



Serial No. N6198

NAFO SC SCR 13/043

**SCIENTIFIC COUNCIL MEETING – JUNE 2013**

A preliminary examination of differential survey trends in recent years between  
the Canadian Spring and EU-Spain surveys for 3NO cod

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**Abstract**

Results of the EU-Spain survey in Divs. 3NO are not used as input to the current ADAPT assessment model for 3NO cod but make an interesting comparison to the Canadian Spring survey since they occur at approximately the same time of year. The two surveys exhibit differences in both abundance and biomass trends in recent years, with the EU-Spain survey results indicating some relatively strong signs of stock growth since 2007 but the Canadian spring survey showing little to no sign of stock growth. Results did not change when analyses of the Canadian survey were restricted only to strata located all or partially within the NRA. An examination of distribution plots for the two surveys suggests that a lower density of fishing sets in the NRA by the Canadian Spring survey relative to the EU-Spain survey might be at least partially responsible for the differential trends between the two survey time series in recent years. However, because the EU-Spain survey covers only a small portion of the stock area, the observed trends for this survey can not be considered indicative of the entire stock. Differences in the length distribution of the catches were also evident in some years.

## Introduction

There are three surveys of the cod stock in NAFO Divisions 3NO: The Canadian Spring survey (1973-2012), Canadian Autumn survey (1990-2012), and the EU-Spain survey (1995-2012). The Canadian surveys cover the entire stock area and are used in the analytical assessment model (Power et al. 2010). The EU-Spain survey covers only the NAFO Regulatory Area portion of the stock. Results of the EU-Spain survey are therefore typically presented as part of the evaluation of stock status but are not used as input data for the VPA. Nevertheless any differences in trends between the Canadian Spring and EU-Spain surveys are interesting and worth exploring since these surveys occur at approximately the same time of year (Table 1).

Results of the currently used ADAPT assessment model suggest that the cod stock in NAFO Divisions 3NO has been at very low levels since the mid-1990s and has shown very little sign of recovery (Power et al. 2010). In contrast, the EU-Spain survey results for the NRA indicate some degree of recovery in this region in recent years (González-Troncoso et al. 2012). Here we set out to investigate if this trend is supported by the portion of the Canadian survey that takes place in the NRA and if not, to explore potential reasons for observed differences.

## Methods

Trends are compared between the Canadian Spring and EU Spain surveys. First we examined the data as they are presented in the assessment (i.e. the Canadian Spring survey results for the entire stock area vs. the EU-Spain survey results for only the NRA). Next we restricted the Canadian survey to only those fishing sets in strata located partially or entirely in the NRA and recalculated the mean values per tow to compare to the EU-Spain survey of approximately the same area. The strata included for the Canadian survey were 353-360, 374-382, 721-728, 752-767 (Fig. 1). It is important to recognize that the absolute values in the two time series are not directly comparable (different fishing vessels, tow durations, etc.) and that we are only comparing trends.

Next we examined yearly distribution plots for 2007-2012 for the two surveys to look for any aspects of survey coverage that could contribute to differences in recent survey trends. The Canadian survey uses a 15 minute tow duration, while the EU-Spain survey uses a 30 minute tow duration. For plotting purposes, the EU-Spain data were divided in half to approximate the results of a 15 minute tow. Note that these plots are not used to make direct comparisons of catch levels between surveys but rather to look at the locations of the relative largest catches for each survey and to compare these locations.

In relation to the survey trends and distribution plots we examined the mean numbers per tow at length taken in the two surveys of the NRA. Data were standardized by dividing the mean number per tow at length by the overall mean number per tow for each year and each survey.

## Results & Conclusions

There are no major differences in the Canadian Spring and EU-Spain time series over the period 1997-2007 (Fig. 2). However, there is a period of divergence over the years 2007-2011, with the Canadian Spring survey demonstrating little trend and the EU-Spain survey demonstrating a clear increase in MWPT from 2007 to 2011. The same divergent patterns were observed for MNPT, except for a spike in 2009 in the Canadian Spring survey.

