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Groundfish By-catch in the Canadian Small (<500 Tons; LOA< 100') and Large (=>500 Tons) Vessel
Division 3L Shrimp Fishery, During 2000 and 2001

by

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Abstract

A NAFO regulated shrimp fishery has existed in Division 3L since 2000. Canadian vessels are allowed to catch 5 000 tons of shrimp inside the Exclusive Economic Zone (EEZ) while a 1 000 tons quota has been set for the NAFO Regulatory Area (NRA). This working paper provides estimates of groundfish by-catch in the 2000 and 2001 Canadian Div. 3L shrimp fisheries.

Introduction

The Div. 3L shrimp fishery is important from an economic standpoint, and because it overlaps the distribution of several groundfish stocks presently under moratoria. In order to minimize by-catch, all vessels fishing Div. 3L shrimp must utilise sorting grates with a maximum bar spacing of 22 mm. Relative spatial distributions of shrimp and groundfish are described in Orr *et al.* (2001), therefore, this document provides estimated counts and weights of groundfish by-catch, as requested by Scientific Council during the 2-14 November 2001 Meeting (NAFO, 2001).

Methods and Materials

Data used in this report were obtained from the Canadian Observer database and the Canadian Atlantic Quota Report. Approximately 12 large (=>500 tons) vessels and more than 300 smaller (<500 tons; <100' LOA) vessels fish shrimp within Davis Strait, along the coast of Labrador and off the eastern coast of Newfoundland. An attempt was made to observe 100% of the large vessel and 10% of the small vessel catches. Groundfish by-catch is recorded to 1 kg precision for all observed fishing sets. Wherever possible, sexed length frequencies (1 cm precision) were taken from randomly selected samples of commercial groundfish species. Using a ratio of weight of fish measured to by-catch weight, the length frequencies were corrected on a set-by-set basis. Length frequencies were added together on a species by species basis. An average length frequency distribution per kg of by-catch was produced and then merged with the catch records. The average frequencies were multiplied by by-catch weights to produce length frequencies on a set-by-set, species by species, basis. Thus it was possible to predict length frequencies for sets that were not sampled. The length frequencies were aggregated to obtain total removals by species, year and size of vessel.

Results and Discussion

Tables 1-4 indicate the estimated removals of Atlantic cod (*Gadus morhua*), redfish (*Sebastes* spp.), American plaice (*Hippoglossoides platessoides*) and Greenland halibut (*Reinhardtius hippoglossoides*) during the 2000 and 2001 shrimp fisheries, in Div. 3L. Caution must be exercised with these results because:

1. weights were recorded to a precision of 1kg, therefore, by-catch levels may be biased, and
2. sample sizes were often low, therefore, length frequencies may not be representative of the actual by-catch.

Small Vessel By-catch (Tables 1 and 2)

In 2000, the small vessel fleet took 3 217 tons of shrimp. Seventy tons (2.19%) of catch was observed. No Atlantic cod or American plaice were found in the by-catch. However, an estimated 776 kg of redfish and 2 694 kg of Greenland halibut were taken, but not sampled, therefore, neither length frequencies nor counts could be estimated.

In 2001, the small vessel fleet took 2 770 tons of shrimp. Ninety-one t (3.27%) of the catch was observed. Eight kg of Atlantic cod were found in the by-catch. Therefore the Atlantic cod by-catch was estimated to be 245 kg ($8 \times 100/3.2715162 = 245$). Since only one cod was measured, the estimated length frequency is not considered reliable.

Small vessels removed approximately 2 140 kg of Greenland halibut during 2001. However, only 58 Greenland halibut were measured, due to the small sample size, the estimated length frequency is not considered reliable. Approximately 1 400 kg of redfish and 1 200 kg. of American plaice were removed, but were not sampled, therefore, neither length frequencies nor total counts could not be estimated.

