



SCALLOP FISHERY AREA/TIME CLOSURE TO PROTECT COD SPAWNING AGGREGATIONS IN 5Z (GEORGES BANK) IN 2011

Context

Canada is required to account for all fishing mortality of Georges Bank cod (*Gadus morhua*) and aims to reduce cod bycatch in the offshore scallop fishery. In order to reduce bycatch and to minimize disturbance to spawning aggregations of cod by the offshore scallop fishery on Georges Bank, DFO has implemented area/time closures from early February to the end of March since 2005. To inform resource managers in determining appropriate area closures for the offshore scallop fishery on Georges Bank during the cod spawning seasons, Fisheries and Aquaculture Management (FAM) asked the following question. "What does a review of 5Z cod distribution, particularly at spawning time, reveal about the spatial and temporal trends of the species and its overlap with the offshore scallop fishery? Highlight areas of high 5Z cod distribution using the cells which have already been defined and used in previous years." This document provides the requested information on the spatial distribution of cod abundance and its overlap with scallop catches on Georges Bank. The information provided in this document is an update of information provided annually for 2006 to 2009 in the Expert Opinions series and for 2010 onward in the Science Response series published by CSAS.

Analysis and Response

The 2010 first quarter offshore scallop catches correspond to 16% (908 tonnes of meats) of the total allowable catch for the year, which is similar to the long term average landings for the first quarter. At the start of the 2010 fishery, there were two industry managed scallop seed closure areas in place, outlined in red in Figures 1 and 2. One was temporarily lifted the first week of January but then reinstated for the rest of the year.

The analysis used for this information has been updated with the 2010 cod abundance data (obtained from the annual DFO RV survey) and scallop catches. The protocol to handle both the cod abundance data and the offshore scallop catch data is given in the Science Expert Opinion 2006 (DFO, 2006). Information from the DFO RV survey conducted during late February/early March was used to identify areas of high aggregations of adult (age 3+) cod. The distribution of age 3+ cod was plotted as the average number per tow in cells 5-minute longitude by 3.33-minute latitude (17 nautical miles² or 55 kms²). From these data, two scenarios were examined: 1) using data from the last 10-year period (2001-2010) and 2) using all available data (1996-2010).

Under Scenario 1, the high cod aggregation areas for the last decade (Figure 1. Cells numbered 1 to 16 in order of decreasing abundance with greater than 50 cod per cell) were compared to first quarter scallop catches in those areas (Table 1). Under Scenario 2, the high cod aggregation areas for the last fifteen years (Figure 2. Cells numbered 1 to 17 in order of

decreasing abundance with greater than 50 cod per cell) were compared to first quarter scallop catches in those areas (Table 2).

Scenario 1 (Figure 1) shows continuity in the location of high ranking cells with the 10 year scenario from last year. Fourteen of the high ranking cells are in the same location as last year, although the order has changed (Fig. 1; DFO, 2010). The highest ranked cells for 3+ cod abundance are dispersed throughout the fishing bank with an aggregation of 8 cells located toward the center of the bank. However, the highest ranking cell from the 2010 analysis is no longer ranked as one of the highest cells in the current year's analysis (Fig. 1; DFO, 2010). This cell and another were dropped from the ranking and two new cell locations were added (cells 10 and 12).

In Scenario 2 (Figure 2), cell locations included in the highest ranking for age 3+ cod abundance are the same as those observed in the analysis conducted in 2010 with the addition of one cell (cell 16). The ranking order varies slightly from last year (Fig. 2; DFO, 2010). This scenario has shown stability from year to year as current data is added. Scenario 2 continues to show an aggregation of age 3+ cod in the center of the bank with 11 high ranking cells grouped together.

The closure area for the past five years has covered a similar geographical area and provided a closure that encompassed a cluster of cells. When comparing the two scenarios for the 2011 closure (Figures 1 and 2), the strongest aggregation of cod for both scenarios occurs in an area near the center of the bank, but, the shorter scenario (Figure 1) indicates that there are noteworthy aggregations of 3+ cod on the northern part of the bank. Although there are variations in annual distribution of the 3+ cod abundance, aggregations have been consistently observed in the area near the center of the bank in all scenarios presented in this document.

