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Update of discarding of cod in the shrimp and cod directed fisheries in NAFO Divisions 2J, 3K and 3L

by

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ABSTRACT

Since the 1960's, trawlers have fished the offshore banks of the Labrador and Northeast Newfoundland Shelves for cod (*Gadus morhua*). As well, shrimp (*Pandalus sp.*) have been fished in the deep channels off Newfoundland and Labrador since the late 1970's. The shrimp gear captures incidental species, including small cod that are of no commercial value to this sector. Cod, discarded from both fisheries were generally under-recorded in the fishing logs. The winter cod and shrimp directed fisheries have been observed since 1980, providing the opportunity to quantify discarding. Close to 100% of the shrimp and cod fisheries in NAFO Divs. Fishery observers have provided coverage for 2J, 3K and 3L since 1987. This analysis updates the discard series for the years 1995 and 1996. Based on the discard levels recorded from the observed fishery, this paper shows that the amount of cod discarded from the shrimp and cod directed fisheries continues to decline. Since 1992, only the shrimp fishery has been open and increasingly, an excluder device, the Nordmore grate has been used on the shrimp gear. This device effectively excludes all but the smaller fish including cod. Given the scarcity of cod and the effect of the grate, the 1995 total cod discards from the shrimp fishery were estimated at only 5.1 t (13,305 fish) in 1995 and 13.2 t (34,438 fish) in 1996, the two lowest amounts in the time series.

RÉSUMÉ

Des chalutiers ont pêché la morue (*Gadus morhua*) sur les bancs du large du Labrador et du nord-est de Terre-Neuve depuis les années 1960. La crevette (*Pandalus sp.*) a aussi été pêchée dans les chenaux profonds du large de Terre-Neuve et du Labrador depuis la fin des années 1970. Les engins de pêche de la crevette capturent d'autres espèces de façon accidentelle, notamment des morues de petite taille sans valeur commerciale. Les morues, rejetées au moment de ces deux pêches, étaient généralement sous-déclarées dans les registres de pêche. Les pêches dirigées d'hiver de la morue et de la crevette sont suivies par observateurs depuis 1980 et cela a permis de quantifier les rejets. Les pêches de la crevette et de la morue dans les divisions 2J, 3K et 3L de l'OPANO ont fait l'objet d'une couverture par observateurs à près de 100 % depuis 1987. La présente analyse met à jour les séries de rejets pour 1995 et 1996. Il est montré, à partir des niveaux des rejets des pêches surveillées par observateurs, que la quantité de morues rejetées au cours des pêches dirigées de la morue et de la crevette continue de diminuer. Depuis 1992, seule la pêche de la crevette est ouverte et un dispositif d'exclusion, la grille Nordmore, est de plus en plus utilisé sur les engins de pêche. À l'exception des plus petits, ce dispositif permet d'exclure pratiquement tous les poissons, dont les morues. Étant donné la rareté de la morue et les effets de la grille, les rejets totaux de morue de la pêche de la crevette ont été estimés à seulement 5,1 t (13 305 poissons) en 1995 et à 13,2 t (34 438 poissons) en 1996, soit les deux valeurs les plus faibles des séries chronologiques.

Introduction

Among the many reasons cited for the decline of northern Atlantic cod in NAFO Divs. 2J, 3K and 3L is unreported catch, including fish discarded at sea. Discarding, the selective removal (by size or other selection criteria) of whole fish from the catch for return to the sea, generally occurs because of unmarketability. Only fish rejected whole are classified as discards, not parts of fish returned to the sea during production whereas dumping is the non-selective process of returning whole or partial (unculled) catches to the sea. This occurs when amounts caught exceed quotas or processing capacity of the vessel. In either case, chance of survival is small given the handling of the fish during production.

Prior to 1980, fishing logs were the only source of information on discarding of fish. Before the mid-1980's, there was little incentive to record discards in the fishing logs. Comparisons of log and observer data for the cod directed fishery for 1981 to 1985 (Kulka and Stevenson 1986) and from the shrimp fishery, particularly in earlier years confirmed that discarded or dumped fish were greatly under-reported in fishing logs. Thus, observer data was chosen as the most reliable source of information on discarding. Since 1980, observers on a portion of the offshore fleet estimated and measured fish caught and discarded. Mandatory use of fishery observers for both fisheries since 1987, and a specific requirement of observers to quantify all species by fishing set has yielded a detailed data set on discard levels for the cod and shrimp directed trawl fisheries

The cod (before 1992) and shrimp directed fisheries accounted for the majority of discarding offshore during the 1980's and 1990's. Although cod was discarded from both of the cod and shrimp directed fisheries, this source of mortality was not accounted for in the assessment of northern cod. Landing statistics, the basis for catch data as input into the assessment does not include amounts discarded and thus, fishing mortality is underestimated. Kulka (1997) presented an analysis observer data set for the years 1980 to 1994 and summarizes previous publications dealing with discarding of cod on the Labrador Shelf and Grand Bank. The purpose of the present paper is to update Kulka (1997) for 1995 and 1996. Discards from other gears, bycatch of cod from trawl fisheries other than shrimp and cod, and discards from the inshore sector are not included in this analysis.

