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Division 3M Northern shrimp (*Pandalus borealis*) – Interim Monitoring Update
By

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Abstract

This document updates some of the indices for northern shrimp (*Pandalus borealis*) harvested within NAFO Divisions 3M. The last assessment for this resource was completed, within Scientific Council in September 2019. Scientific Council recommended that there was sufficient evidence to allow a small amount of directed fishing on this stock. Considering the uncertainty about the future recruitments and the response of the resource to resumed exploitation, Scientific Council advised that the catch in 2020 should not exceed the 2009 level (5 448 t). The effort directed to the shrimp fishery and catches in the first half of 2020 were very low (2 days), and the biomass indices from EU survey decreased by 29%, breaking the upward trend of recent years. Despite the decrease in biomass the stock continue above B_{lim} and it is from 2018 outside the collapse zone defined by the NAFO PA framework. The total and female biomass indexes were 6 719 t and 6 038 t respectively. The abundance at age 2 from the main gear increased around 19%, this increase was very higher from the small bag attached on the cod-end, recording the second highest value in the series and it could indicate the improvement of recruitment in 2020. This year class will be totally recruited to the shrimp stock in 2021 and it would improve the state of impaired recruitment of the last years. Considering the uncertainty about the future recruitments in the fishable stock the next years, Scientific Council advises that the catch in 2021 should not exceed the 2009 level (5 448 tonnes).

UE Bottom Trawl Research Survey Trends

Summer multi-species research surveys have been conducted onboard the Spanish vessels R/V Cornide de Saavedra since 1988 and R/V Vizconde de Eza since 2003. From 1988 to 2002 the indexes estimated by the R/V Cornide de Saavedra were calibrated and transformed to the R/V Vizconde de Eza following the Warren's method. Fishing sets of 30 minute duration, with a tow speed of 3 knots, were randomly allocated to strata covering the Flemish Cap Bank to a depth of 1462 m since 2004, with the number of sets in a stratum proportional to its size (Figure 1). Both vessels used the same gear (Lofoten) with a codend mesh size of 35 mm. In order to obtain information about the juvenile fraction of the stock, since 2001 a small bag with 10 mm mesh size was attached to the cod-end of the Lofoten gear. Different sensors (SIMRAD ITI, SCANMARK, MARPORT) were employed along the historical surveys to monitor the net geometry. Details of the survey design and fishing protocols are outlined in (Casas, 2008).

In 2020 the survey was carried out from 1 to 30 July. As previous years, the area prospected in Flemish Cap was spread up to 1450 meters. The haul number carried out in the traditional 19 strata with depths minor than 740 m. was of 120. The area with depths higher than 740 m. was sampled by means of 61 additional hauls proportionally distributed in the new 13 strata.

The increasing of shrimp biomass from 1988 to 1992, coincided with a period of time where there was not a directed fishery to shrimp and the cod stock began to decline. With the beginning of the shrimp fishery in 1993 the biomass declined up to 1997. After that from 1998 to 2008 the stock recovered reasonably well although with high annual variability (historical maximums in 2002 and 2005 were followed by years with lower



biomass but at a relative high level). In 2009 the biomass markedly decreased with values close to the lowest of the historical series in that year. In 2010 despite of the biomass increase about 77% compared to 2009 this was still among the lowest in the total of the historical series. From 2011 to 2014 the total and female biomass decreased successively and were recorded the lowest values in the historical series showing the worsening and depletion state of the shrimp stock. Since 2015 the biomass indexes increased year after year and they are above B_{lim} from 2018 (Figure 2). The total and female biomasses estimated in 2020 were 6727 t and 6032 t respectively (Table 1). Just as the increase in shrimp biomass was associated with the worsening and decrease in the biomass of cod and redfish stocks, the decrease in biomass of shrimp in 2020 coincides with the increase in biomass of these same stocks (Figure 3).

The biomass estimated in 2020 was mainly represented by female and big specimens with sizes around 19-27 mm (Figure 4); Young specimens (mainly males) increased (around 15% in number) compared to 2019 but remain well below average.

Considering the abundance at age 2 as indicator of recruitment, the number of shrimp of two years old in the survey and from juvenile bag were estimated and the index average-weighted (Table 2, Figure 5a). Since 2005, both indices showed low values indicating the succession in recent years of weak year classes. In 2020 the abundance at age 2 (around 15 mm CL) increased by 19% compared to 2019. This increase was supported by the high catches recorded from the small mesh size bag attached on the cod-end where the second highest value in the historical series was recorded and it could indicate the improvement of recruitment in 2020 and 2021.

The youngest specimens (age 1, around 8 mm CL) do not appeared in the catches of the main gear but they were present in the small mesh size bag attached on the cod-end. However, the estimated abundance for these specimens (2019 year class) was very lower than last year, suggesting a weaker year class (Figure 5b).

Fishery and Management

Catch trends

The fishery for northern shrimp at Flemish Cap began in the spring of 1993 and has since continued with estimated annual catches (as estimated by STACFIS, Table 3 and Figure 6) of approximately 26 000 t to 48 000 t in the years 1993 through 1996. After 1996 the catches were lower and rising slowly from 26 000 t in 1997 to 53 000 t in 2000 and 2001. There was 50 000 t taken in 2002. The catch increased in 2003, reaching the highest value in the catches series (64 000 t), declining in the following years to about 1 766 t in 2010. Since 2011 following the NAFO SC recommendation no effort was directed to shrimp fishery in Flemish Cap and in 2020 the NAFO Scientific Council advised to resume the shrimp fishery with catches not exceeding the 2009 level (5 448 t). However, preliminary data in 2020 in the first half of the year shows a very low effort (2 days) direct to shrimp. Preliminary removals to July 2020 can be considered residuals 0.067 t.