Mean weight and number of fish per tow was recalculated for the Canadian Spring survey by including only strata that were all or partially within the NRA to determine if differential survey trends were simply due to the different portion of the stock area covered by the two surveys (i.e. do both surveys indicate stock growth in the NRA with the overall Canadian survey numbers affected by lack of growth in the remainder of the stock). Results suggest, however, that this was not the case as the differences in trends did not disappear when analyses were restricted to the NRA (Fig. 3). There was an apparent year effect in the Canadian survey in 2009 with a very sharp spike that disappeared again in the subsequent year. This spike would appear to be primarily related to three large sets (one set of 800 kg and another of nearly 2200 kg in strata 727, and one set of 2400 kg in strata 358) in 2009 (Fig. 4).

An examination of the distribution plots for the two surveys demonstrates an obvious difference in the extent of coverage in the NRA, with the EU-Spain survey having a much higher density of sets (Fig. 4). There appears to be some general correspondence between the two surveys in relation to where large sets occurred. However, it is possible that the lower number of sets in the NRA for the Canadian survey could result in areas of higher fish density not being sampled. For example, this would appear to be the case in 2011 when the EU-Spain survey had a cluster of relatively large sets on the southernmost part of the bank in an area that was very poorly covered by the Canadian survey. The EU-Spain survey results for 2011 were the highest in that time series, while indices based on the 2011 Canadian spring survey were low and not different than other recent years. Such results would appear to reinforce the idea that reduced coverage of the Canadian Spring survey in the NRA relative to the EU-Spain survey might be responsible for the differential trends between the two survey time series in recent years. It is important to note, however, that the EU-Spain survey covers only this small portion of the total stock area and that the results of this survey are therefore not indicative of overall stock status.

There are some interesting differences in the length composition of the EU-Spain survey versus the portion of the Canadian Spring survey in the NRA (Fig. 5). The two surveys show strong agreement in length distributions for 2007-2009. The mode that appears at 15 cm in the length distribution in 2007 would correspond to the 2006 cohort (i.e. 1 year old fish). Both surveys track this cohort up to 2012, although the signal is very weak for the Canadian survey in 2011. In 2010, the Canadian survey picks up a second cohort of fish at 25-30 cm that is not reflected in the EU-Spain survey. Differences are even more pronounced in 2011, when the Canadian survey tracked this new cohort of fish as the major mode at about 30 cm, whereas the EU-Spain survey did not observe these smaller fish and instead continued to track the 2006 cohort at 45-50 cm. Differences between the two surveys diminished again in 2012.

## References

González-Troncoso, D., E. Román and X. Paz. 2012. Results for Greenland halibut, American plaice and Atlantic cod of the Spanish survey in NAFO Div. 3NO for the period 1997-2011. NAFO SCR Doc. 12/12. Ser. No. N6036.

Power, D., J. Morgan, E.F. Murphy, J. Bratney and B. Healey. 2010. An assessment of the cod stock in NAFO Divisions 3NO. NAFO SCR Doc. 10/42. Ser. No. N5801.

Table 1. Comparison of the timing of the EU-Spain Survey and the Canadian Spring Survey.

| Year | EU-Spain Survey |        | Canadian Spring Survey |        |
|------|-----------------|--------|------------------------|--------|
|      | Start           | End    | Start                  | End    |
| 2002 | Apr-29          | May-19 | Apr-27                 | May-29 |
| 2003 | May-11          | Jun-02 | May-08                 | Jun-04 |
| 2004 | Jun-06          | Jun-24 | May-12                 | Jun-08 |
| 2005 | Jun-10          | Jun-29 | May-09                 | Jun-19 |
| 2006 | Jun-07          | Jun-27 |                        |        |
| 2007 | May-29          | Jun-19 | May-03                 | Jun-29 |
| 2008 | May-27          | Jun-16 | May-23                 | Jun-22 |
| 2009 | May-31          | Jun-18 | May-13                 | Jun-11 |
| 2010 | May-30          | Jun-18 | May-08                 | Jun-06 |
| 2011 | Jun-05          | Jun-24 | May-08                 | May-30 |
| 2012 | Jun-03          | Jun-21 | Apr-27                 | Jun-03 |