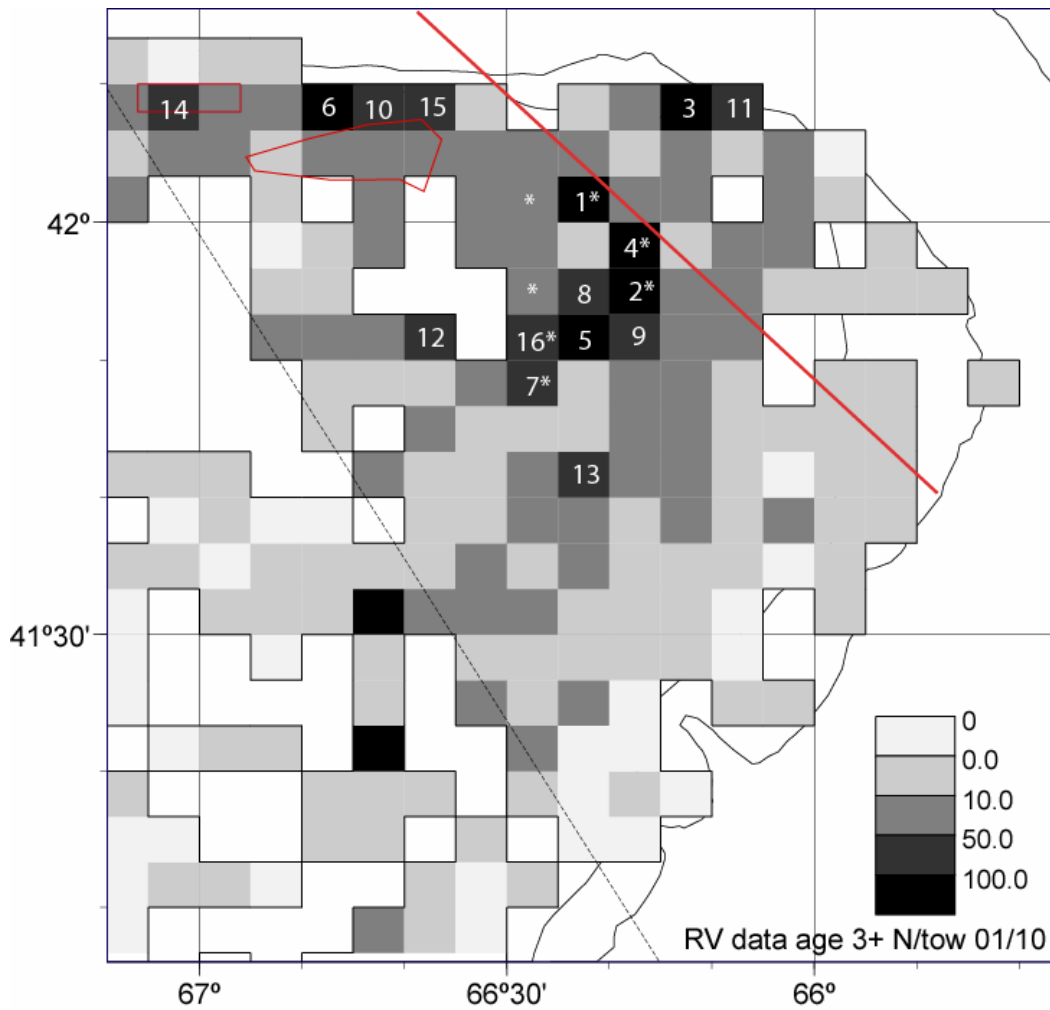


Figure 1. Scenario 1 - Distribution of aggregated age 3+ cod from RV data for the period of 2001 to 2010. Cells on the Canadian side with 50+ cod per cell have been ranked in descending order. The current scallop seed closures are outlined in red. * indicates cells that were part of the 2010 closure.

Table 1. Scenario 1 - association between first quarter scallop catch (tonnes of meats) by the offshore scallop fleet and cells of high cod density (cells with 50 or more age 3+ cod on average in Feb.-Mar. survey data). The cod cells, numbered 1 to 16, are in descending order of abundance. Grey scale rankings indicate the abundance of scallop catch that corresponds to each cell of high cod density.