Exploitation rate

Considering the Exploitation rate estimated as nominal catches divided by the EU survey biomass index of the same year (Table 4 and Figure 7), this was high in the years 1994-1997 when biomass was generally lower. In the years 1998-2004 the catch rate has been rather stable at a lower level. From 2005 to 2008 despite the exploitation rate remained stable at relative low values (between 1.9-1.5), the UE survey indexes estimated decreased year after year. This trend continued in the following years despite the moratorium established on 3M shrimp stock from 2011. From 2015 there has been a change in the downward trend and the survey indexes increased successively. In 2020, although the fishery was resumed, the effort directed to shrimp fisheries and catches were residual.

In October 2011 Scientific Council notes that there are indications of factors other than fishery that may be involved in the evolution of the stock.

Effort and TAC regulation

The shrimp fishery in 3M is actually managed by effort regulation and new information of catch rates and the posterior standardizing CPUE are needed to provide annual indices of stock biomass related with the stock exploitation.

From 2011 meeting, Scientific Council (NAFO 2011) noted the stock was at very low level in the time series: bellow B_{lim} and remaining in a state of impaired recruitment. Therefore, Scientific Council recommended that fishing mortality be set as close to zero as possible. In 2019 after five years of continuous increases of biomass the stock was well above B_{lim} NAFO SC advised to resume the fishery in 2020 with catches not to exceed 2009 level (5 448 t). Finally at the annual meeting in September 2019, NAFO FC agreed to re-open the shrimp fishery by regulating the effort with 2640 days.

The SC noted at the SC/NIPAG meeting in November last year its concern about the goodness of effort regulation for shrimp on 3M in a context of mixed fisheries managed by quotas and TACs, as well as the difficulty to include the “technology creep” as one relevant factor to include in the analyses of the CPUE series with more than 10 years. (Palomares et al. 2019). With the resumed exploitation in 2020, in a medium term it can be carried out the assessment that will permit a sustainable management method based on quota or TACs allocation that it would allow overcome those problems.

From EU Survey summer in 2020, although the shrimp biomass decreased by 29% compared to 2019, it remains above B_{lim} . Considering the uncertainty about the future recruitments in the fishable stock the next years, Scientific Council advises that the catch in 2021 should not exceed the 2009 level (5 448 tonnes).

Shrimp predation by cod and redfish

From 2015 to 2019, the incipient recovery of the shrimp stock coincided with the decline of redfish and cod stocks suggesting that the historic evolution of shrimp biomass may also not be related only to fishing mortality. Accordance to this, studies based in multispecies model developed in Gadget which covers the main commercial stocks in Flemish Cap over the period 1988-2012 (Pérez-Rodríguez et al. 2016) and 1988-2016 (Pérez-Rodríguez and D. González-Troncoso 2018), suggested that, predation by redfish and cod, together with fishing have been the main factors driving the shrimp stock to the collapse (Figure 2). The decline of the shrimp stock in Flemish Cap in 2020 coincides once again with the recovery of redfish and cod stocks and the consequent increase of the predation mortality on shrimp.

Conclusions

The Female biomass index decreased 29% in 2020 but remains above B_{lim} proxy. There are indications of the improvement in recruitment in the 2020 survey data. These small shrimp could potentially add to the fishable stock in 2021 and 2022. Considering the uncertainty about the future recruitments and the response of the resource to resumed exploitation, Scientific Council advises that the catch in 2021 should not exceed the 2009 level (5 448 tonnes).

References

Casas, J. M. 2008. Northern Shrimp (*Pandalus borealis*) on Flemish Cap Surveys 2007. NAFO SCR Doc.08/ 68, Serial No.N5600.

Palomares, M. L. D., and D. Pauly. 2019. On the creeping increase of vessels' fishing power. Ecology and Society 24(3):31. <https://doi.org/10.5751/ES-11136-240331>

Pérez-Rodríguez, A.; Howell, D.; Casas, M.; Saborido-Rey, F.; Ávila-de Melo, A. 2016. Dynamic of the Flemish Cap commercial stocks: use of a gadget multispecies model to determine the relevance and synergies between predation, recruitment and fishing. (doi: 10.1139/cjfas-2016-0111).

Pérez-Rodríguez, A. and D. González-Troncoso. 2018. Update of the Flemish Cap multispecies model GadCap as part of the EU SC05 project: “Multispecies Fisheries Assessment for NAFO”. NAFO SCR Doc.18/024, Serial No.N6808.

