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

By

J.M. Casas Sánchez

**Abstract**

This document updates some of the indices for northern shrimp (*Pandalus borealis*) harvested within NAFO Divisions 3M. The assessment for this resource was completed, within Scientific Council during autumn 2008, and although it was not possible to present a management advice on a specific TAC due to insufficient information, in light of the poor prospect for this stock, the scientific council recommended that the exploitation level for 2009 and 2010 should not exceed the levels that have occurred since 2005. The catch table (to September 2009) and biomass estimates (EU survey summer 1988-2009) are updated within this report. Preliminary data indicate that 20267 t and 12889 t of shrimp were taken in 2007 and 2008 respectively against an annual TAC of 48000 t y 32000 respectively. In the 2009 EU survey the 3M biomass index was 2797 t, next to the lowest values estimated in the beginning of the EU survey series and confirming the decrease initiated in 2002. This drastic decline in the biomass index make necessary the revision of the recommendation carried out within Scientific Council during autumn 2008.

**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 2). 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 bag with 6 mm mesh size was attached to the cod-end of the Lofoten gear. SCANMAR sensors were employed to monitor net geometry. Details of the survey design and fishing protocols are outlined in (Casas, 2008).

The increasing of 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 the stock recovered reasonably well although with high annual variability in the last years (historical maximums in 2002 and 2005 were followed by years with lower biomass but at a relative high level). The total and female biomass 2797 t and 1764 t respectively estimated in 2009 (Table 1), show a decrease of 74 % with respect to 2008 and they are between the lowest values of biomass recorded in the total of the historical series. This drastic decline of shrimp biomass is likely associated to the increase of the cod stock experimented in the last years (Figure 2).

Biomass estimated by depth strata from 1988 to 2009 is shown in Table 2. The presence of shrimp in shallowest strata, with depths less than 140 fathoms (257 m), was scarce in the first years (1988-1995). However, since 1996, a noticeable amount of shrimp occurred in these strata and the estimated biomass increased up to 2002 year where 12978 tons, about the 36 % of the total biomass were estimated in depths lesser than 140 fathoms. After 2002 the biomass estimated in these depths declined each year and in 2008 and 2009 they were residual (about 0.4 % and 1.9% of total biomass respectively). In accordance with this, the catch distributions observed during the 2009 survey (Fig. 3) showed a distribution around the central area of the bank but in depths higher.
As in previous years (2003-2008) the youngest specimens (age 1) didn’t appear in the catches (Fig. 4), and they were weakly present in the small mesh size bag attached to the cod-end, suggesting the absence of any strong year classes since 2003.

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 (Fig. 5) were estimated and the index average-weighed. In 2009 the trends showed by both indexes was different. Anyway from both indexes the 2003-2007 year classes ought to be considered as weak year classes.

**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 26000 t to 48000 t in the years 1993 through 1996. After 1996 the catches were lower and rising slowly from 26000 t in 1997 to 53000 t in 2000 and 2001. There was 50000 t taken in 2002. The catch increased in 2003, reaching the highest value in the catches series (64000t), declining to about 13000 in 2008. Removals to September 2009 (about 2600 t) are lower than the reported in 2008 for the same period and much lower than usually reported in previous years.

**Exploitation rate**

Considering the Exploitation rate estimated as nominal catches divided by the EU survey biomass index of the same year (Figure 7 and Table 4), 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 remains stable at relative low values (between 1.9-1.5), the UE survey indexes estimated decreased year after year and in 2009 the estimated biomass was the second lowest of the historical series in the EU survey.

**Effort and TAC regulation**

During 2008 meeting, Scientific Council (NAFO 2008) noted there was insufficient information on which to base predictions of annual yield potential for this resource and was therefore unable to advise on a specific TAC for 2009 and 2010. However, in light of the poor prospect for this stock, the Scientific Council recommended that exploitation level for 2009 and 2010 should not exceed the levels that have occurred since 2005. This corresponded to catches in the range of 18000 to 27000 tons. However the drastic decline in the biomass index of shrimp from EU survey makes necessary the revision of this recommendation.

In the light of new information from EU Survey summer in 2009 the recommended advice in 2008 corresponding to catches between 18000 and 27000 t. would produce very high and unsustainable exploitation rates (10.2-15.3). Annual catches in 2009 around 2500 t. produce exploitation rates values next to 1.5 and could be one option to estimate the exploitation level for 2009 y 2010 (around 86% lower than recommended in 2008).

**Conclusions**

Preliminary data indicate that 2615 t of shrimp had been taken in the 3M shrimp fishery by September 2009 and it is very unlike that the catches recommended in 2008 from 18000 to 27000 tons would be taken by the end of December 2009.

The low values of the Total and Female biomass index in 2009 confirm the strong decrease of this stock caused by the weak recruitments in the last five years and the increase of cod stock, one of their most important predators. Based on the information available in October 2008 no change was proposed for the Scientific Council advice for which the exploitation level in 2010 should not exceed the levels that have occurred since 2005. However in the light of the poor results in the EU Survey in 2009 the advice ought to be revised and the exploitation level reduced.
References


Table 1. Total and Female Biomass (tons) of shrimp estimated by swept area method in the years 1988-2009 on EU Flemish Cap surveys.

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*Since 2003 the area surveyed and strata number increased up to depths from 740 to 1450 m. increasing proportionally the number of sets.
Table 2. Total shrimp biomass estimated by strata (tons) in the years 1988-2009 from EU Flemish Cap surveys. Between 1988 and 2002 data were transformed by Warren’s method. (cells with 0 values corresponding to strata with biomass lower than 0.5 t; empty cells corresponding to strata with biomass = 0 t.)

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1 codend mesh-size 40 mm
2 codend mesh-size 25 mm liner
Table 3. Annual nominal catches (t) by country of northern shrimp (*Pandalus borealis*) caught in NAFO Div. 3M.

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| Total                   | 25611 | 24579 | 33471 | 48299 | 26028 | 30321 | 43439 | 52867 | 53389 | 50214 | 63970 | 45757 | 27479 | 18162 | 20267 | 12889 | 2615  |

1  NAFO Statlant 21 A
2  From the fisheries biologist of respective countries
*  Provisional to 10 September
Table 4.- Exploitation Rate of Shrimp (Div. 3M) as Nominal Catches (tons) divided by UE Survey Index (tons).

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* Preliminary data to 10 September
Figure 1. The NAFO 3M stratification scheme used in EU research bottom trawl survey showing the sets carried out in 2009.
Figure 2. EU survey cod biomass (gross solid line) and total shrimp biomass (dashed line) in the years 1988-2009 on Flemish Cap.
Figure 3.- Distribution of NAFO Div. 3M Northern shrimp (Pandalus borealis) catches kg/tow as obtained from EU research bottom trawl surveys conducted over the period 2004-2009.
Figure 4. Shrimp size distribution from Flemish Cap 2001-2009 surveys. Y-Axis=Frequency ($10^6$), X-Axis=Carapace Length (mm).
Figure 5. Abundance indexes at age 2 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 TAC over the period 1993-2009.

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