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By-catch of cod, Greenland halibut and American plaice in redfish fisheries on NAFO Divisions 3L and 3N, 2010-2014

by

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1. Introduction

Redfish in NAFO Divisions 3L and 3N has been under moratorium between 1998 and 2009. In 2010, Fisheries Commission (FC) reopened this fishery with a TAC of 3500 t and catches increased since then. In 2014, FC approved a Management Strategy (MS) for this stock with a Harvest Control Rule (HCR) based on two year stepwise TAC increase starting with 10 400 t in 2015-2016 till 18 100 t in 2019-2020 (NAFO, 2014).

The predicted increase of 3LN redfish catches under the present HCR generate concerns regarding the impact of expected by-catch increases on 2J3KL and 3NO cod, 3LNO American plaice and SA 2 + 3KLMNO Greenland halibut. The present work aims to quantify this impact, and is based on 2010-2014 observed catch data of four Portuguese trawlers operating in the NAFO Regulatory Area, sampled on board under the National Biological Sampling Program.

2. Material and methods

From a total of 1593 hauls carried out on Divisions 3L and 3N, observed catch by haul were split into shallower and deeper than 400m depth, taking into account the different depth distribution of the by-catch species of this study.

In order to select the hauls directed to redfish, a first criterion is that its catch should represent at least 20% of the total catch of the haul. The second criterion is that redfish catch should be higher than the sum of the catches of the selected by-catch species. A total of 659 hauls was found, 188 hauls in Div. 3L and 471 hauls in Div. 3N. The by-catch rates in relation to redfish catch were then allocated into four different assemblages/categories, each with its own average by-catch rate:

- Overall average 2010-2014 by-catch;
- Average by-catch by division and depth category;
- Average by-catch by month and depth category;
- Average by-catch by year and depth category.

Based on the anomalies given by the difference between the overall average and the average of each category, a correction factor by depth was obtained for the by-catch rates of each division, month and year. Standardized by-catch rates of the variables within each category were finally calculated with the additive model used to standardize Greenland halibut commercial CPUE series for Portugal (Ávila de Melo and Alpoim, 1995). Variables with a single observation assigned were discarded from the analysis.

Analysis was carried out considering the ensemble of 3L and 3N in the case of species with a single stock within the two divisions, American plaice and Greenland halibut. As regards cod, and taking into account the existence of different stocks by division, the analysis was carried out for Div. 3L and Div. 3N separately.

3. Results

By-catch rates relative to redfish catch are presented in percentages in table I-V and graphic 1-8.

4. Discussion

4.1 – Cod by-catch in Div. 3L

After no records in 2010 and a single observation in 2011, cod became a common presence on redfish by-catch on Division 3L depths shallower than 400 m, representing 9-12% of the redfish catch in 2012-2013 but declining to 6% next year. Deeper than 400 m redfish fishing effort was sparse, with cod representing 9% of the redfish catch on 2010 and 2012 at (Table I, Graphic 1 and 2).

4.2 – Cod by-catch in Div. 3N

By catch of cod in Div. 3N is more frequent than on Div. 3L, with more records on depths shallower than 400m. But, apart almost 16% on 2013, by-catch declined roughly from 12% to 7% between 2010 and 2014. On the contrary by-catch increased from 7% to 16% on the redfish fishery deeper than 400m between 2010 and 2013 (no by-catch of cod was recorded on 2014) (Table II, Graphic 3 and 4).

4.3 – American plaice by-catch in Div. 3L and 3N

American plaice by-catch occurs in both divisions and depth intervals. Is more frequent on Div. 3N depths shallower than 400m, though higher by-catch rates are recorded on Div. 3L. American plaice by-catch is maximum on depths deeper than 400m on Div. 3N (4.8-7.5%) (Table III; Graphic 5 and 6).

4.4 – Greenland halibut by-catch in Div. 3L and 3N

The Greenland halibut by-catch on depths shallower than 400 m is residual (0.6-1.1%) and only occurred on Div. 3N. At depths deeper than 400 m Greenland halibut on redfish fishery is also rare on Div. 3L and frequent on 3N but confined to small by-catch levels fluctuating below 5% (Table IV; Graphic 7 and 8).

5. Conclusions

Based on 2010-2014 Portuguese observed data, cod is the most important by-catch in redfish fisheries on NAFO Div. 3L and 3N, at depths shallower or deeper than 400m. American plaice comes second, with higher by-catch rates on Div. 3N on depths deeper than 400m, but more frequent on shallower depths. By-catch of Greenland halibut is occasional and at low to very low levels on both divisions, at depths deeper than 400m (Table V).