Table 1. Total and Female Biomass (tons) of shrimp estimated by swept area method in the years 1988-2020 on EU Flemish Cap surveys.

| Year | Total Biomass (t) | Total Mean Catch per tow (kg) | Female Biomass (t) | Female Mean Catch per tow (kg) |
|-------------------|-------------------|-------------------------------|--------------------|--------------------------------|
| 1988 | 5615 | 6.98 | 4525 | 5.63 |
| 1989 | 2252 | 2.80 | 1359 | 1.69 |
| 1990 | 3405 | 4.23 | 1363 | 1.69 |
| 1991 | 11352 | 14.12 | 6365 | 7.91 |
| 1992 | 24508 | 30.48 | 15472 | 19.24 |
| 1993 | 11673 | 14.52 | 6923 | 8.61 |
| 1994 ¹ | 3879 | 4.82 | 2945 | 3.66 |
| 1995 | 7276 | 9.05 | 4857 | 6.04 |
| 1996 | 10461 | 13.01 | 5132 | 6.38 |
| 1997 | 7449 | 9.26 | 4885 | 6.07 |
| 1998 ² | 39367 | 48.95 | 11444 | 14.23 |
| 1999 | 24692 | 30.70 | 13669 | 17.00 |
| 2000 | 19003 | 23.63 | 10172 | 12.65 |
| 2001 | 27204 | 33.83 | 13336 | 16.58 |
| 2002 | 36510 | 45.40 | 17091 | 21.25 |
| 2003 | 21087 | 26.22 | 11589 | 14.41 |
| 2004 | 20182 | 25.10 | 12081 | 15.02 |
| 2005 | 30675 | 38.14 | 14381 | 17.88 |
| 2006 | 16235 | 20.19 | 11359 | 14.27 |
| 2007 | 17046 | 21.20 | 12843 | 15.97 |
| 2008 | 11092 | 13.79 | 8630 | 10.73 |
| 2009 | 2797 | 3.48 | 1764 | 2.19 |
| 2010 | 4894 | 6.09 | 3819 | 4.31 |
| 2011 | 1621 | 2.02 | 1132 | 1.39 |
| 2012 | 1055 | 1.31 | 791 | 0.98 |
| 2013 | 844 | 1.05 | 691 | 0.86 |
| 2014 | 900 | 1.12 | 716 | 0.89 |
| 2015 | 1551 | 1.93 | 1079 | 1.34 |
| 2016 | 2520 | 3.08 | 1982 | 2.46 |
| 2017 | 2885 | 3.54 | 2304 | 2.86 |
| 2018 | 4394 | 5.31 | 4051 | 4.90 |
| 2019 | 9273 | 11.53 | 8486 | 10.55 |
| 2020 | 6719 | 8.35 | 6038 | 7.51 |

Table 2. Abundance indices at age 1 and 2 from the EU survey main gear (Lofoten) and small mesh size bag attached on the cod-end (juvenile bag). Each series was standardized to its mean.

| Year | Lofoten gear | | | | Juvenile bag | | | |
|------|--------------|-----------|----------|-----------|--------------|-----------|--------|-----------|
| | Age 1 | | Age 2 | | Age 1 | | Age 2 | |
| | ('00000) | Av. pond. | ('00000) | Av. pond. | ('000) | Av. pond. | ('000) | Av. pond. |
| 1996 | 0 | 0.00 | 3424 | 1.05 | | | | |
| 1997 | 0 | 0.00 | 695 | 0.21 | | | | |
| 1998 | | 0.00 | | | | | | |
| 1999 | 13 | 0.14 | 4735 | 1.45 | | | | |
| 2000 | 94 | 1.03 | 1148 | 0.35 | | | | |
| 2001 | 27 | 0.30 | 3711 | 1.14 | 380 | 0.06 | 1361 | 0.26 |
| 2002 | 1806 | 19.75 | 11004 | 3.37 | 6044 | 0.90 | 2125 | 0.41 |
| 2003 | 146 | 1.59 | 13869 | 4.24 | 48165 | 7.21 | 0 | 0.00 |
| 2004 | 0 | 0.00 | 27415 | 8.39 | 2314 | 0.35 | 41818 | 8.06 |
| 2005 | 0 | 0.00 | 1792 | 0.55 | 9515 | 1.42 | 3741 | 0.72 |
| 2006 | 0 | 0.00 | 809 | 0.25 | 953 | 0.14 | 7498 | 1.45 |
| 2007 | 0 | 0.00 | 282 | 0.09 | 5123 | 0.77 | 3824 | 0.74 |
| 2008 | 0 | 0.00 | 473 | 0.14 | 5916 | 0.88 | 4969 | 0.96 |
| 2009 | 6 | 0.07 | 1514 | 0.46 | 1504 | 0.22 | 3011 | 0.58 |
| 2010 | 77 | 0.84 | 1106 | 0.34 | 6102 | 0.91 | 954 | 0.18 |
| 2011 | 2 | 0.03 | 611 | 0.19 | 1050 | 0.16 | 2440 | 0.47 |
| 2012 | 0 | 0.00 | 216 | 0.07 | 42 | 0.01 | 160 | 0.03 |
| 2013 | 10 | 0.11 | 63 | 0.02 | 195 | 0.03 | 102 | 0.02 |
| 2014 | 1 | 0.01 | 242 | 0.07 | 239 | 0.04 | 56 | 0.01 |
| 2015 | 0 | 0.00 | 1111 | 0.34 | 61 | 0.01 | 427 | 0.08 |
| 2016 | 2 | 0.03 | 230 | 0.07 | 1592 | 0.24 | 390 | 0.08 |
| 2017 | 0 | 0.00 | 676 | 0.21 | 6669 | 1.00 | 1411 | 0.27 |
| 2018 | 0 | 0.00 | 1048 | 0.32 | 327 | 0.05 | 552 | 0.11 |
| 2019 | 9 | 0.10 | 1010 | 0.31 | 31594 | 4.73 | 3536 | 0.68 |
| 2020 | 0 | 0.00 | 1276 | 0.39 | 5912 | 0.88 | 25332 | 4.89 |