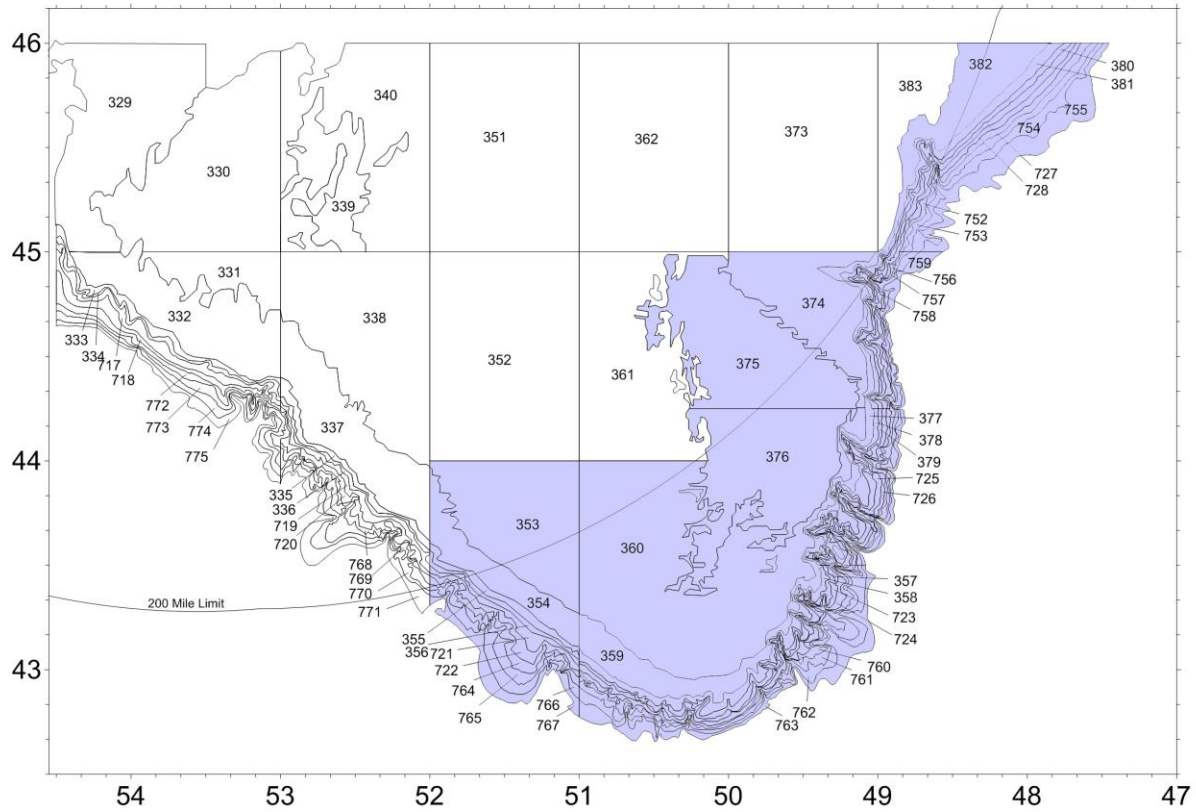


Figure 1. Stratification scheme used for the Canadian spring survey. Shaded strata are those that were used to compare the Canadian spring survey results for the NRA portion of the stock to the EU-Spain survey results.