6. Bibliography

Ávila de Melo, A. M. and Alpoim, R. (1995) – Portuguese cod fisheries in NAFO Div.s 3N and 3O, 1989-1993. NAFO Scientific Council Studies No 23, pp 65-84.

NAFO (2014) – Risk-Based Management Strategy for 3LN Redfish. NAFO FC Doc 14/29, 2p.

Table I: By-catch (%) of cod in division 3L, 2010-2014 (above and below 400 m)

Year	Depth < 400 m	n	Depth > 400 m	n
2010			9.2	3
2011	45.7	1	0.0	1
2012	9.1	39	9.5	2
2013	12.2	74	0.0	1
2014	6.3	67		

n = number of observations (hauls)

Table II: By-catch of cod in division 3N, 2010-2014 (above and below 400 m)

Year	Depth < 400 m	n	Depth > 400 m	n
2010	11.5	71	7.0	31
2011	11.1	92	7.7	47
2012	10.5	109	9.6	8
2013	15.9	50	15.6	28
2014	6.7	20	0.0	15

n = number of observations (hauls)

Table III: By-catch (%) of American plaice in divisions 3L and 3N, 2010-2014 (above and below 400 m)

Year	Division	Depth < 400 m	n	Depth > 400 m	n	Division	Depth < 400 m	n	Depth > 400 m	n
2010	3L			1.9	3	3N	2.8	71	5.2	31
2011	3L	5.6	1	1.7	1	3N	2.8	92	4.8	47
2012	3L	2.6	39	2.5	2	3N	1.8	109	6.1	8
2013	3L	3.8	74	0.2	1	3N	2.1	50	7.5	28
2014	3L	5.0	67			3N	2.6	20	4.9	15

n = number of observations (hauls)

Table IV: By-catch (%) of Greenland halibut in divisions 3L and 3N, 2010-2014 (above and below 400 m)

Year	Division	Depth < 400 m	n	Depth > 400 m	n	Division	Depth < 400 m	n	Depth > 400 m	n
2010	3L			0.6	3	3N	1.1	71	3.5	31
2011	3L	0.5	1	3.1	1	3N	0.6	92	2.6	47
2012	3L	0.01	39	5.2	2	3N	0.9	109	3.4	8
2013	3L	0.0	74	2.9	1	3N	1.0	50	4.6	28
2014	3L	0.0	67			3N	1.0	20	2.9	15

n = number of observations (hauls)

Table V: Average by-catch (%) of cod, American plaice and Greenland halibut in the redfish fishery on Divisions 3L and 3N in the redfish fishery on Divisions 3L and 3N based on observed catch data from the Portuguese fleet (2010-2014)

Depth < 400 m			Depth > 400 m	
3L	Average	CV	Average	CV
Cod	9.3	28%	6.7	2%
American plaice	4.0	23%	1.8	18%
Greenland halibut	0.006	89%	2.6	95%
3N	Average	CV	Average	CV
Cod	11.4	19%	8.5	53%
American plaice	2.4	19%	5.6	19%
Greenland halibut	0.9	22%	3.3	23%