Table 3. Annual nominal catches (mt) by country of northern shrimp (*Pandalus borealis*) caught in NAFO Div. 3M.

| Nation | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011* | 2012* | 2013* | 2014* | 2015* | 2016* | 2017* | 2018* | 2019* | 2020 | | |
|-------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|-------------------|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------|--|
| Canada | 3724 | 1041 | 970 | 906 | 807 | 484 | 490 ² | 618 ² | 295 ¹ | 16 | | | | 10 ¹ | | | | | | | | | | | | | | | 0.1 ³ | |
| Cuba | | | | | | | 119 | 46 ¹ | 1037 ¹ | 1537 ¹ | 1462 ¹ | 969 ¹ | 964 ¹ | 1126 ¹ | 446 ¹ | 11 | | | | | | | | | | | | | | |
| EU/Estonia | | 1081 | 2092 | 1900 | 3240 | 5694 | 10835 ¹ | 13256 ² | 9851 ¹ | 14215 ² | 12851 ¹ | 13444 ¹ | 12009 ¹ | 8466 ² | 10607 ² | 10255 ² | 2152 ² | 266 ² | | | | | | | | | | | | |
| EU/Denmark | 800 | 400 | 200 | | | 437 | 235 | | 93 ¹ | 359 ¹ | | | | | | | | | | | | | | | | | | | | |
| EU/Latvia | | 300 | 350 | 1940 | 997 ¹ | 1191 ¹ | 3080 ¹ | 3105 ¹ | 2961 ¹ | 1892 ¹ | 3533 ¹ | 3059 ¹ | 2212 ¹ | 1330 ¹ | 1939 ¹ | 1285 ¹ | 1194 ¹ | 611 ¹ | | | | | | | | | | | | |
| EU/Lithuania | | 1225 | 675 | 2900 | 1785 ¹ | 3107 ¹ | 3370 ¹ | 3529 ¹ | 2701 ¹ | 3321 ¹ | 3744 ¹ | 4802 ¹ | 3652 ¹ | 1245 ¹ | 1992 ¹ | 485 ¹ | | | | | | | | | | | | | | |
| EU/Poland | | | | | 824 | 148 ¹ | 894 ¹ | 1692 ¹ | 209 ¹ | | | 1158 ¹ | 458 ¹ | 224 ¹ | | | | | | | | | | | | | | | | |
| EU/Portugal | 300 | | 150 | | 170 ¹ | 203 ¹ | 227 ¹ | 289 ¹ | 420 ¹ | 16 ¹ | | 50 ¹ | | | | | | 3 | | | | | | | | | | | | |
| EU/Spain | 240 | 300 | 158 | 50 | 423 ¹ | 912 ¹ | 1020 ¹ | 1347 ¹ | 855 ¹ | 674 ¹ | 857 ¹ | 1049 ² | 725 ² | 997 ² | 768 ¹ | 406 ² | 537 ¹ | 507 ² | | | | | | | | | | | | |
| EU/United Kingdom | | | | | | | | | | | 547 ¹ | | | | | | | | | | | | | | | | | | | |
| Faroe Is. | 7333 | 6791 | 5993 | 8688 | 7410 | 9368 | 9199 | 7719 ² | 10228 ² | 8516 ² | 12676 ² | 4952 ¹ | 2457 ¹ | 1102 ¹ | 2303 ¹ | 1201 | 1349 ¹ | 495 ¹ | | | | | | | | | | | | |
| France (SPM) | | | | | 150 | | | 138 ¹ | 337 ¹ | 161 ¹ | | | 487 | | 741 ¹ | | 193 ¹ | | | | | | | | | | | | | |
| Greenland | 3788 ¹ | 2275 ¹ | 2400 ¹ | 1107 ¹ | 104 ¹ | 866 ¹ | 576 ¹ | 1734 ¹ | | 644 ¹ | 1990 ² | | 12 ¹ | 778 ² | | | | | | | | | | | | | | | | |
| Iceland | 2243 | 2355 ¹ | 7623 | 20680 ¹ | 7197 ¹ | 6572 ¹ | 9277 ² | 8912 ² | 5265 ² | 5754 ¹ | 4715 ¹ | 3567 ¹ | 4014 ¹ | 2099 ¹ | | | | | | | | | | | | | | | | |
| Japan | | | | | | | | 114 ¹ | 130 | 100 ¹ | 117 ¹ | | | | | | | | | | | | | | | | | | | |
| Norway | 7183 | 8461 | 9533 | 5683 | 1831 ¹ | 1339 ¹ | 2975 ¹ | 2669 ² | 12972 ¹ | 11833 ¹ | 21238 ¹ | 11738 ¹ | 223 ¹ | 890 ² | 1914 ¹ | 321 ² | | | | | | | | | | | | | | |
| Russia | | 350 | 3327 | 4445 | 1090 | | 1142 | 7070 ¹ | 5687 ¹ | 1176 ¹ | 3 ¹ | 654 ¹ | 266 ¹ | 46 ¹ | 73 ¹ | 21 ¹ | 20 ¹ | 7 ¹ | | | | | | | | | | | | |
| Ukraine | | | | | | | | | 348 ¹ | | 237 ¹ | 315 ¹ | | 282 ¹ | | | | | | | | | | | | | | | | |
| USA | | | | | | | | 629 ¹ | | | | | | | | | | | | | | | | | | | | | | |
| Total | 25611 | 24579 | 33471 | 48299 | 26028 | 30321 | 43439 | 52867 | 53389 | 50214 | 63970 | 45757 | 27479 | 18595 | 20741 | 13985 | 5448 | 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1³ | |

