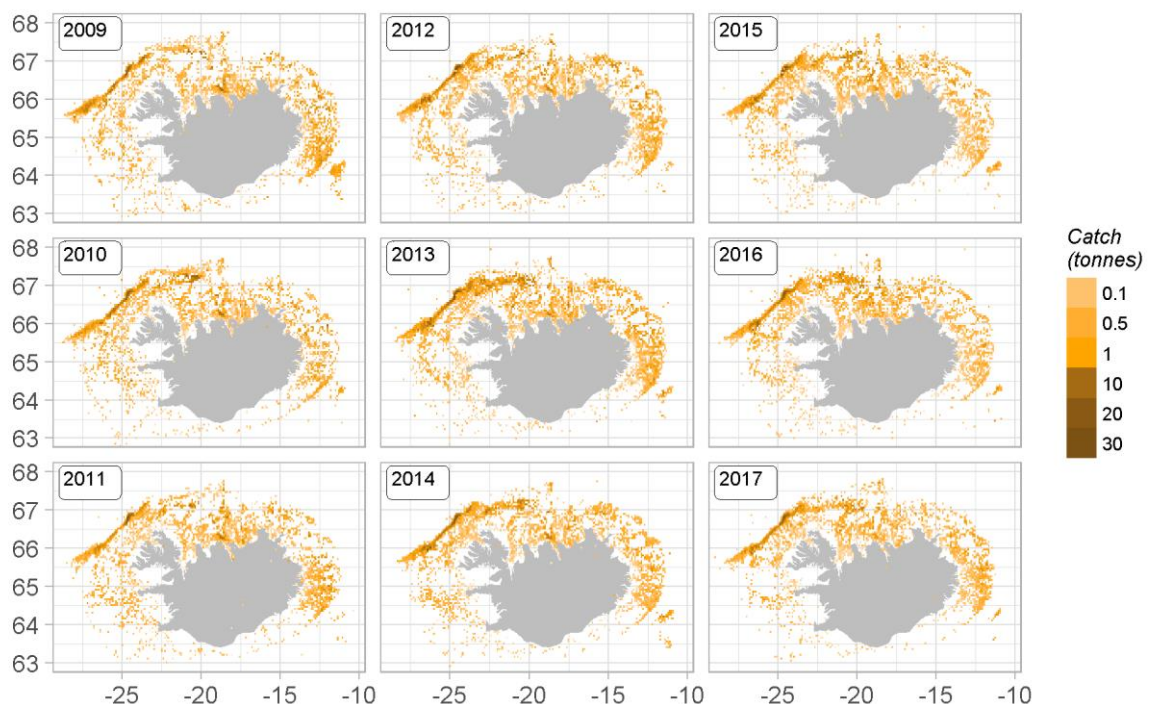
## *Anarhichas minor*

### GENERAL INFORMATION

Spotted wolffish has been exploited for many years in Icelandic waters. It is an oblong fish with characteristic dark spots in its skin and sharp, protruding teeth. In catches, a common length range is 60-90 cm, but the largest spotted wolffish caught around Iceland was 144 cm. Spotted wolffish is mainly found at the northwest and north parts of the continental shelf of Iceland, at sandy or muddy substrate and depths of 100-400 meters. In Icelandic waters, female spotted wolffish mature at the average of 83 cm and 9 years old. Before maturity, annual growth is on the average 6.5 cm annually.

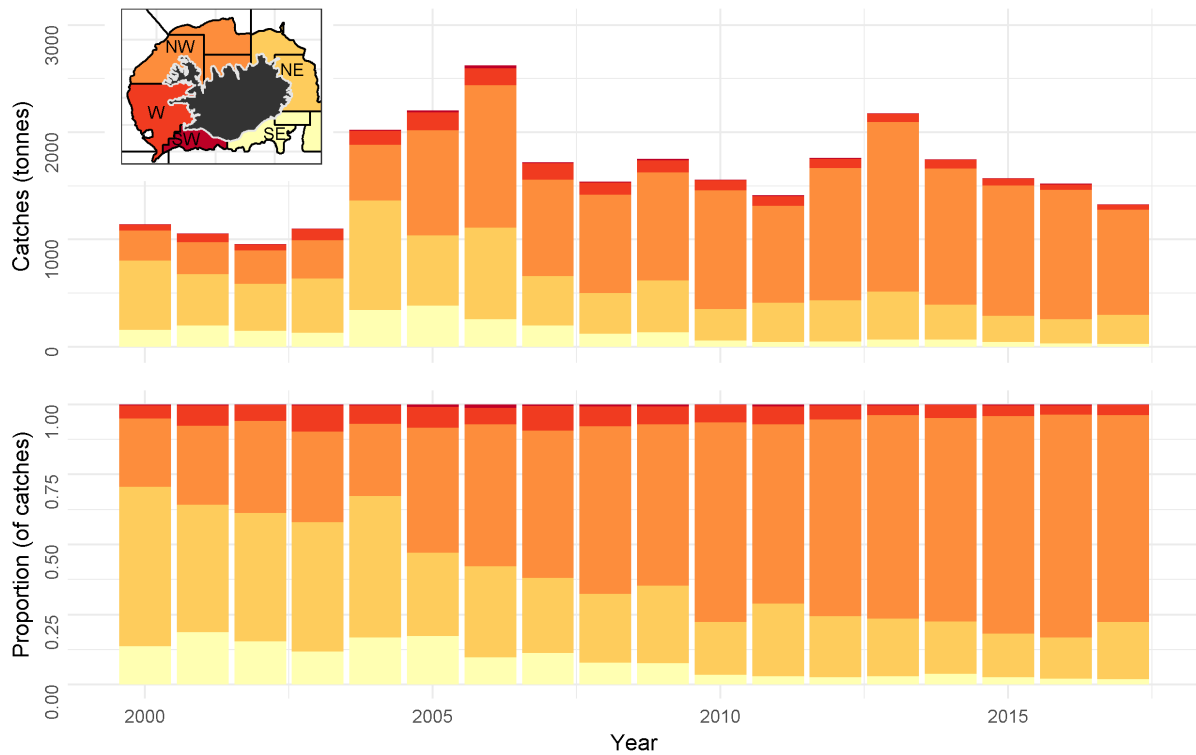
### THE FISHERY

The main fishing grounds for spotted wolffish are in the northwest of Iceland. The proportion of the catch in the NW area has been increasing since 2000 and approximately 75% of the last years catch was in those waters. At the same time the proportion of the catch has been decreasing in the NE area, from around 50% in 2000 to around 20% in 2017 (Figure 1 and 2).



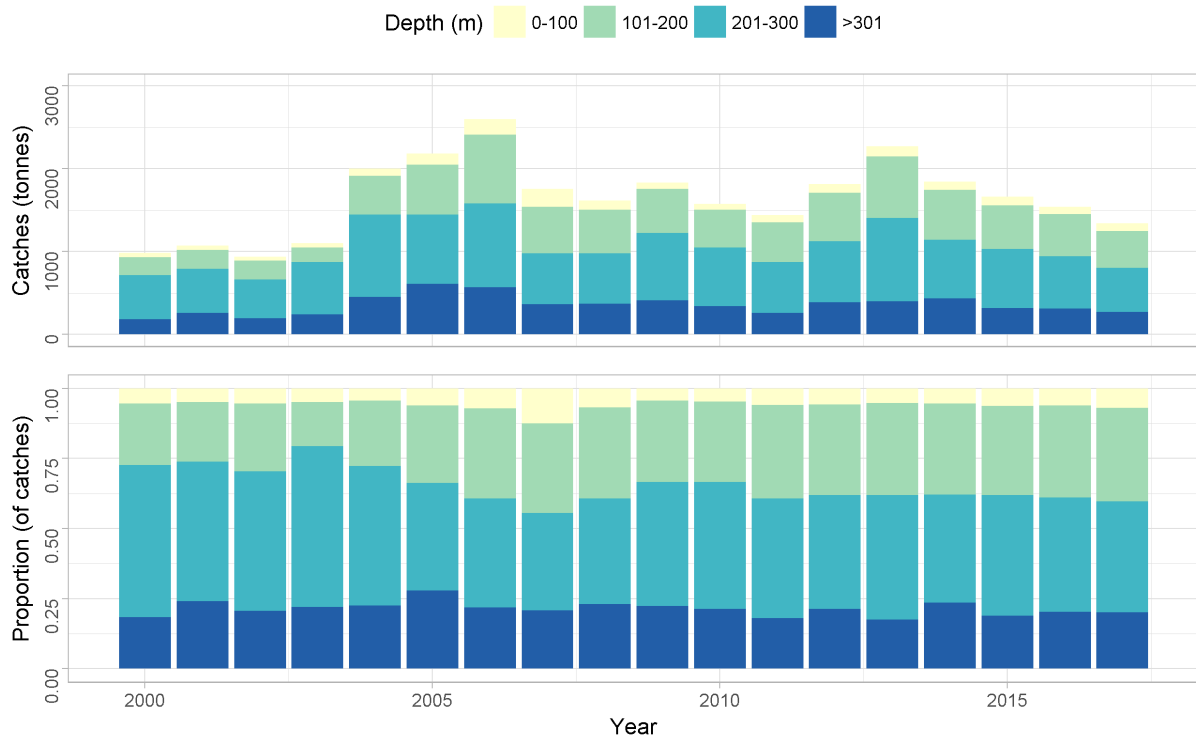
**Figure 1. Spotted wolffish. Geographical distribution of the Icelandic fishery since 2009. Reported catch from logbooks.**