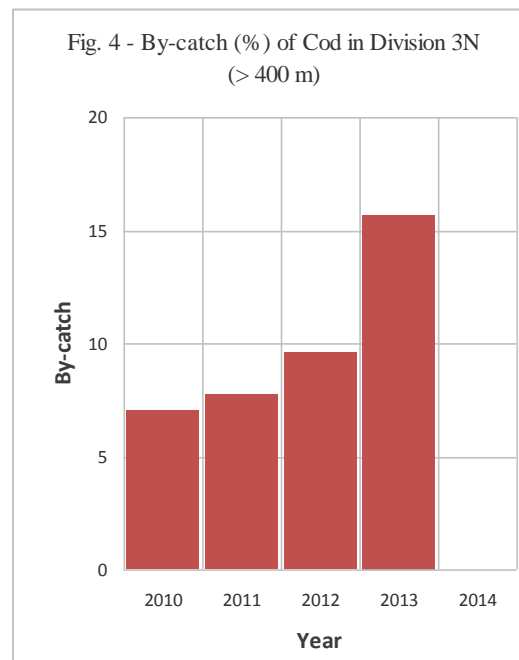
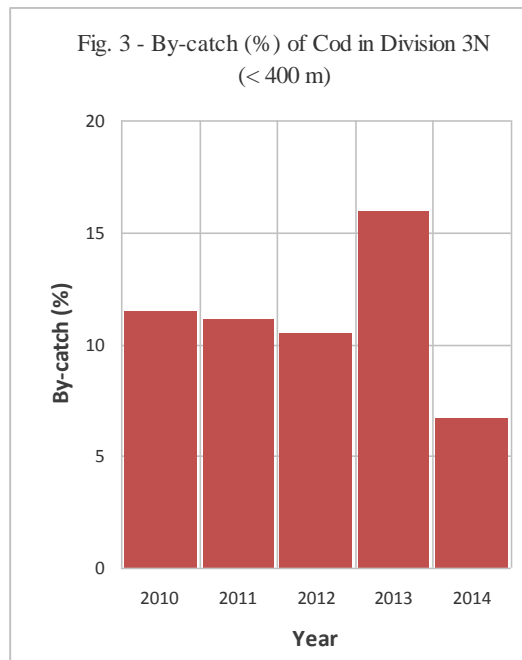
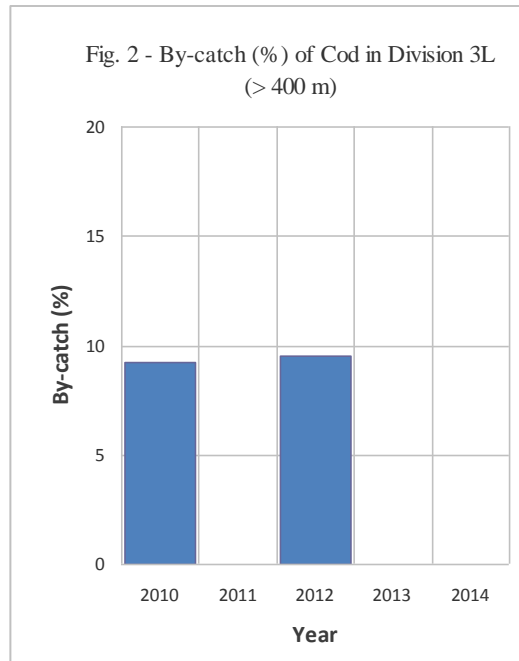
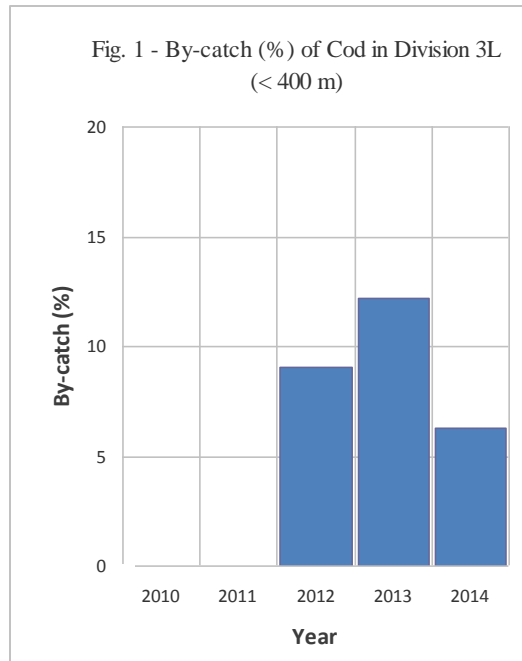


Fig. 5 - By-catch (%) of American plaice in Divisions 3L and 3N (< 400 m)