¹ NAFO Statlant 21 A

² From the fisheries biologist of respective countries

³ Reported to NAFO provisionally

* Moratorium



Table 4 Exploitation Rate of Shrimp (Div. 3M) as Nominal Catches (tons) divided by UE Survey Female Index (tons).

| Year | Nominal Catches | UE Survey Female Index | Exploitation Rate |
|-------|-----------------|------------------------|-------------------|
| 1993 | 25611 | 6923 | 3.7 |
| 1994 | 24579 | 2945 | 8.3 |
| 1995 | 33471 | 4857 | 6.9 |
| 1996 | 48299 | 5132 | 9.4 |
| 1997 | 26028 | 4885 | 5.3 |
| 1998 | 30321 | 11444 | 2.6 |
| 1999 | 43439 | 13669 | 3.2 |
| 2000 | 52867 | 10172 | 5.2 |
| 2001 | 53389 | 13336 | 4.0 |
| 2002 | 50214 | 17091 | 2.9 |
| 2003 | 63970 | 11589 | 5.5 |
| 2004 | 45757 | 12081 | 3.8 |
| 2005 | 27479 | 14381 | 1.9 |
| 2006 | 18595 | 11359 | 1.6 |
| 2007 | 20741 | 12843 | 1.6 |
| 2008 | 13985 | 8630 | 1.6 |
| 2009 | 5448 | 1764 | 3.1 |
| 2010 | 1988 | 3819 | 0.5 |
| 2011* | 0 | 1132 | 0.0 |
| 2012* | 0 | 791 | 0.0 |
| 2013* | 0 | 691 | 0.0 |
| 2014* | 0 | 716 | 0.0 |
| 2015* | 0 | 1079 | 0.0 |
| 2016* | 0 | 1982 | 0.0 |
| 2017* | 0 | 2304 | 0.0 |
| 2018* | 0 | 4051 | 0.0 |
| 2019* | 0 | 8486 | 0.0 |
| 2020 | 0.067 | 6038 | ≈0.0 |