*Mynd 1. Hlýri. Útbreiðsla veiða á Íslandsmiðum frá 2009 samkvæmt afladagbókum.*



**Figure 2. Spotted wolffish. Spatial distribution of the Icelandic fishery by fishing areas from 2000-2017 according to logbooks. All gears combined.**

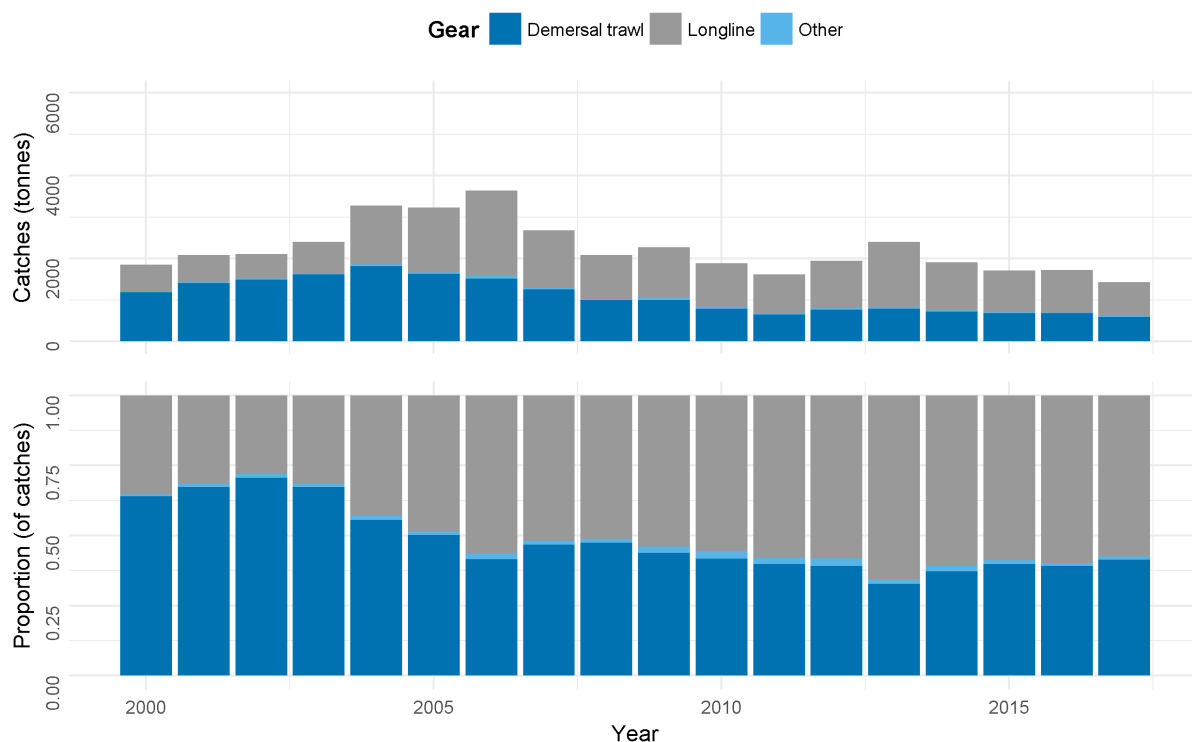
*Mynd 2. Hlýri. Útbreiðsla veiða við Ísland árin 2000-2017 samkvæmt afladagbókum. Öll veiðarfæri samanlagt.*



**Figure 3. Spotted wolffish. Depth distribution of longline and demersal trawl catches according to logbooks.**

*Mynd 3. Hlýri. Afli í línu og botnvörpu skipt eftir dýpi, samkvæmt afladagbókum.*

About 50% of the catch of spotted wolffish is caught at depths between 200-300 m, but only a low proportion in waters shallower than 100 m. The depth distribution of spotted wolffish catch has been relatively stable since 2000 (Figure 3).



**Figure 4. Spotted wolffish. Total catch (landings) by fishing gear since 2000, according to statistics from the Directorate of Fisheries.**

*Mynd 4. Hlýri. Landaður afli eftir veiðarfærum frá 2000, samkvæmt aflaskráningarkerfi Fiskistofu.*

Around 98% of landed spotted wolffish is caught on longline and in demersal trawl. In the year 2000, the longline catch was less than 40% of the total catch, and in demersal trawl little more than 60%. From 2002, the catch on longline has been increasing relative to that taken in demersal trawl. In 2017, longline catch was around 60% of the total catch (Figure 4).

In 2000-2006, the number of longliners reporting catches of 1000 kg/year or more of spotted wolffish increased from 24 to 87 (Table 1). At the same time catches on longline increased from 700 to 2000 tonnes. Since then, the number of longliners reporting spotted wolffish catches decreased to around 60 vessels from 2008-2017, with an annual longline catch of around 1100 tonnes on average. The number of trawlers was 40-60 vessels in 2000-2017 with no trend observed. However, catches in demersal trawl from 2008 have been only about half of what they were in 2000-2007 (Table 1).

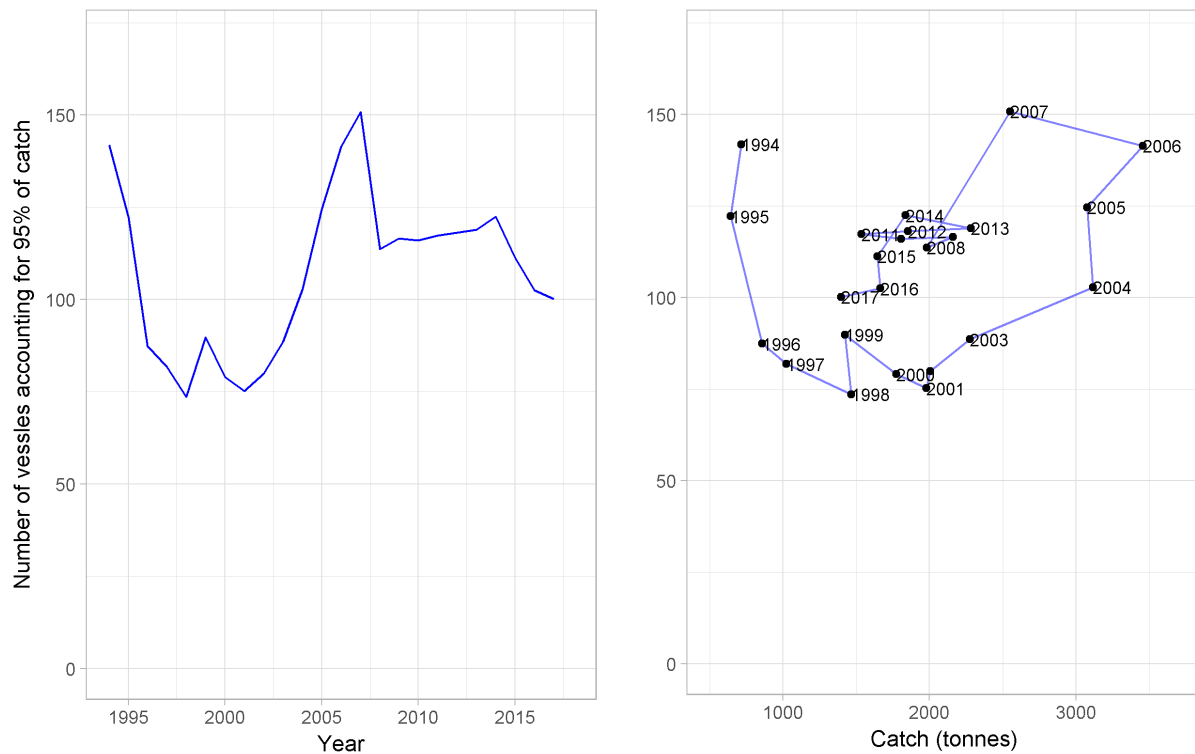
The increased targeting of longliners began in 1996 with a catch over 400 tonnes, but before that it was usually less than 100 tonnes annually. This increased effort could be related to the fact that in the fishing year 1996/97 its closely related species, Atlantic wolffish, was for the first time included in ITQ system.