Large Vessel By-catch (Tables 3 and 4)

In 2000, the large vessels caught 1 033 tons (92% observed) of shrimp while in 2001, the nominal catch was 2 394 tons (100% observed). Greenland halibut were frequently found in the large vessel by-catch. Almost 1 000 Greenland halibut were measured during 2000 while approximately 2 700 were measured during 2001. These are relatively large sample sizes and much of the catch was observed, therefore, it is assumed that the measurements are representative of the actual by-catch. Length frequencies ranged between 10 and 42 cm during 2000 and between 9 and 43 cm during 2001. In both cases, there was a mode at ~13 cm and second one at 24 cm. An estimated 21 771 and 52 487 Greenland halibut were taken during 2000 and 2001, respectively.

Atlantic cod are relatively low in abundance consequently they were not often found in the by-catch. During 2000, 525 cod weighing 88 kg were found in 56 sets. Seventy-eight cod were sampled and a composite length frequency was constructed. Lengths ranged between 12 and 27 cm. and had a mode at 19 cm. In 2001, an estimated 572 Atlantic cod weighing 235 kg were found in 184 sets. However, only 17 cod were measured therefore it was not possible to obtain a reliable length frequency.

Redfish were present in 236 and 459 observed sets during 2000 and 2001, respectively. The 2000 redfish by-catch weighed 721 kg and ranged between 7 and 18 cm in total length, however, only 47 fish were measured. Due to the low sample size, this length frequency is not reliable. The 2001 redfish by-catch weighed approximately 1 000 kg but no fish were sampled.

American plaice were present in 155 observed sets during 2000 and 361 observed sets during 2001. It was estimated that 4 700 American plaice were removed during 2000. The composite length frequency was based on approximately 400 American plaice whose lengths ranged between 12 and 38 cm and had a mode at approximately 23 cm. In 2001, the American plaice by-catch weighed 1 147 kg, however, no fish were sampled.

General Observations

Regardless of species, the number of groundfish removed was insignificant in relation to their respective population sizes. Only 7.14 tons (1.68 kg by-catch/ton of shrimp) and 13.30 tons (2.58 kg by-catch/ton of shrimp) of groundfish were taken as by-catch in 2000 and 2001, respectively. By-catch length frequencies provide an indication of the sizes and relative number of animals passing through the grate, thus providing information that about the impact that fishing may have upon year classes of various species. For this reason, it is important that observers continue to collect lengths of various by-caught species. However, care must be taken when interpreting

estimated removals, because the results may be misleading if sample sizes are low relative to the number removed in the fishery. In these cases, it may be better to indicate kg by-catch/ton of shrimp harvested.

References

NAFO. 2001. NAFO Sci. Coun. Rep. 2001, p. 278.

ORR, D.C., D.G. PARSONS, P.G. VEITCH, and D. SULLIVAN. 2001. An update of information pertaining to northern shrimp (*Pandalus borealis*, Kroyer) and groundfish in NAFO Divisions 3LNO. *NAFO SCR Doc.*, No. 186 Serial No. N4576, p. 49.

Table 1. Estimated bycatch of Atlantic cod (*Gadus morhua*), redfish (*Sebastes spp.*), American Plaice (*Hippoglossoides platessoides*) and Greenland halibut (*Rheinhardtius hippoglossoides*) taken in the small vessel (<= 500 t; LOA <100') shrimp fishery in 3L during 2000.

observed shrimp catch (t)					70.446
nominal catches of shrimp (t)					3,217
percent of catch that was observed					2.18980417
correction factor used to estimate bycatch					45.666184
				Species	
	Atl. cod	redfish	Am. Plaice		Gr. Halibut
Wt. Bycatch (kg)	0	776	0		2,694
Kg/tons of shrimp	0	0.241	0		0.837
number of observed sets with bycatch sp.	0	16	0		35
number of fish measured	0	0	0		0

Lt (cm)

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Table 2. Estimated bycatch of Atlantic cod (*Gadus morhua*), redfish (*Sebastes spp.*), American Plaice (*Hippoglossoides platessoides*) and Greenland halibut (*Rheinhardtius hippoglossoides*) taken in the small vessel (<= 500 t; LOA <100') shrimp fishery in 3L during 2001.