*moratorium on fishing shrimp in 3M



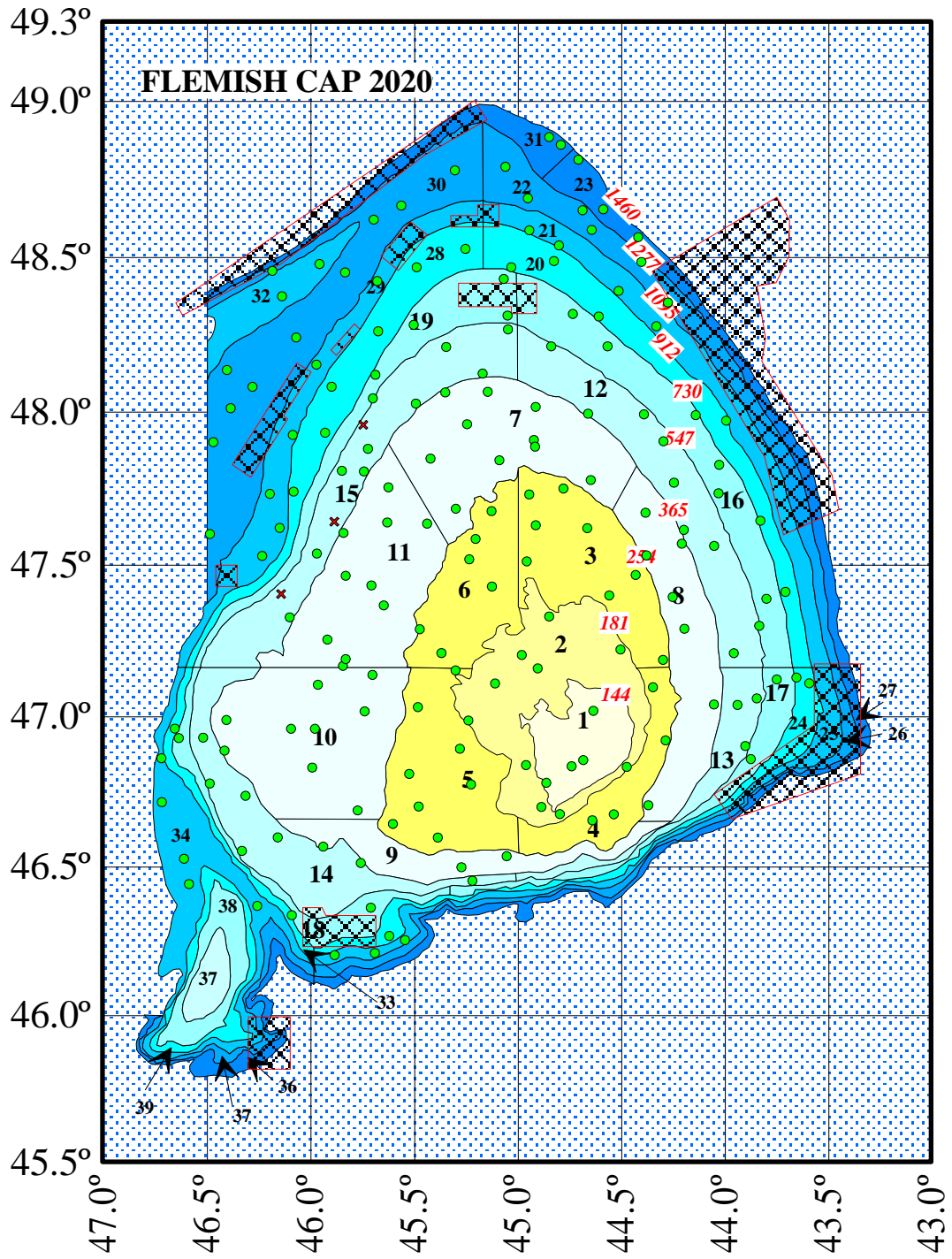


Figure 1. Chart with the positions of the hauls carried out in EU Flemish Cap survey 2020.

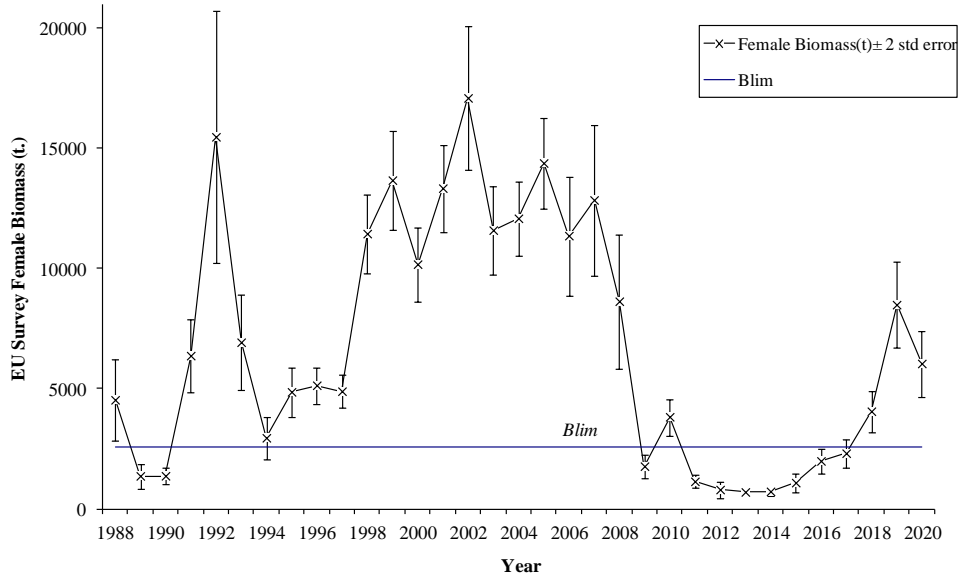


Figure 2. EU survey female shrimp biomass in the years 1988-2020 on Flemish Cap and *Blim* proxy of 3M shrimp stock.