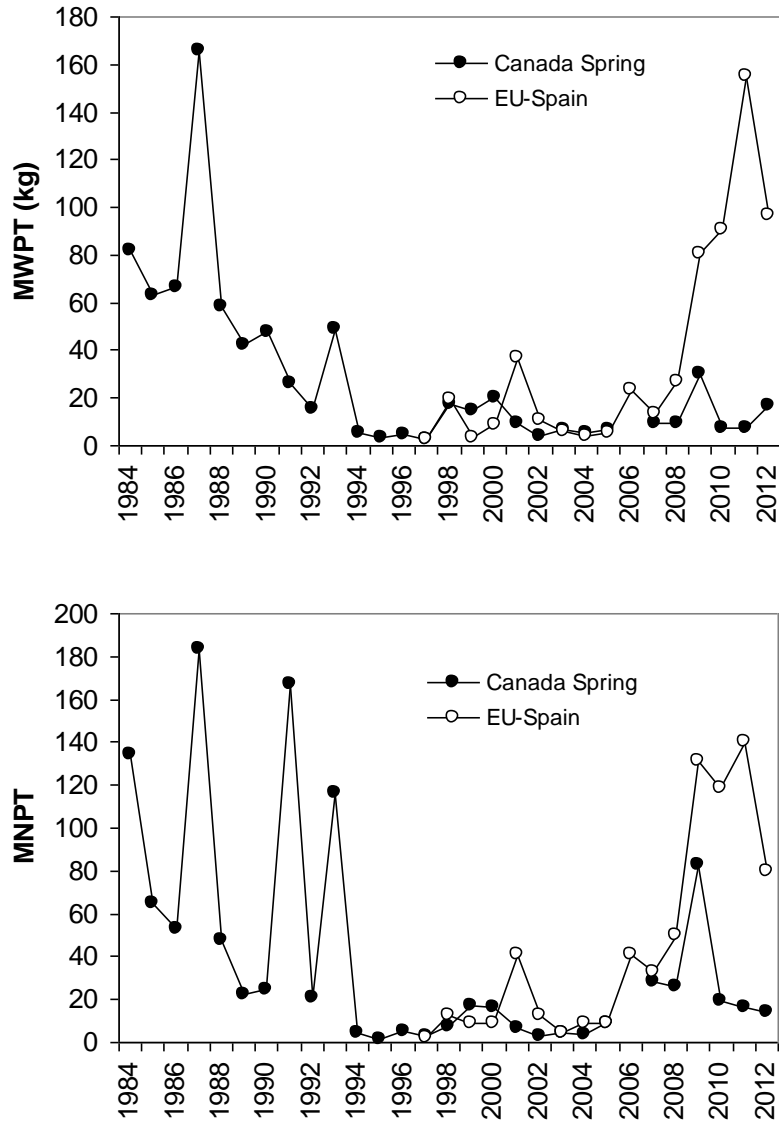


Figure 2. Comparison of Survey trend indices for the Canadian Spring and EU-Spain surveys for Atlantic cod in NAFO Divisions 3NO. Plots are intended for comparison of trends and not absolute values. Note that the EU-Spain survey covers only the portion of the stock in the NRA, whereas the Canadian Spring survey covers the entire stock area.