**Table 1. Spotted wolffish. Number of Icelandic vessels reporting catch of 1000 kg/year or more, and all landed catch divided by gear type.**

**Tafla 1. Hlýri. Fjöldi íslenskra skipa sem veitt hefur 1000 kg eða meira af hlýra yfir árið og allur landaður afli eftir veiðarfærum.**

| YEAR | NUMBER OF VESSELS |                 |              | CATCHES (TONNES) |                       |              |            |
|------|-------------------|-----------------|--------------|------------------|-----------------------|--------------|------------|
|      | <i>Longline</i>   | <i>Trawlers</i> | <i>Other</i> | <i>Longline</i>  | <i>Demersal trawl</i> | <i>Other</i> | <i>Sum</i> |
| 2000 | 24                | 39              | 2            | 693              | 1149                  | 10           | 1852       |
| 2001 | 32                | 42              | 0            | 673              | 1399                  | 15           | 2087       |
| 2002 | 29                | 42              | 2            | 610              | 1463                  | 35           | 2108       |
| 2003 | 29                | 41              | 3            | 748              | 1618                  | 58           | 2424       |
| 2004 | 53                | 53              | 1            | 1409             | 1813                  | 59           | 3281       |
| 2005 | 71                | 45              | 3            | 1571             | 1631                  | 48           | 3250       |
| 2006 | 87                | 51              | 3            | 2041             | 1565                  | 35           | 3641       |
| 2007 | 84                | 44              | 1            | 1391             | 1258                  | 38           | 2687       |
| 2008 | 60                | 50              | 2            | 1069             | 990                   | 25           | 2084       |
| 2009 | 63                | 55              | 8            | 1243             | 1000                  | 49           | 2292       |
| 2010 | 56                | 54              | 8            | 1042             | 808                   | 51           | 1901       |
| 2011 | 63                | 49              | 6            | 934              | 642                   | 38           | 1614       |
| 2012 | 63                | 56              | 5            | 1124             | 761                   | 38           | 1923       |
| 2013 | 77                | 61              | 8            | 1575             | 788                   | 35           | 2398       |
| 2014 | 72                | 55              | 6            | 1180             | 714                   | 34           | 1928       |
| 2015 | 67                | 50              | 7            | 1005             | 740                   | 29           | 1774       |
| 2016 | 56                | 49              | 8            | 1031             | 727                   | 17           | 1775       |
| 2017 | 59                | 54              | 4            | 818              | 589                   | 18           | 1424       |

The number of vessels accounting for 95% of the annual catch of spotted wolffish has been in the range of 75-150 vessels (Figure 5). The number of vessels was relatively stable in 1996-2003, despite increased catches, but increased in 2004-2006 when annual catches exceeded 3000 tonnes. Since 2007, a drop in the number of vessels accounting for 95% of the catches has coincided with catch reductions (Figure 5).



**Figure 5. Spotted wolffish. Number of vessels (all gear types) accounting for 95% of the total catch annually since 1994. Left: Plotted against year. Right: Plotted against total catch. Data from the Directorate of Fisheries.**

*Mynd 5. Hlýri. Fjöldi skipa og báta (öllum veiðarfæri) sem veiddu 95% heildaraflans hvert ár frá 1994. Vinstri: Sýnt eftir árum. Hægri: Sýnt í samanburði við heildarafla. Gögn frá aflaskráningarkerfi Fiskistofu.*

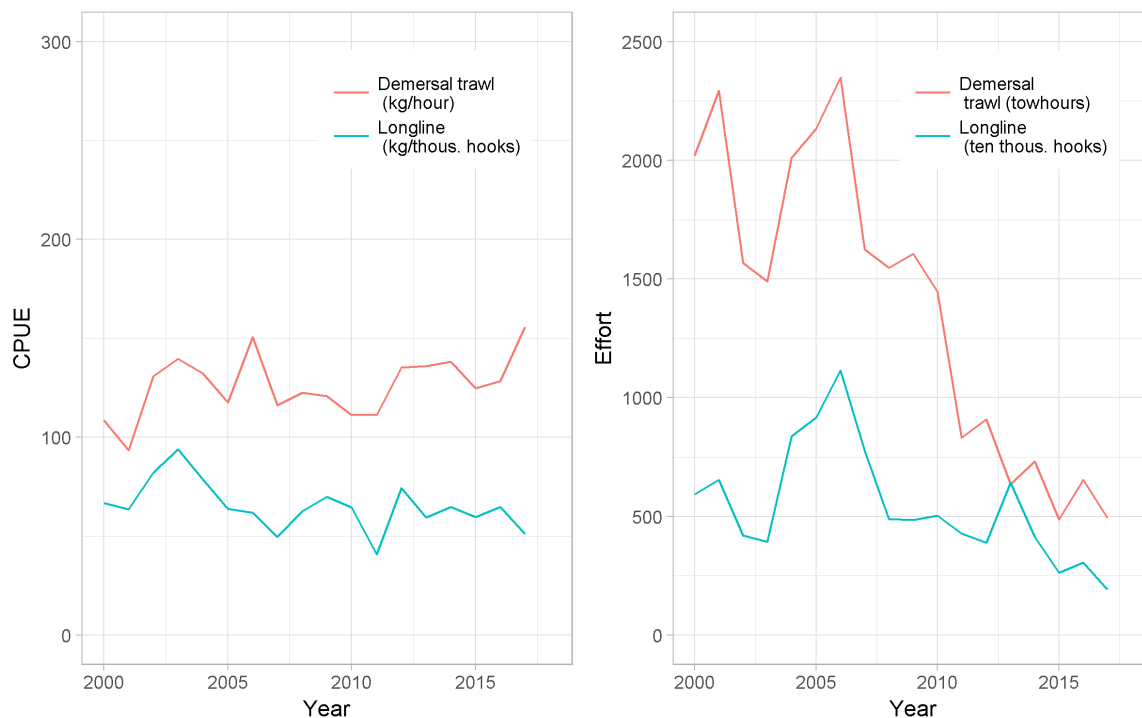
## CATCH PER UNIT EFFORT (CPUE) AND EFFORT.

CPUE estimates of spotted wolffish in Icelandic waters are not considered representative of stock abundance, as changes in fleet composition, technical improvements and differences in gear setup among other things have not been accounted for when estimating CPUE.

None-standardised estimates of CPUE of longline (kg/1000 hooks), and demersal trawl (kg/tow hour), was calculated as the total weight in sets or tows in which spotted wolffish was more than 10% of the catch, according to logbooks. Similarly, effort of demersal trawl was the number of tow hours and for longline number of hooks, in both cases data in which spotted wolffish was more than 10% of the catch.

The estimated longline CPUE has no clear trend; it was highest in 2003 (94 kg/1000 hooks) and lowest in 2011 (41 kg/1000 hooks). Estimates of CPUE from demersal trawl increased from about 100 kg/h in 2000-2001 to 110-156 kg/h in 2002-2017 (Figure 6).

Longline effort increased from 6 million hooks in 2000 to around 11 million in 2006, since then it has been decreasing and was in 2017 around 2 million hooks. The fishing effort of demersal trawl was in the range of 1500-2350 tow hours in 2000-2010. Since 2010 the effort has been decreasing and was around 500 tow hours in 2017 (Figure 6).