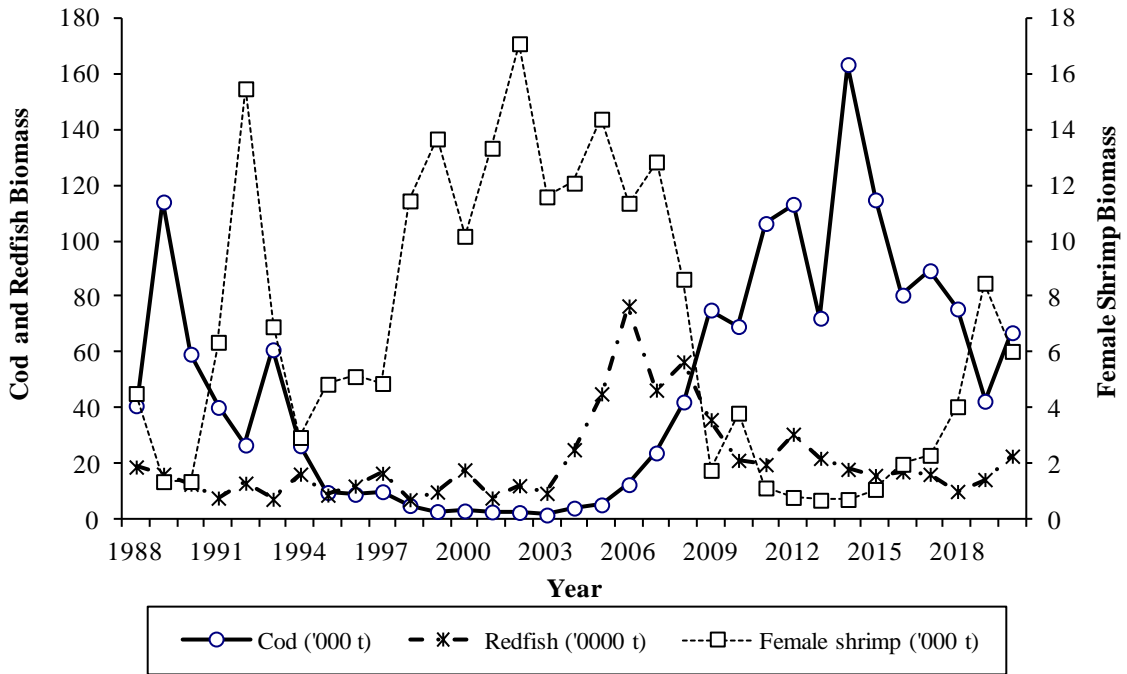


Figure 3. Cod, Redfish and Female shrimp biomass from EU trawl surveys on Flemish Cap, 1988-2020.

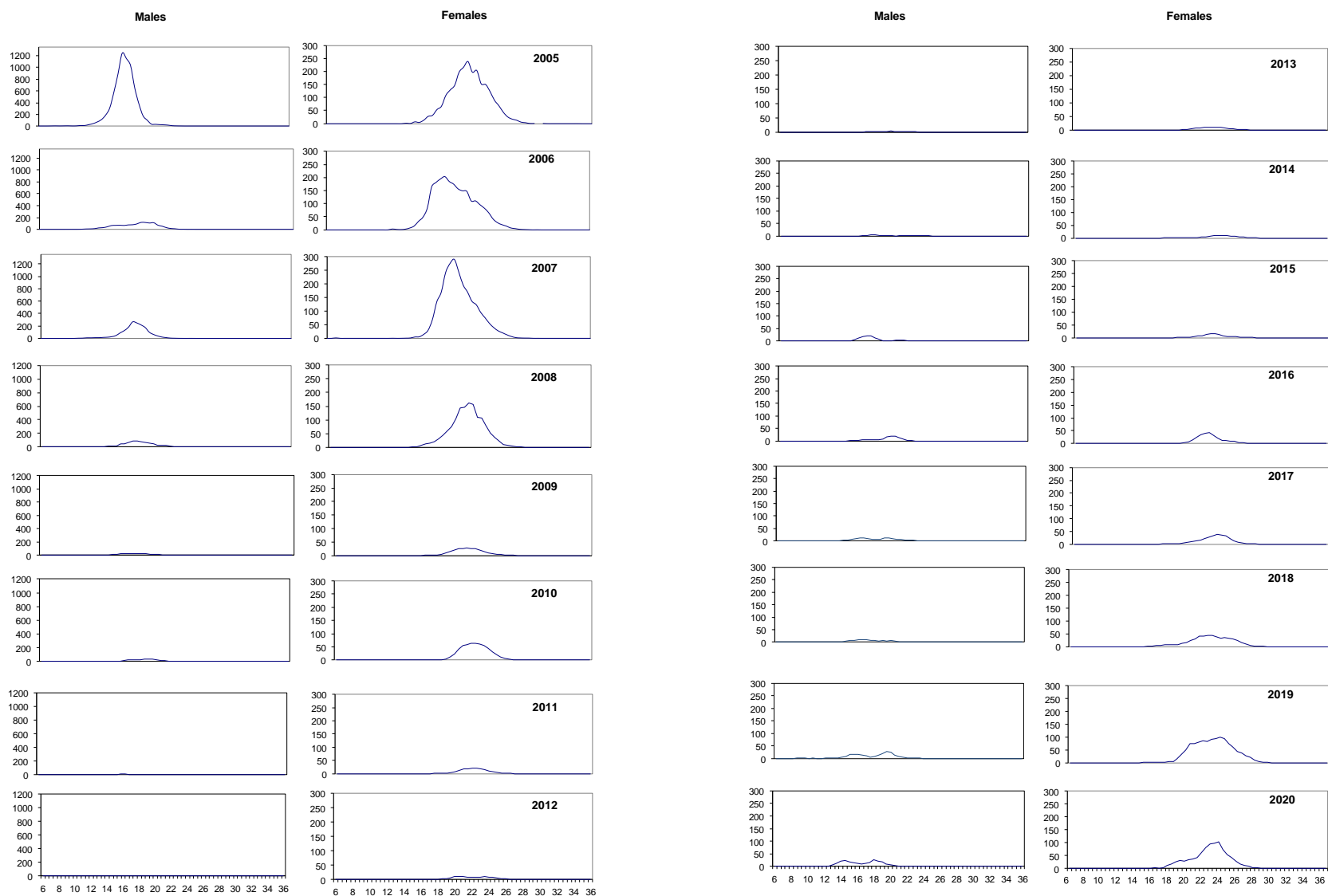


Figure 4. Shrimp size distribution from Flemish Cap 2005 -2020 surveys. Y-Axis=Frequency (10^6), X-Axis=Carapace Length (mm).