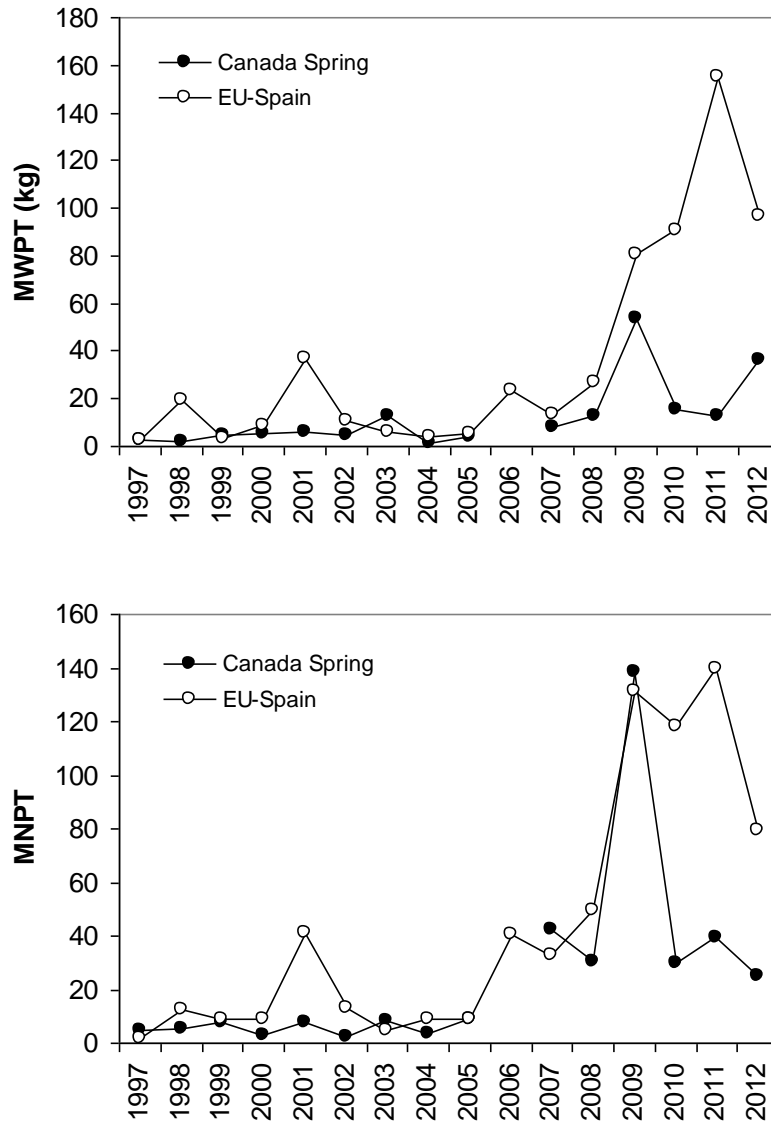


Figure 3. Comparison of Survey trends for NAFO Divisions 3NO cod for the EU-Spain survey and the Canadian Spring survey limited to strata that are (at least partially) in the NAFO Regulatory Area.