**Figure 6. Spotted wolffish. Non-standardised estimates of CPUE (left) from demersal trawl (kg/h, red) and longline (kg/1000 hooks, blue). Fishing effort (right) for demersal trawl (tows hours, red) and longline (10000 hooks, blue).**

*Mynd 6. Hlýri. Afli á sóknareiningu (vinstri) í botnvörpu (kg/togtími, rautt) og línu (kg/1000 krókar, blátt). Sókn (hægri) í botnvörpu (togtímar, rautt) og á línu (10000 krókar, blátt).*

## AGE DISTRIBUTION OF LANDED SPOTTED WOLFFISH

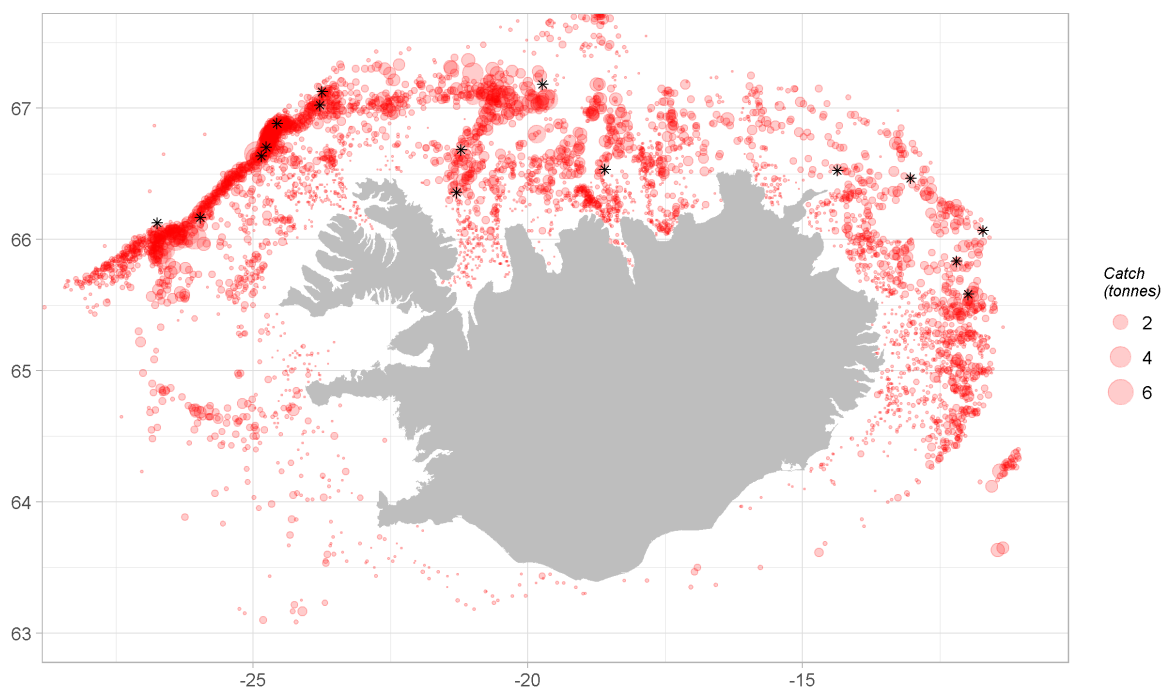
Around 400-1900 otoliths were sampled annually by the MRI, and in the last eight years 7-45 samples from longliners and 4-29 samples from demersal trawl were collected (Table 2, Figure 7). Samples were not taken from other gear, as they represent a very small proportion (~2%) of the total catch.

In 2015 and 2016 about 400 specimens was age all from samples from commercial catches in 2015. However, from then none have been aged. The estimated age range was between 5-16 years, age 8 and 9 years were most common or about 40%. The mean age was 9 years.

**Table 2. Spotted wolffish. Number of samples and otoliths sampled from landed catch.**

*Tafla 2. Hlýri. Fjöldi sýna og kvarnaðra fiska úr lönduðum afla.*

| Year | Longline |          | Demersal trawl |          |
|------|----------|----------|----------------|----------|
|      | Samples  | Otoliths | Samples        | Otoliths |
| 2010 | 7        | 295      | 8              | 355      |
| 2011 | 7        | 329      | 5              | 246      |
| 2012 | 9        | 432      | 10             | 451      |
| 2013 | 16       | 789      | 4              | 200      |
| 2014 | 45       | 1101     | 29             | 775      |
| 2015 | 19       | 475      | 20             | 500      |
| 2016 | 14       | 350      | 12             | 300      |
| 2017 | 8        | 200      | 9              | 225      |

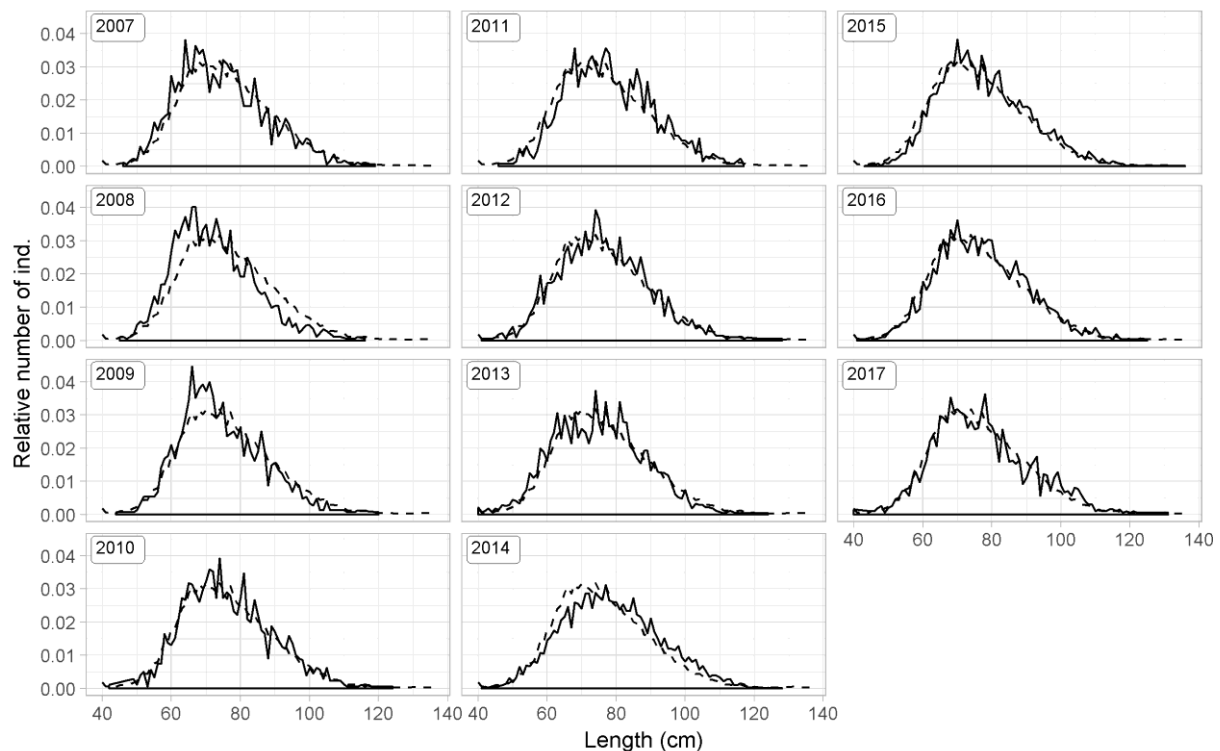


**Figure 7. Spotted wolffish. Fishing grounds in 2017 as reported in logbooks (red) and positions of samples taken from landings (asterisks).**

*Mynd 7. Hlýri. Veiðisvæði við Ísland árið 2017 samkvæmt afladagbókum (rautt) og staðsetningar sýna úr lönduðum afla (stjörnur).*

## LENGTH DISTRIBUTION OF LANDED SPOTTED WOLFFISH

The length range and mean length of spotted wolffish sampled from commercial catches has been similar between years. In 2017, the length range was 40-131 cm and the mean length 77.2 cm (Figure 8).