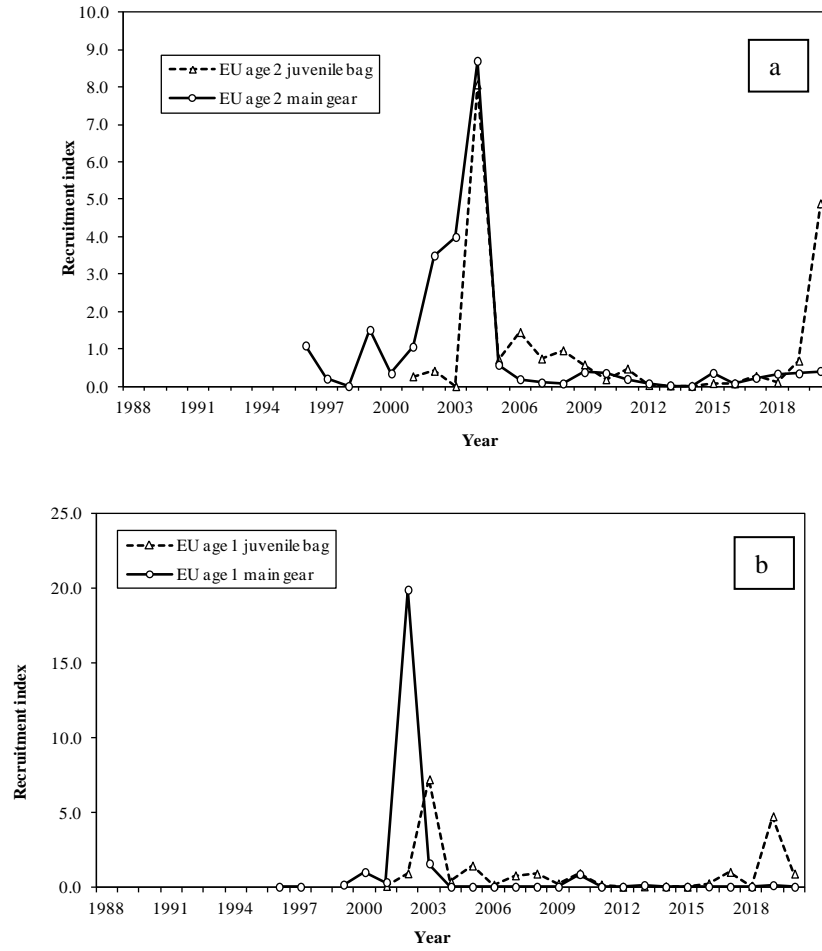


Figure 5. Abundance indexes at age 2 (a) and age 1 (b) obtained in EU Flemish Cap surveys from Lofoten gear (black line) and Juvenile bag (dotted line).

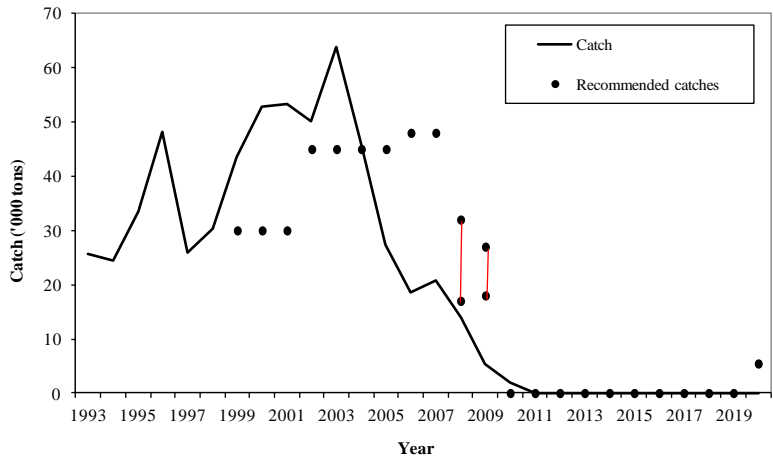


Figure 6. Trends in NAFO Div. 3M northern shrimp (*Pandalus borealis*) catch (t) and recommended catches over the period 1993-2020.

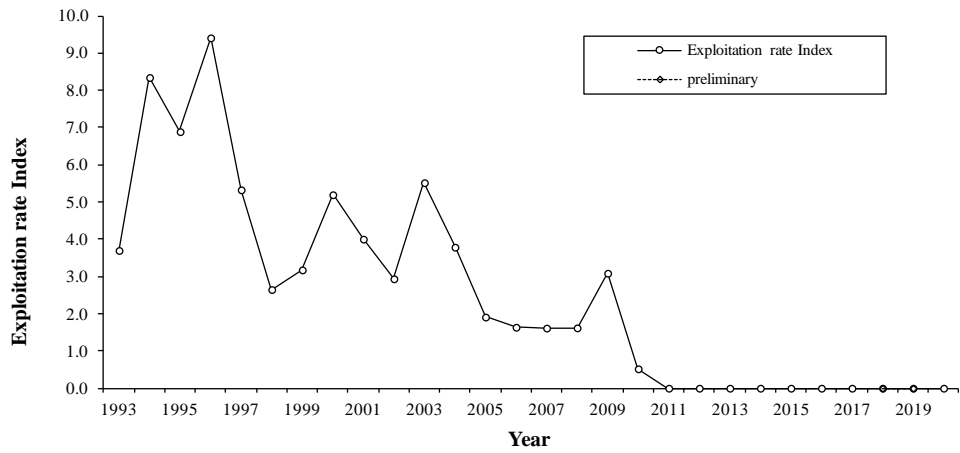


Figure 7. Exploitation rates as nominal catch divided by the EU survey female biomass index of the same year.