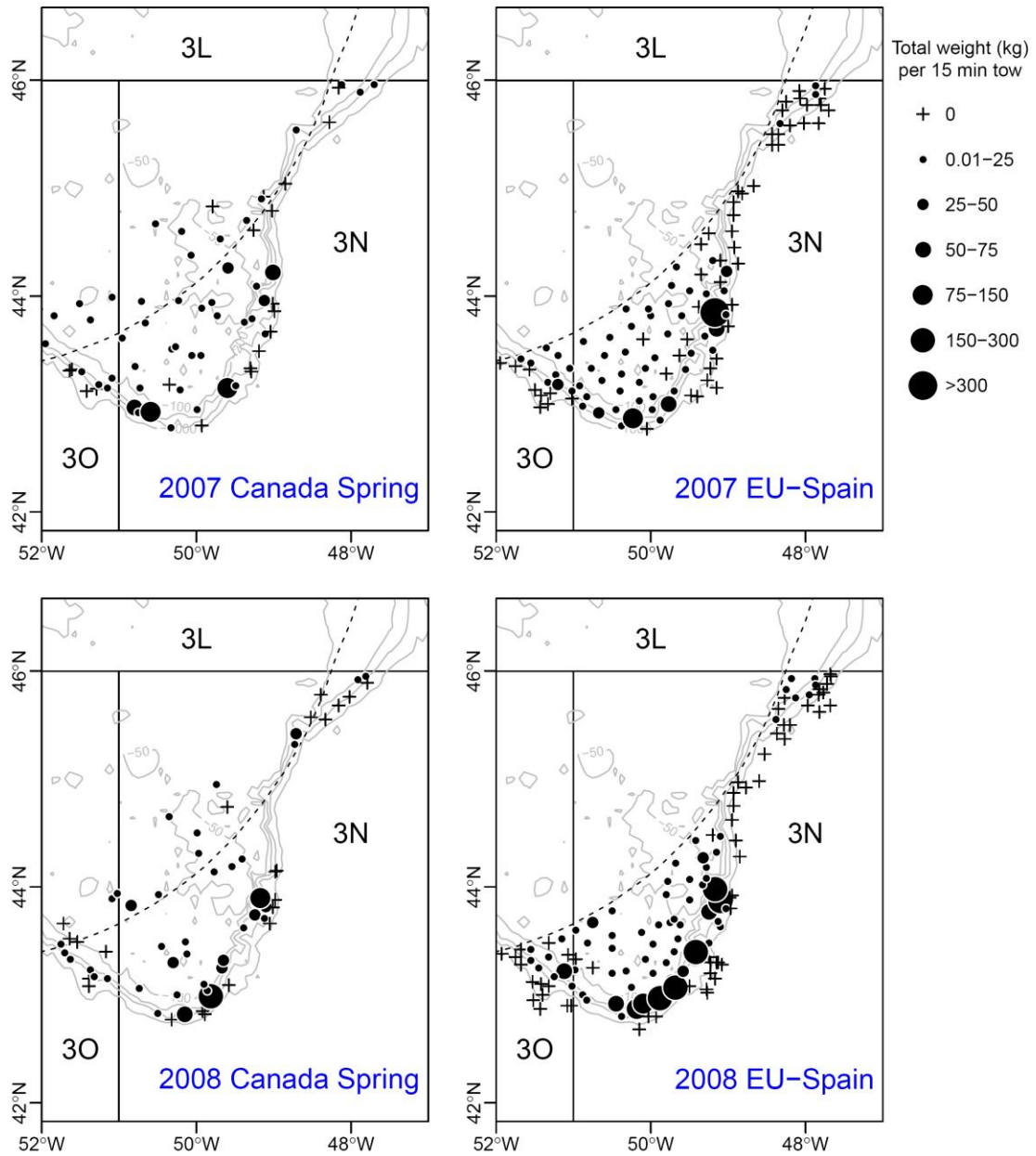


Figure 4. Year by year distribution plot comparisons (kg/15 min tow) for the Canadian Spring and EU-Spain surveys since 2007. Note that the EU-Spain survey conducts 30 minute tows and therefore catch totals were divided in half to approximate a 15 minute tow.