Year/Cod cell no.	1*	2*	3	4*	5	6	7*	8	9	10	11	12	13	14	15	16*
2001	Light	Dark	Light	Light	Light	Light	Dark	Dark	Dark	Light	Light	Light	Light	Light	Light	Dark
2002	Light	Dark	Light	Dark	Light	Light	Light	Light	Dark	Light	Light	Light	Light	Light	Light	Light
2003	Light	Dark	Light	Light	Light	Light	Light	Light	Dark	Light	Light	Light	Light	Dark	Light	Light
2004	Dark	Dark	Light	Dark	Light	Light	Light	Light	Dark	Light	Light	Light	Light	Light	Light	Light
2005	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light
2006	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light
2007	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light
2008	Dark	Dark	Light	Dark	Light	Light	Light	Light	Dark	Light	Light	Light	Light	Light	Light	Light
2009	Dark	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light
2010	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light	Light

* indicates cells that were part of the 2010 closure (Note: closure included two cells that are not represented here)

Legend: Scallop Catch

Color	Scallop Catch (t of meats)
Dark	catch ≥ 50
Dark-Gray	25 ≤ catch < 50
Medium-Gray	10 ≤ catch < 25
Light-Gray	0 < catch < 10
White	catch = 0

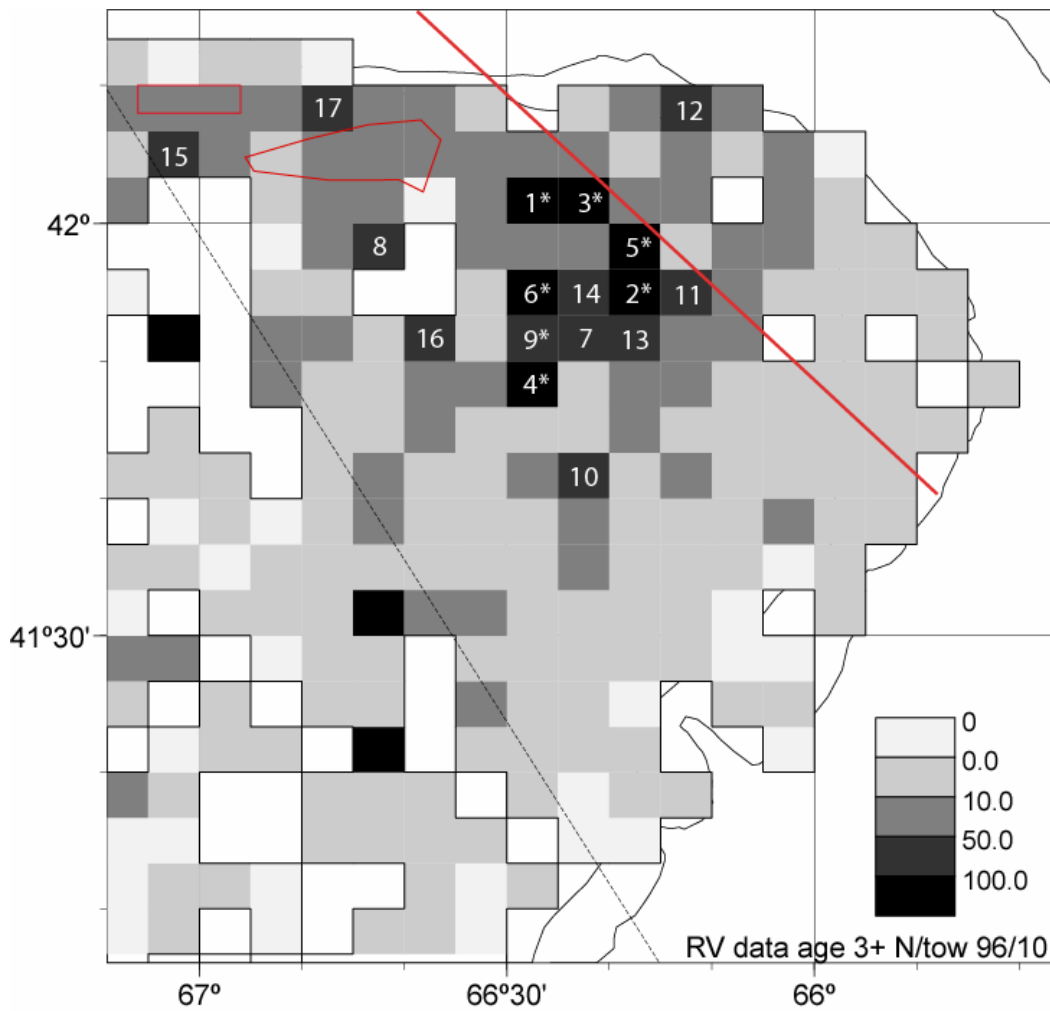


Figure 2. Scenario 2 - Distribution of aggregated age 3+ cod from RV data for the period of 1996 to 2010. Cells on the Canadian side with 50+ cod per cell have been ranked in descending order. The current scallop seed closures are outlined in red. * indicates cells that were part of the 2010 closure

Table 2. Scenario 2 - association between first quarter scallop catch (tonnes of meats) by the offshore scallop fleet and cells of high cod density (cells with 50 or more age 3+ cod on average in Feb.-Mar. survey data). The cod cells, numbered 1 to 17, are in descending order of abundance. Grey scale rankings indicate the abundance of scallop catch that corresponds to each cell of high cod density.

Year/Cod cell no.	1*	2*	3*	4*	5*	6*	7	8	9*	10	11	12	13	14	15	16	17
1996	Dark Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey
1997	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Black	Light Grey	Light Grey
1998	Dark Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Black	Light Grey	Light Grey
1999	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey
2000	Black	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey
2001	Black	Dark Grey	Light Grey	Dark Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Dark Grey	Light Grey	Light Grey	Light Grey
2002	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Black	Light Grey	Dark Grey	Light Grey	Dark Grey	Light Grey	Light Grey
2003	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Black	Light Grey	Dark Grey	Light Grey	Dark Grey	Light Grey	Light Grey