**Figure 8. Spotted wolffish. Length distribution of spotted wolffish sampled from landed catch. The dotted line represents the mean length distribution for all years.**

*Mynd 8. Hlýri. Lengdardreifing úr afláslýnum frá árinu 2007 með meðal lengdardreifingu fyrir öll árin (punktalína).*

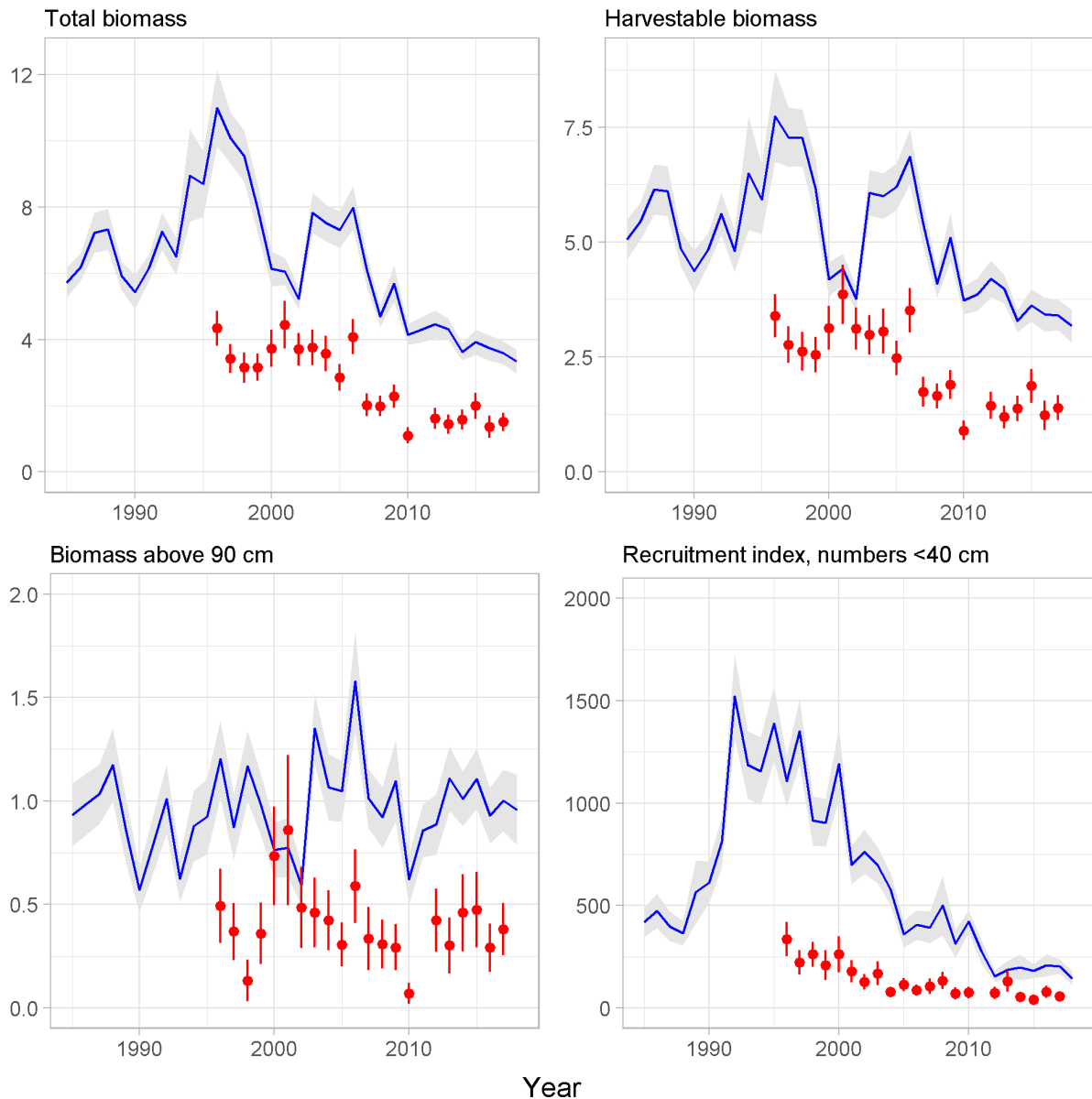
## SURVEY DATA

The Icelandic spring groundfish survey (hereafter spring survey, IS-SMB), which has been conducted annually in March since 1985, covers the most important distribution area of the spotted wolffish fishery. In addition, the Icelandic autumn groundfish survey (hereafter autumn survey, IS-SMH) was commenced in 1996 and expanded in 2000. However, a full autumn survey was not conducted in 2011 due to a labour dispute and therefore the results for 2011 are not presented. For spotted wolffish, the spring survey is considered to measure changes in abundance/biomass better than the autumn survey (Figure 9).

Indices of total biomass and harvestable biomass have been decreasing since 1996, except in the years 2003-2006, and are now at a historical low level.

The recruitment index was high in the years 1992-2000. Since then it decreased almost every year to a historically low level in 2012, wherefrom it has been similar.

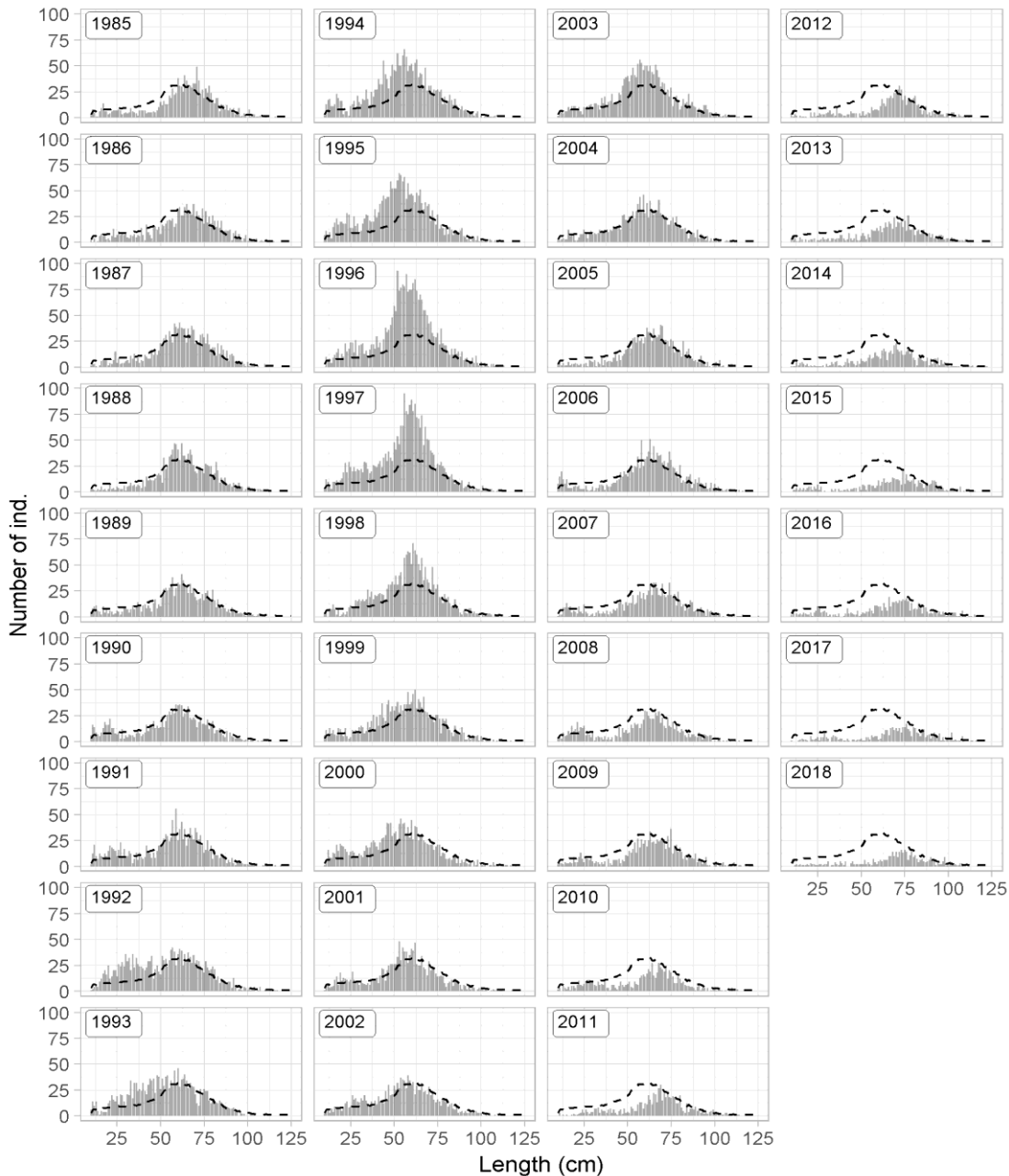




**Figure 9. Spotted wolffish. Total biomass indices (upper left) and harvestable biomass indices (>60 cm, upper, right), biomass indices of larger individuals (>90cm, lower left) and juvenile abundance indices (<40 cm, lower right) from the spring survey (blue) from 1985 and autumn survey (red) from 1996, along with the standard deviation.**