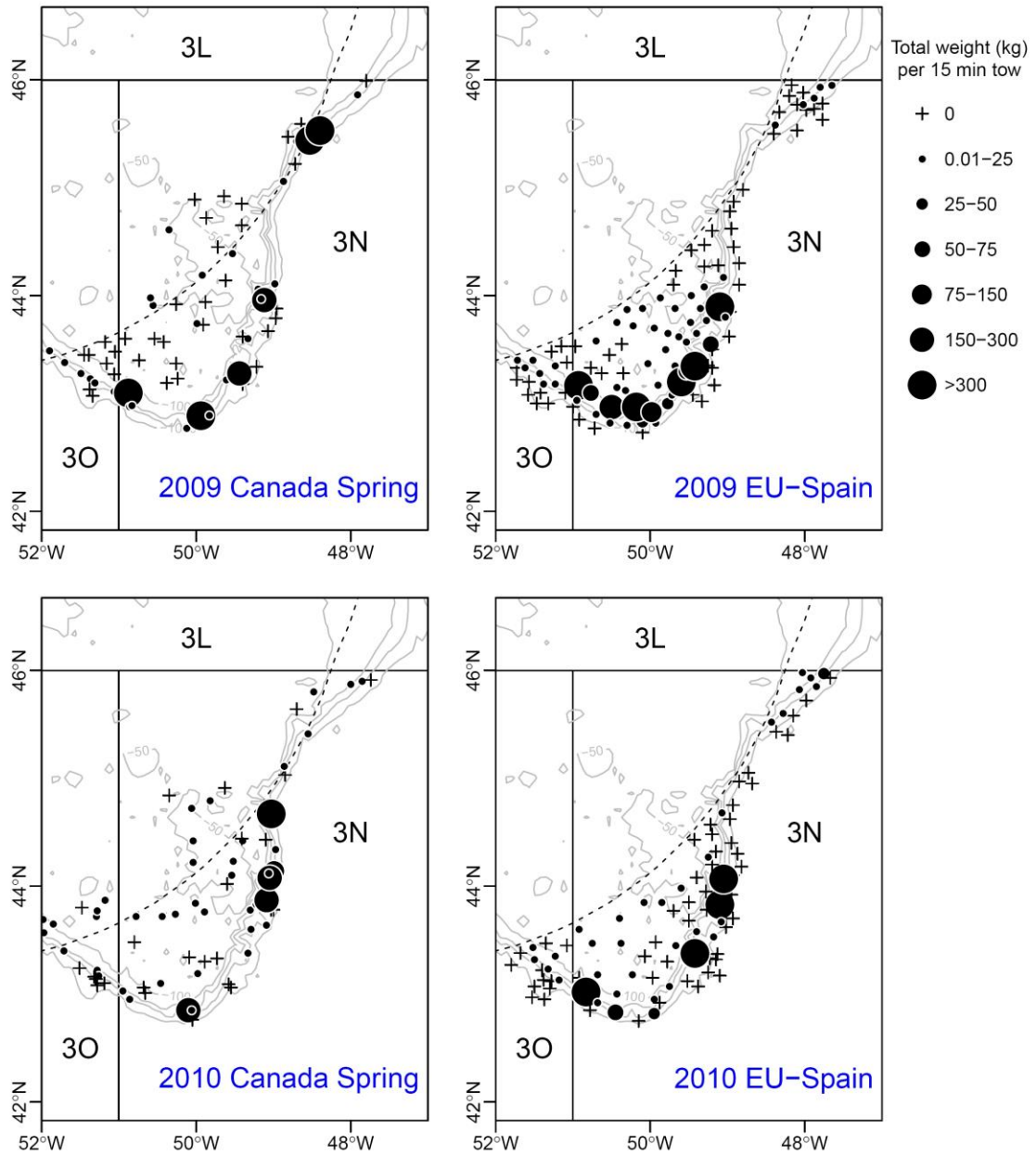


Figure 4. Continued...