Methods

Information gathered by fishery observers from offshore (vessel class 4+) trawler fleets of all countries directing for northern cod and northern shrimp in NAFO Divisions 2J, 3K and 3L (Fig. 1) was used to examine discarding practices by those fleets from 1980 to 1996. Observers on a portion of the trawl fleet estimated, for each set, the catches of cod, including amount kept and discarded, using the methods of Kulka and Firth (1987). These data were used to calculate total discard weights and numbers when adjusted to the landing statistics. Kulka (1997) describes how the data were analysed.

The catch at age breakdown for 1994, 1995 and 1996 is based on 1993 length and age samples because cod were not caught in large enough numbers in the recent years to obtain sufficient

samples to derive an age/length key. However, limited samples collected in 1994 to 1996 suggest that the frequency of sizes in these years were very similar to 1993.

Results

Table 1 shows that discarding of cod increased annually up to 1987 then declined to low levels by 1992. For the cod directed fishery, total discarding was generally highest in the winter months in NAFO Div. 3K corresponding to area of greatest fishing effort and along with NAFO Div. 2J, where catch per set was greatest and where fish were smaller. For the offshore cod directed fishery, from 155 t (124,081 fish) in 1980, discarding peaked in 1986 at 9,330 t or 10,097,621 fish then declined to 451 t (561,399 fish) in 1992, the last year of the directed fishery. The fishery for shrimp was limited before 1986 to the more northerly areas, namely Cartwright and Hawke Channels in NAFO Div. 2J. Discards increased proportionately with the catches of shrimp as effort spread southward and peaked in 1988 as the shrimp fishery spread to more southerly locations. The cod bycatches were highest in Hawke Channel and Funk Island Deep (Fig. 1) contributing to most of the shrimp fishery discarding, particularly between 1987 and 1991. Discarding from both fisheries dropped off sharply after 1991 as the cod fishery was closed (Feb. 1992) and Nordmore grates on shrimp nets were used to exclude cod bycatch. Only 5.1 t and 13.2 t (13,305 and 34,438 small cod) of discards were observed to have been discarded in 1995 and 1996, respectively, the two lowest years in the series. Preliminary results for 1997 show a similar low level of cod caught and discarded in the offshore shrimp fishery. A new small boat shrimp fishery was started in 1997. Given the mandatory use of the Nordmore grate in and the scarcity of cod, only 175 kg. of cod against a 5,700 t shrimp catch were discarded from this fishery.

Size of cod discarded in the shrimp fishery was fairly consistent over time particularly after the introduction of the Nordmore grate in 1993 that restricted the capture of larger fish. Numbers of cod discarded at age is shown in Table 2 and Fig. 1. Older fish, mainly 4 and 5 year olds dominated in the years prior to 1992 with a minor component of 3 and 6 year olds. Some fish were retained in all size and age groups but an increasing proportion of younger and smaller fish caught were discarded. An expanding shrimp fishery capturing and discarding younger fish and closure of the cod fishery led to a greater proportion of 2 and 3 year olds discarded in the later years.

Discussion

Kulka (1997) summarizes the factors that contributed to the increasing discard rates of the early 1980's and explains why discarding diminished after 1986. Following the moratorium on the directed fishery for cod in 1992, and introduction of the Nordmore grate in 1993 that allowed the live escapement of most cod from the shrimp gear, amounts discarded dropped to the lowest level in 1995.

Discarding is only one form of under-reported fishing mortality and the offshore cod and shrimp trawl fleets are just two of a number sectors for which discarding is generally not included in the

official catch statistics. However, cod and shrimp were the biggest contributors of all the offshore fisheries. Three other sources of discarding remain unquantified. First, for the bycatch from other trawl fisheries, a portion of cod bycatch was discarded. It is expected that for most fisheries the discard rate and absolute amounts would be low because cod was usually more valuable than the directed species and amounts bycaught were relatively low. Second, some discarding was done for other offshore gears but this was a much smaller fishery and discards associated with it would be correspondingly small. Limited data exists for these non-cod directed trawl fisheries and other offshore gears and these amounts should be quantified. Third, for the inshore sector, which was a complex set of fisheries made up of a variety of gears and extending along the northeast coast of Newfoundland and Labrador, there exists no reliable source of data. Less direct methods will be required to attempt to examine discarding practises and under-reporting for these fisheries.

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Table 1 - Summary discard amounts and numbers for the directed cod and shrimp fisheries in NAFO Divisions 2J, 3K and 3L.