*Mynd 9. Hlýri. Stofnvísitala (efri til vinstri), vísitala veiðistofns (60 cm og stærri, efri til hægri) og vísitala stærri einstaklinga (90 cm og stærri, neðri til vinstri) og nýliðunarvísitala (<40 cm, neðri til hægri), úr stofnmælingu botnfiska að vori (blátt) frá árinu 1985 og hausti (rautt) frá árinu 1996, ásamt staðalfrávik.*

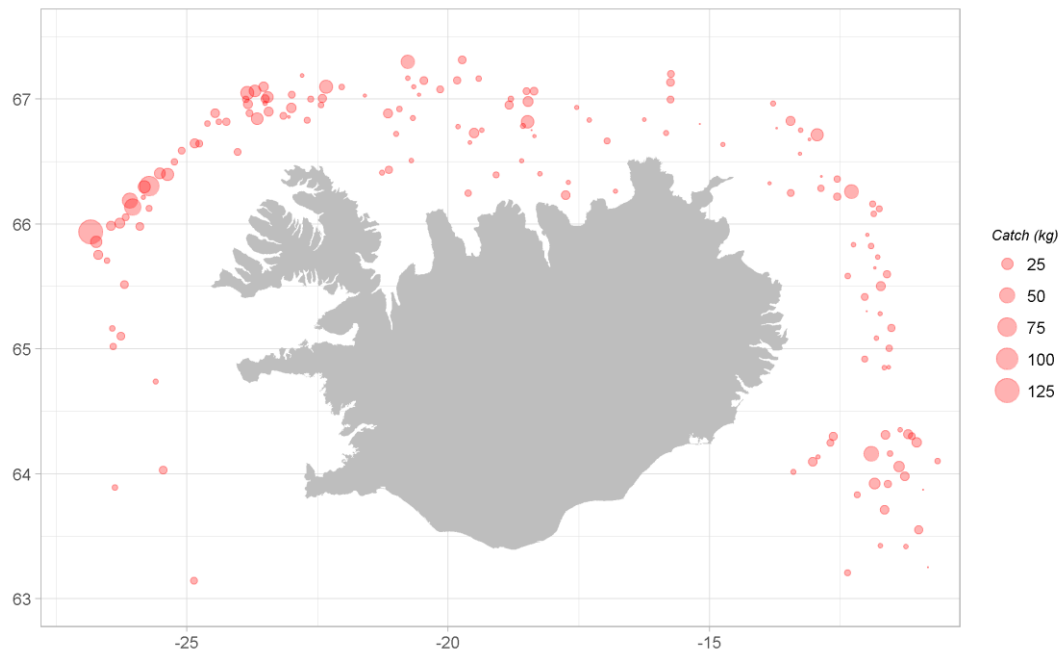
The mean length in spring survey decreased from 1986 (62.9 cm) to 1995 (52.1 cm) due to increased abundance of smaller fish (<60 cm) (Figure 10). Thereafter, the mean length has been increasing due to lower abundance of fish smaller than 60 cm. The number of spotted wolffish caught in the spring survey increased from 1273 fish in 1990 to 2744 fish in 1997. Since then the number has been declining and reached the lowest level in 2018 or 447 fish.



**Figure 10. Spotted wolffish. Length distribution from the spring survey. The dotted line shows mean length distribution for all years combined.**

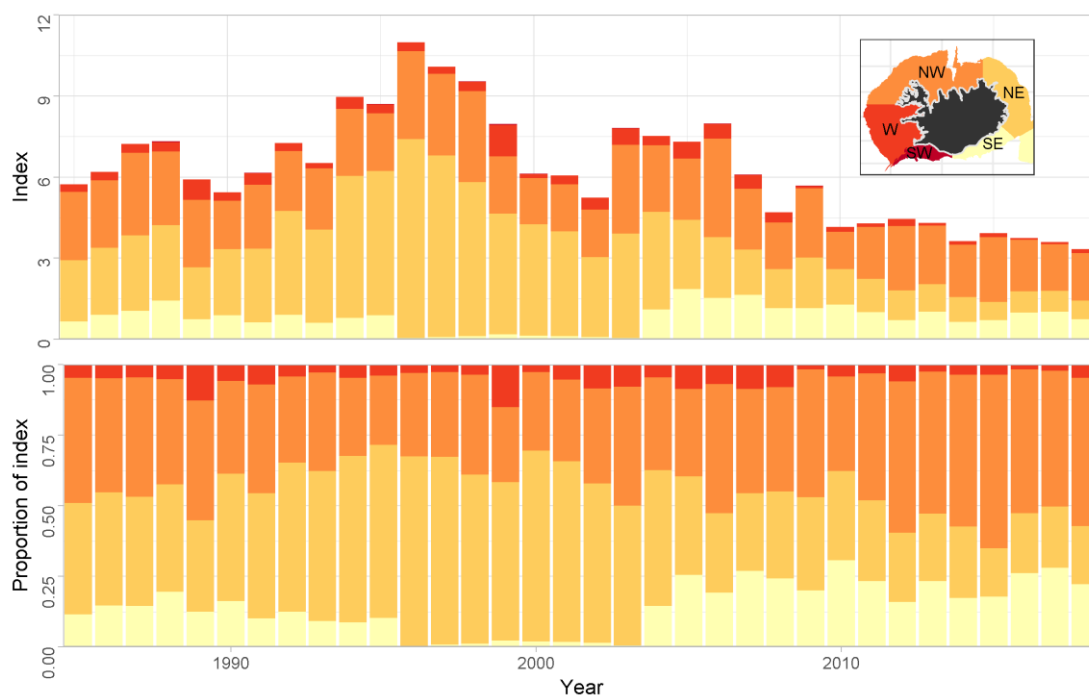
*Mynd 10. Hlýri. Lengdardreifing úr stofnmælingu botnfiska að vori frá 1985 ásamt meðal lengdardreifingu allra ára (punktalína).*

Since 2012, spotted wolffish has mostly been caught in the slope areas northwest and north of Iceland in the spring survey (Figure 11 and 12). Biomass indices from the NW area have relatively stable throughout the survey period. Greater changes have taken place in the NE area, where biomass increased in 1985-1996 but have decreased significantly since then (Figure 12). In 1996-2013 the Iceland-Faeroe ridge was not sampled in the spring survey, which seem to have resulted in 15-20% underestimation of the total biomass index for spotted wolffish.