2004	Dark Grey	Dark Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey
2005	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey
2006	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey
2007	Black	Light Grey	Light Grey	Light Grey	Light Grey	Black	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey
2008	Dark Grey	Dark Grey	Dark Grey	Light Grey	Dark Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Black	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey
2009	Dark Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Black	Light Grey	Light Grey
2010	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Dark Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Light Grey	Black	Light Grey	Light Grey

* indicates cells that were part of the 2010 closure

Legend: Scallop Catch

Color	Scallop Catch (t of meats)
Black	catch ≥ 50
Dark Grey	25 ≤ catch < 50
Medium Grey	10 ≤ catch < 25
Light Grey	0 < catch < 10
White	catch = 0

Conclusions

Implementing a cod area/time closure for 2011 with a similar location as the cod area/time closure of 2010 should achieve the aims of reducing cod bycatch and disturbance of spawning aggregations while also having a relatively low impact on the offshore scallop fishery. Due to cod area/time closures in the past few years during the first quarter, the scallop catch on Georges Bank for the first quarter has been dispersed to other locations. The 2010 first quarter scallop landings in the 6 highest ranked cells for Scenarios 1 and 2 were 2.05 t and 5.97 t, respectively.

With the addition of the 2010 cod data to the existing dataset, the cell rankings in Scenario 1 have changed. The cell that had been ranked number 1 since this exercise began is no longer ranked among the highest cells. The cluster of cells in the center of the bank only contains 4 of the 6 highest ranking cells, and two of the cells in this cluster that were closed last year are no longer ranked. These changes in Scenario 1 may warrant a slight change in the location of the closure area to encompass the highest ranked cells on the northern edge of the bank and the cluster located in the center of the bank.

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Date: 10 February 2011

Sources of Information

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This Report is Available from the:

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ISSN 1919-3750 (Print)
ISSN 1919-3769 (Online)
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La version française est disponible à l'adresse ci-dessus.



Correct Citation for this Publication:

DFO. 2012. Scallop Fishery Area/Time Closure to Protect Cod Spawning Aggregations in 5Z (Georges Bank) in 2011. DFO Can. Sci. Advis. Sec. Sci. Resp. 2011/014.