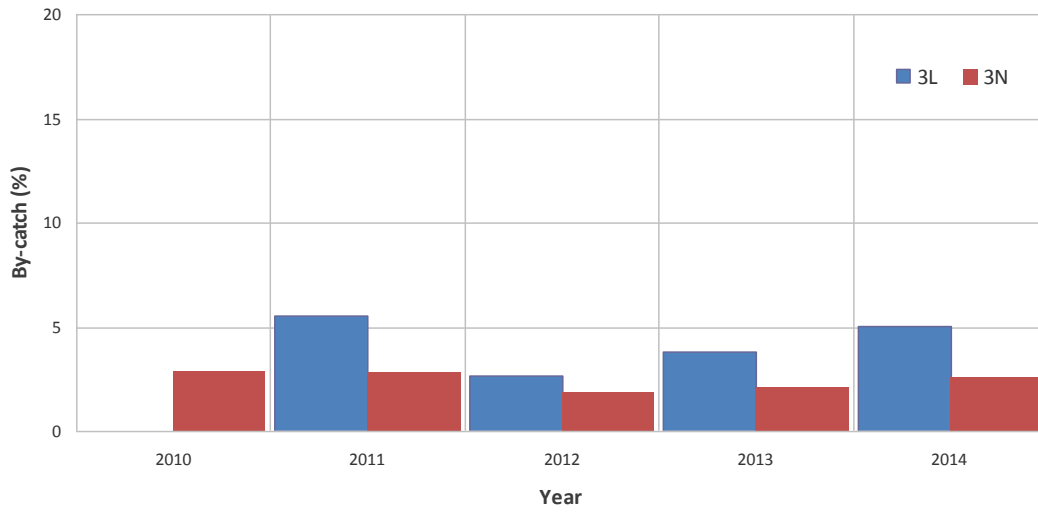


Fig. 6 - By-catch (%) of American plaice in Divisions 3L and 3N (> 400 m)

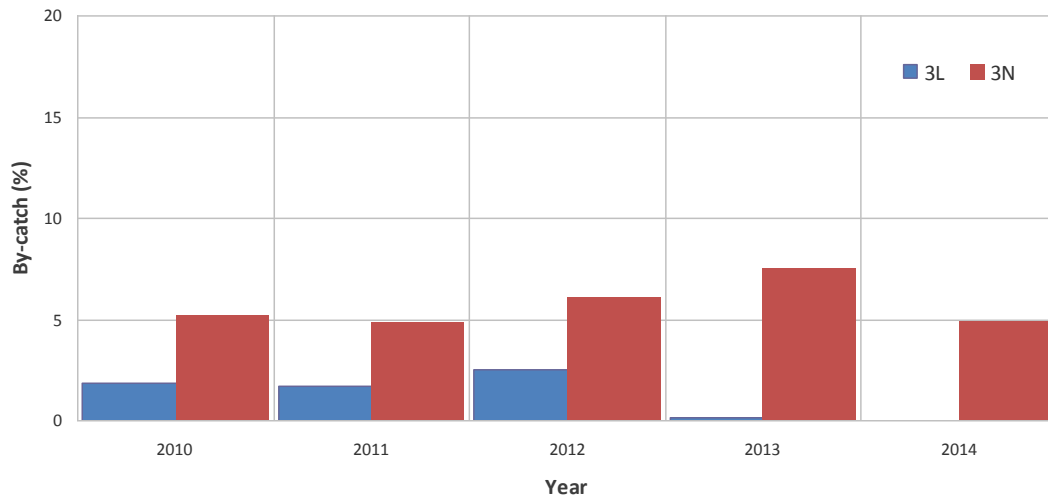


Fig. 7 - By-catch (%) of Greenland halibut in Divisions 3L and 3N (< 400 m)

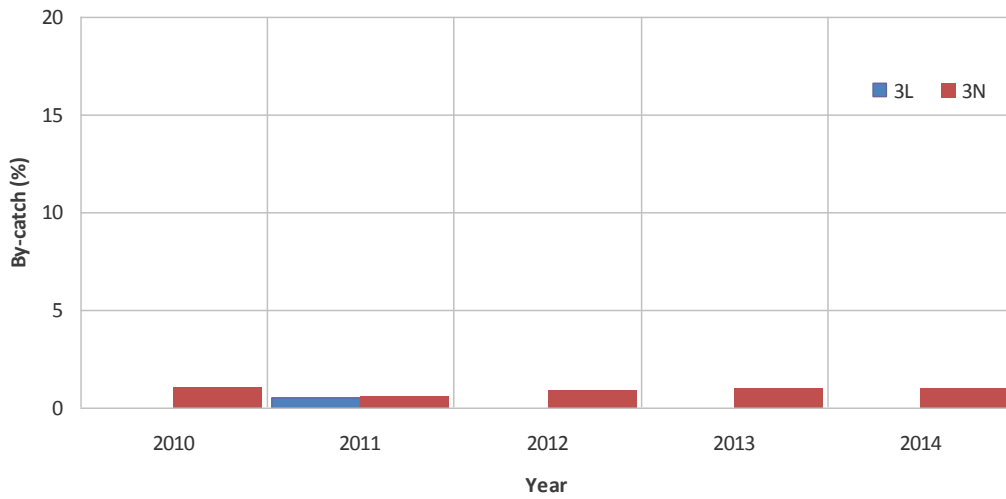


Fig. 8 - By-catch (%) of Greenland halibut in Divisions 3L and 3N (> 400 m)