**Figure 11. Spotted wolffish. Spatial distribution in the spring survey in 2018.**

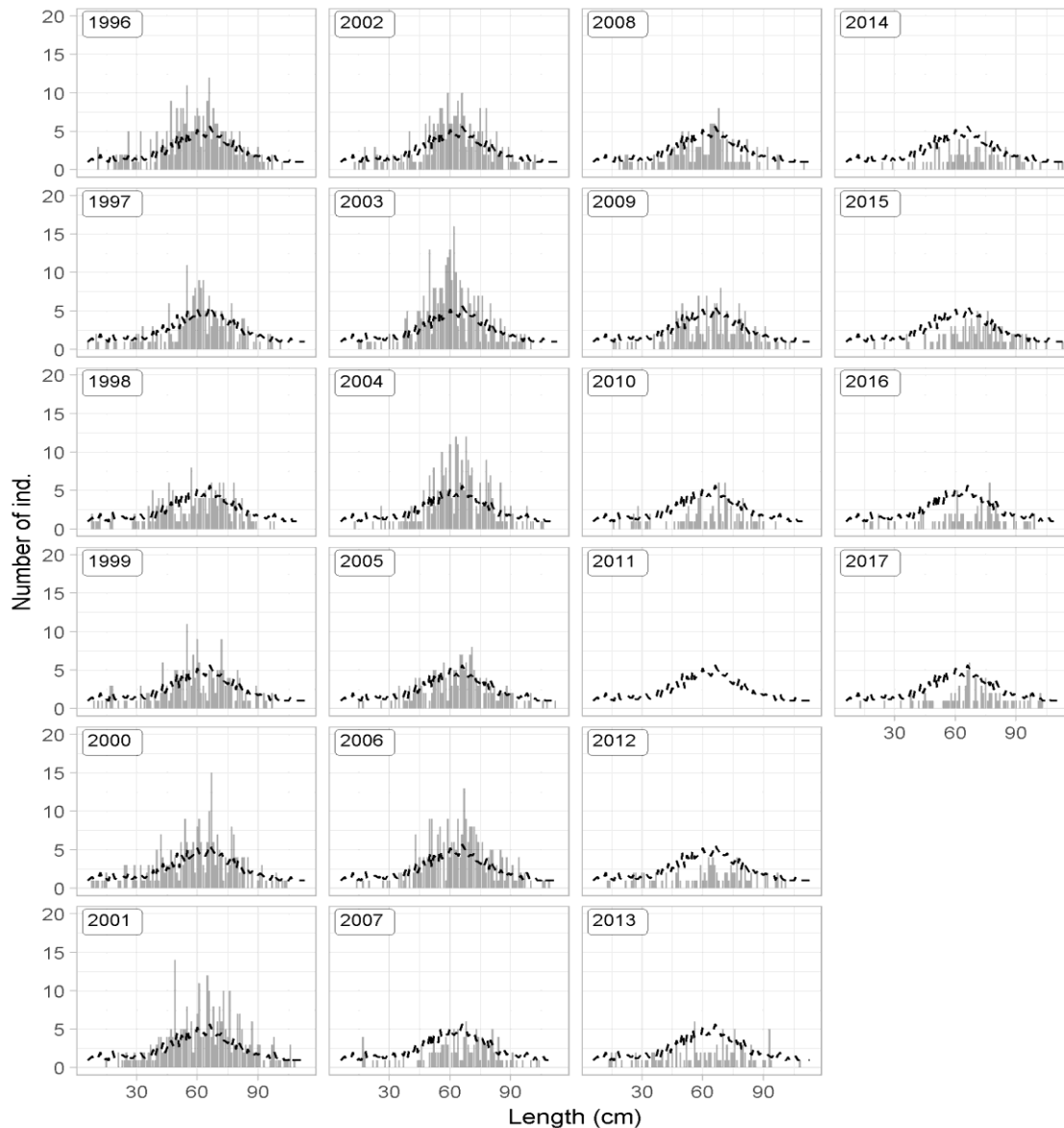
*Mynd 11. Hlýri. Útbreiðsla í stofnmælingu botnfiska að vori 2018.*



**Figure 12. Spotted wolffish. Spatial distribution of the index from the spring survey in 1985-2018.**

*Mynd 12. Hlýri. Dreifing vísitölu í stofnmælingu botnfiska að vori, árin 1985-2018.*

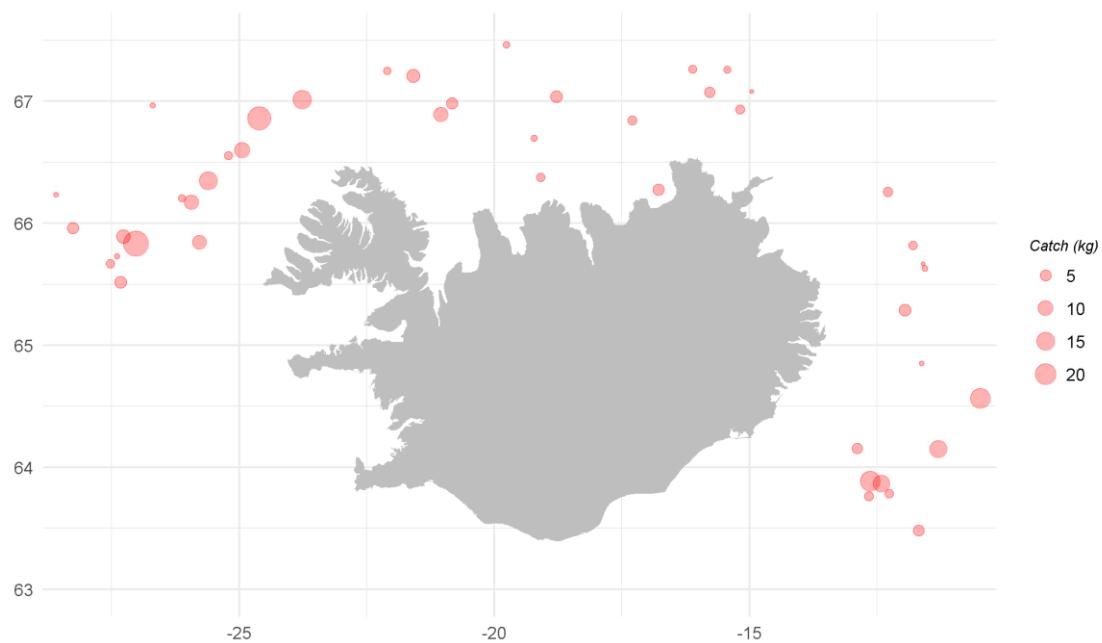
The mean length of spotted wolffish in the autumn survey has increased from 1996 (58.8 cm) to 2017 (68.2 cm). This is in accordance with the spring survey and the reason is decreased abundance of fish smaller than 60 cm (Figure 13). Number of spotted wolffish caught in the autumn survey was on the average 250 fish in the years 1996-2006. Since then the number has been decreasing and was on average 90 fish in the years 2010-2016, but 82 fish were caught in the 2017 survey.



**Figure 13. Spotted wolffish. Length distribution from the autumn survey. The dotted line shows mean length distribution for all years combined.**

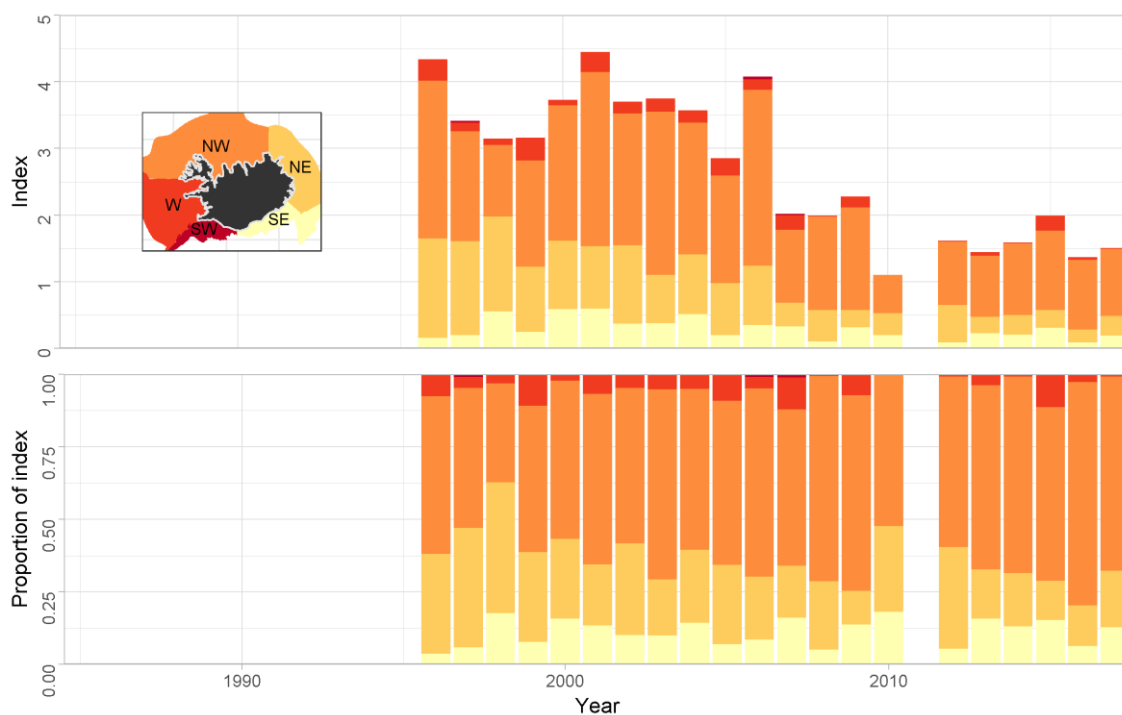
*Mynd 13. Hlýri. Lengdardreifing úr stofnmælingu botnfiska að hausti frá 1996 ásamt meðal lengdardreifingu allra ára (punktalína).*

The distribution of the catch is similar in the autumn and spring surveys, which may suggest a proximity between spawning and feeding grounds. Spotted wolffish spawn in late summer or autumn. However, in the years 1996-2003, a lower proportion of the autumn survey biomass was measured in the NE area as compared to the spring survey. Most spotted wolffish in the autumn survey in 2017 were caught at the slope areas northwest of Iceland (Figure 14 and 15).