observed shrimp catch (t)	90.621			
nominal catches of shrimp (t)	2,770			
percent of catch that was observed	3.2715162			
correction factor used to estimate bycatch	30.566866			
				Species
	Atl. cod	redfish	Am. Plaice	Gr. Halibut
Wt. Bycatch (kg)	245	1,406	1,192	2,140
Kg/tons of shrimp	0.088	0.508	0.43	0.773
number of observed sets with bycatch sp.	8	43	29	55
number of fish measured	1	0	0	58
Lt (cm)				
5	0			0
6	0			0
7	0			0
8	0			0
9	0			0
10	0			0
11	0			0
12	0			178
13	0			1248
14	0			1248
15	0			2140
16	245			1070
17	0			535
18	0			0
19	0			0
20	0			0
21	0			0
22	0			0
23	0			178
24	0			0
25	0			357
26	0			1426
27	0			535
28	0			535
29	0			178
30	0			178
31	0			357
32	0			178
33	0			0
Total	245			10,341

Table 3. Estimated bycatch of Atlantic cod (*Gadus morhua*), redfish (*Sebastes spp.*), American Plaice (*Hippoglossoides platessoides*) and Greenland halibut (*Rheinhardtius hippoglossoides*) taken in the large vessel (>500t) shrimp fishery in 3L during 2000.

observed shrimp catch (t)		951.04			
nominal catches of shrimp (t)		1,033			
percent of catch that was observed		92.06582769			
correction factor used to estimate bycatch		1.086179341			
				Species	
	Atl. cod	redfish	Am. Plaice		Gr. Halibut
Wt. Bycatch (kg)	88	721	482		2,379
Kg/tons of shrimp	0.085	0.698	0.467		2.303
number of observed sets with bycatch sp.	56	236	155		262
number of fish measured	78	47	399		985
Lt (cm)					
5	0	0	0		0
6	0	0	0		0
7	0	3,233	0		0
8	0	2,515	0		0
9	0	1,078	0		0
10	0	1,078	0		67
11	0	3,233	0		156
12	7	718	12		1008
13	13	1,078	24		2054
14	34	1,078	60		2335
15	27	1,796	24		1686
16	40	718	24		346
17	34	0	84		82
18	40	359	156		13
19	81	0	312		102
20	67	0	372		178
21	47	0	600		740
22	34	0	661		1232
23	47	0	721		1638
24	20	0	384		1983
25	7	0	432		1734
26	0	0	216		1547
27	27	0	156		1633
28	0	0	108		861
29	0	0	60		752
30	0	0	108		426
31	0	0	24		372
32	0	0	48		433
33	0	0	84		393
34	0	0	36		340
35	0	0	48		151
36	0	0	24		109
37	0	0	0		86
38	0	0	12		87
39	0	0	0		157
40	0	0	0		75
41	0	0	0		31
42	0	0	0		62
43	0	0	0		0
Total	525	16,884	4,670		21,771

Table 4. Estimated bycatch of Atlantic cod (*Gadus morhua*), redfish (*Sebastes spp.*), American Plaice (*Hippoglossoides platessoides*) and Greenland halibut (*Rheinhardtius hippoglossoides*) taken in the large vessel (>500t) shrimp fishery in 3L during 2001.

observed shrimp catch (t)	2,403.14			
nominal catches of shrimp (t)	2,394			
percent of catch that was observed	100			
correction factor used to estimate bycatch	1			
				Species
Wt. Bycatch (kg)	Atl. cod	redfish	Am. Plaice	Gr. Halibut
	235	1,002	1,147	5,937
Kg/tons of shrimp	0.098	0.419	0.479	2.48
number of observed sets with bycatch sp.	184	459	361	505
number of fish measured	17	0	0	2,732
Lt (cm)				
5	0			0
6	0			0
7	0			0
8	0			0
9	0			11
10	0			138
11	0			609
12	0			1,215
13	0			1,896
14	0			1,491
15	0			1,178
16	0			409
17	0			109
18	0			138
19	0			281
20	0			702
21	67			2,101
22	34			5,074
23	168			7,407
24	67			9,129
25	34			6,749
26	34			5,339
27	67			3,182
28	0			1,805
29	67			1,356
30	0			569
31	0			764
32	0			462
33	0			373
34	0			188
35	0			233
36	0			150
37	0			125
38	0			119
39	0			66
40	0			83
41	0			0
42	0			0
43	0			12
44	0			0
45	34			0
Total	572			52,487