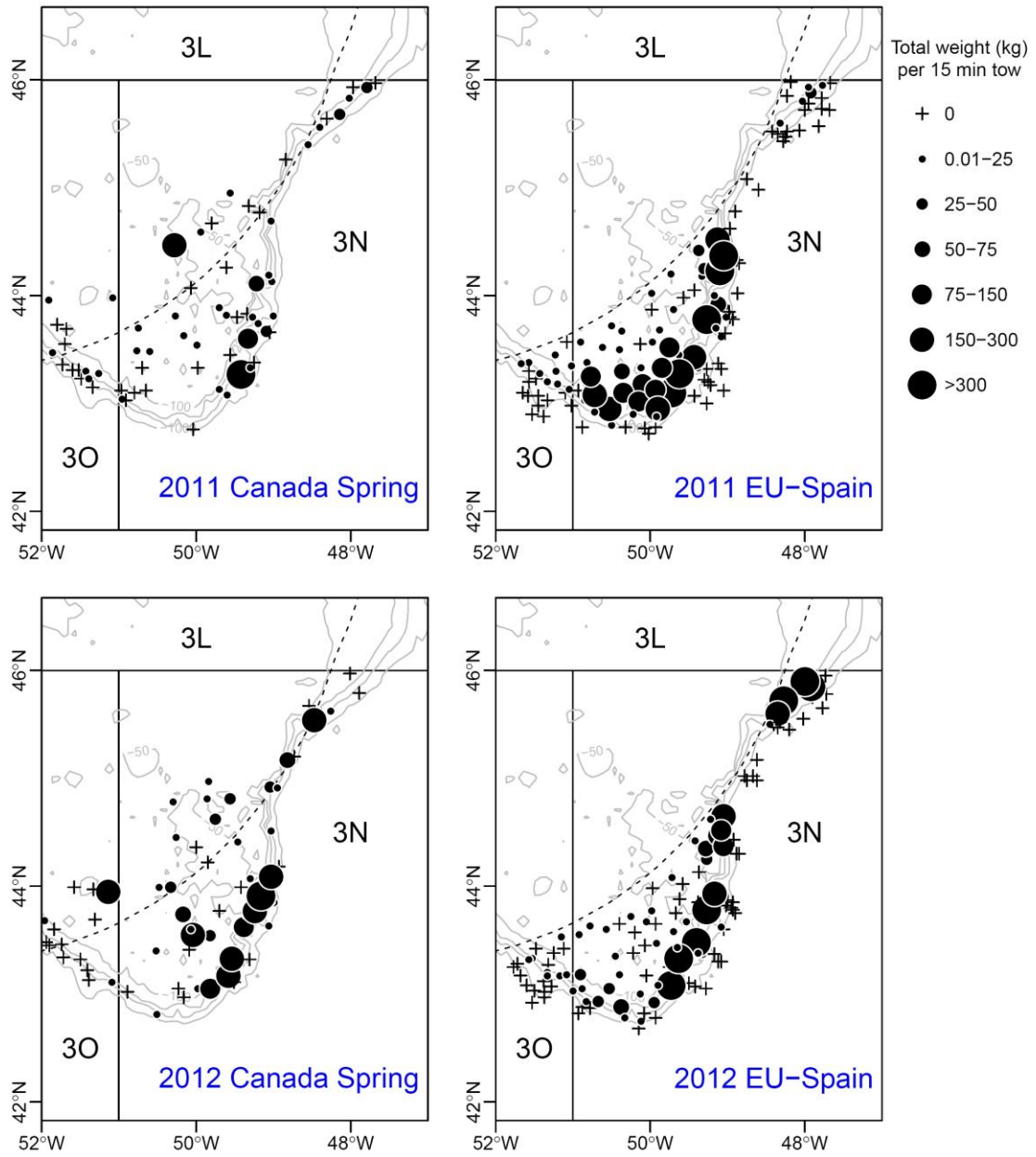


Figure 4. Continued...

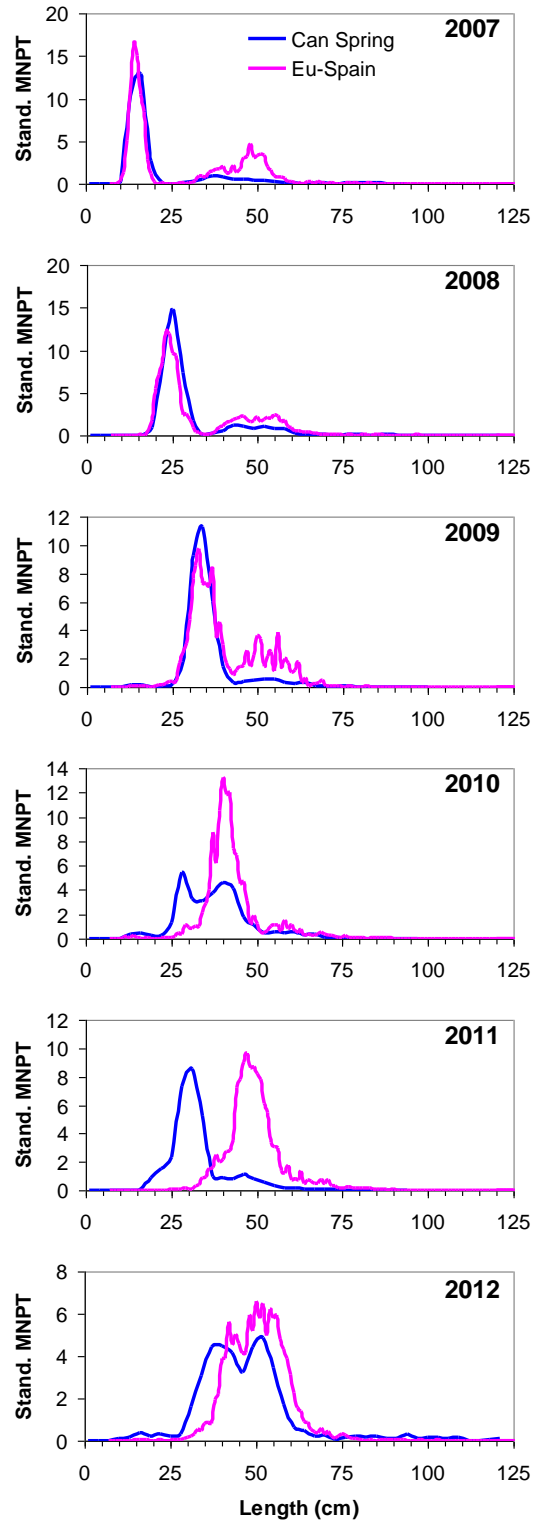


Figure 5. Comparison of standardized mean number of fish at length per tow between the Canadian Spring and EU-Spain surveys for 3NO cod.