**Figure 14. Spotted wolffish. Spatial distribution of spotted wolffish in 2017 in the autumn survey.**

*Mynd 14. Hlýri. Útbreiðsla í stofnmælingu botnfiska að hausti árið 2017.*



**Figure 15. Spotted wolffish. Spatial distribution of the index from the autumn survey in 1995-2017.**

*Mynd 15. Hlýri. Dreifing vísitölu í stofnmælingu botnfiska að hausti, árin 1995-2017.*

## MANAGEMENT AND ADVICE

The Ministry of Industries and Innovation is responsible for management of the Icelandic fisheries and implementation of legislation. Spotted wolffish has not been included in the ITQ system because its catch is mostly bycatch in other fisheries, mainly for cod. The MRI advised catch based on  $F_{proxy}$  for the first time in the fishing year 2012/2013. For the first four fishing years, the advice was based on average catch in the years 1985-1997 which was around 900 tonnes and the stock size was rather stable during these years. When advising catch for the fishing year 2016/2017, it was decided to use 70% of the average  $F_{proxy}$  of the years 2001-2015 as target  $F_{proxy}$ , but the biomass index from spring survey decreased about 20% at this time. Catches of spotted wolffish in the fishing years 2012/2013 to 2016/2017 were around 100% higher than recommended by MRI (Table 3).

**Table 3. Spotted wolffish. Recommended TAC, national TAC, and landings (tonnes).**

*Tafla 3. Hlýri. Tillögur Hafrannsóknastofnunar um hámarksafla, ákvörðun stjórnvalda um aflamark og landaður afli (tonn).*

| <b>FISHING YEAR</b> | <b>REC. TAC</b> | <b>NATIONAL TAC</b> | <b>CATCH</b> |
|---------------------|-----------------|---------------------|--------------|
| <b>2012/13</b>      | 900             | -                   | 2042         |
| <b>2013/14</b>      | 900             | -                   | 2250         |
| <b>2014/15</b>      | 900             | -                   | 1655         |
| <b>2015/16</b>      | 900             | -                   | 1913         |
| <b>2016/17</b>      | 1128            | -                   | 1587         |
| <b>2017/18</b>      | 1080            | -                   |              |
| <b>2018/19</b>      | 1001            |                     |              |

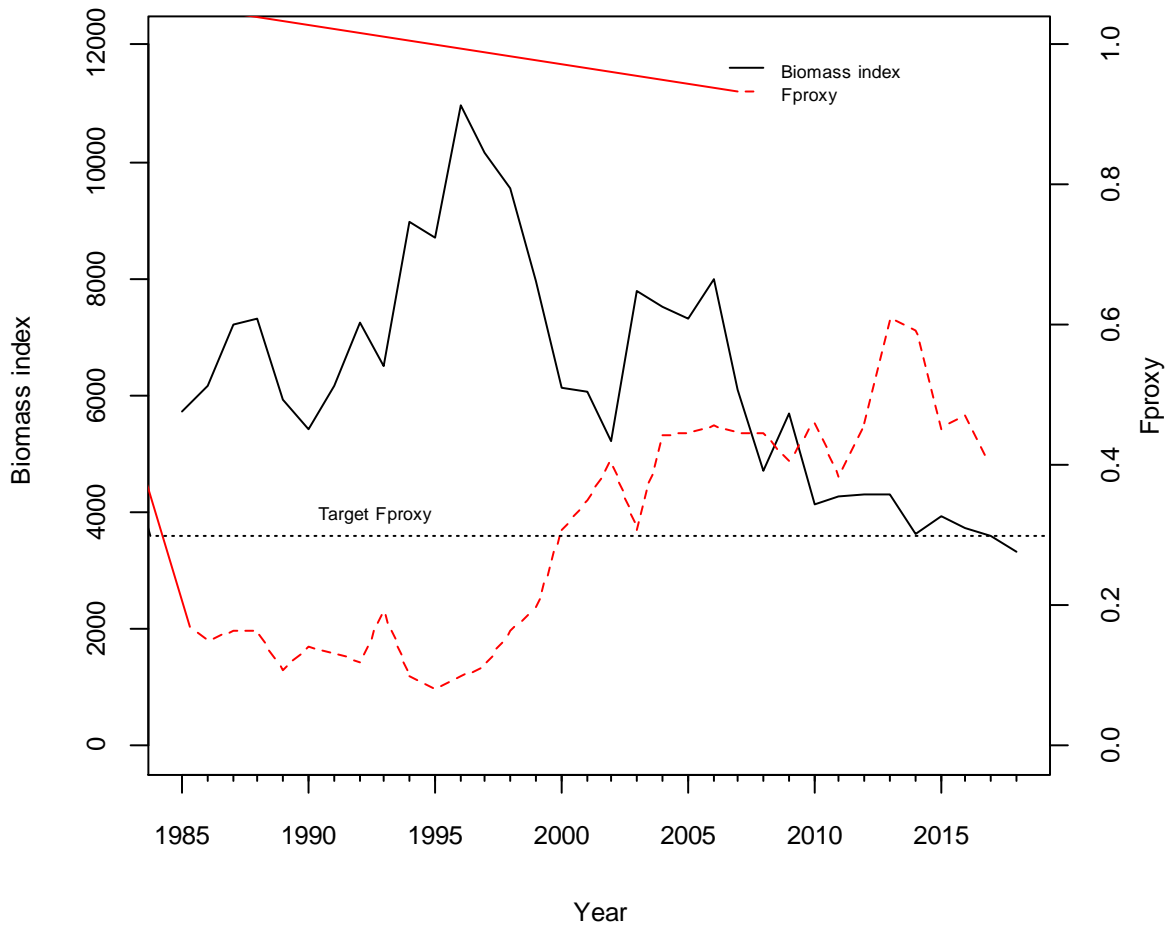
## ADVICE

This advice follows ICES framework for stocks where reliable stock biomass indices are available, but analytical age-length based assessments are not feasible. Spring survey biomass index with catch, is used to calculate  $F_{proxy}$  (catch/survey biomass) (Figure 16). The target  $F_{proxy}$  was defined as 70% of the mean from the reference period of 2001-2015, or 0.3. As the 2018 spring survey biomass was 3336, the MFRI advises that catches in the 2018/2019 fishing year should be no more than 1001 tonnes (Table 4).

**Table 4. Spotted wolffish. Advice calculations**

*Tafla 4. Hlýri. Útreikningur ráðgjafar*

|   |                            |
|---|----------------------------|
| Index 2018                                    | 3336                       |
| Target $F_{proxy}$                            | 0.3                        |
| Advice 2017                                   | 1080                       |
| Index 2018 x Target $F_{proxy}$ / Advice 2017 | 0.93                       |
| Uncertainty cap                               | Not applied                |
| Catch advice                                  | $3336 \times 0.3 = 1001$ t |



**Figure 16. Spotted wolffish.  $F_{\text{proxy}}$  (catch/survey biomass). The target  $F_{\text{proxy}}$  is set as the 70% of the mean of the reference period of 2001-2015.**

**Mynd 16. Hlýri. Vísitala veiðihlutfalls ( $F_{\text{proxy}} = \text{afli}/\text{vísitala}$ ). Markgildi ( $F_{\text{proxy}}$  target) byggir á 70% af meðaltali árunna 2001-2015.**