	Weight				Shrimp Directed (tonnes)						Numbers			
	Cod Directed (tonnes)			Cod	Cartwright	Hawke	St. Anth.	St. Anth.	Funk Isl.	Shrimp	Both Fisheries	Cod Directed	Shrimp Bycatch	Both Fisheries
	2J	3K	3L		Channel	Channel	East	West	Deep					
1997														
1996					6.1	6.8	0.1	0.2	0.0	13.2	13.2		34,438	34,438
1995					2.1	2.9	0.2	0.0	0.0	5.1	5.1		13,305	13,305
1994				0.0	9.6	8.7	2.8		0.9	22.0	22.0		57,396	57,396
1993				0.0	2.8	40.9	2.3	0.5	0.0	46.5	46.5		180,723	180,723
1992	0.0	73.1	377.9	451.0	7.6	124.4	10.6	18.8	70.9	232.3	683.3	561,399	565,056	1,126,455
1991	23.0	492.0	444.0	959.0	6.4	383.7	35.8	68.0	64.1	558.0	1,517.0	1,151,877	1,106,472	2,258,349
1990	950.6	573.5	1,339.8	2,864.0	14.7	24.0	60.8	61.9	227.1	388.4	3,252.4	3,486,868	1,257,283	4,744,151
1989	1,088.5	973.2	519.8	2,581.5	26.2	103.5	36.4	53.5	280.7	500.3	3,081.8	3,018,173	1,435,815	4,453,988
1988	1,310.7	967.8	560.5	2,839.0	1.3	121.8	23.1	14.9	257.9	419.0	3,258.0	3,339,565	3,142,446	6,482,011
1987	1,747.0	2,013.5	665.1	4,425.6	4.6	215.5		91.5		311.6	4,737.3	4,416,849	348,245	4,765,094
1986	529.3	6,054.9	2,746.0	9,330.1	72.8					72.8	9,402.9	10,097,621	113,768	10,211,389
1985	83.3	5,545.7	1,333.7	6,962.7	0.4					0.4	6,963.2	5,953,800	625	5,954,425
1984	528.5	3,185.0	1,740.5	5,453.9	1.1					1.1	5,455.0	5,224,741	1,719	5,226,460
1983	1,577.2	1,344.9	641.6	3,563.7	0.0					0.0	3,563.7	3,224,708	0	3,224,708
1982	965.1	581.9	236.7	1,783.7	5.9					5.9	1,789.6	2,107,224	9,220	2,116,444
1981	329.9	241.8	65.5	637.2	18.9	47.6				66.5	703.7	776,260	67,580	900,341
1980	55.7	76.2	22.8	154.7	31.7					31.7	186.4	124,081	27,860	151,941
Avg.	706.8	1,701.8	822.6	2,800.4	13.6	118.9	24.5	44.2	128.8	177.1	2,977.5	43,483,166	8,176,089	51,659,255

Table 2 - Numbers of discards from the cod and shrimp directed fisheries in NAFO Divisions 2J, 3K and 3L, 1980-1996, by age.

Year/Age	1	2	3	4	5	6	7	8	9	10	11+	Sum	Catch (t)
80	0	0	6,540	60,369	49,273	7,831	68	0	0	0	0	124,081	186.4
81	0	3,026	249,251	408,524	96,194	19,547	3,599	0	0	0	0	780,141	703.7
82	0	0	447,424	1,284,176	302,991	67,290	5,209	134	0	0	0	2,107,224	1,789.6
83	0	45	157,092	1,939,526	989,955	118,733	14,518	3,475	1,136	228	0	3,224,708	3,563.7
84	0	925	396,004	3,154,599	1,430,782	251,973	1,073	9,285	100	0	0	5,244,741	5,455.0
85	0	62	84,133	1,936,741	3,232,521	573,057	107,142	14,570	2,360	3,215	0	5,953,800	6,963.2
86	0	9,674	537,680	4,075,233	4,406,498	1,053,066	108,652	6,769	273	634	118	10,198,597	9,402.9
87	11,759	39,204	96,809	673,300	2,723,640	1,107,711	80,670	20,805	7,240	2,543	1,412	4,765,093	4,737.3
88	17,257	535,703	545,495	1,092,489	1,131,458	678,534	148,652	6,227	2,028	402	182	4,158,427	3,258.0
89	187,669	887,234	622,664	1,666,380	869,880	179,174	31,761	8,557	484	127	59	4,453,989	3,081.8
90	284,928	511,453	709,224	2,114,216	1,027,604	85,363	5,580	3,626	1,868	217	70	4,744,150	3,252.4
91	80,388	468,579	363,299	615,885	609,638	112,240	7,255	675	244	95	51	2,258,349	1,517.0
92	14,189	315,446	180,622	386,419	201,927	26,336	1,260	254	3	0	0	1,126,455	683.3
93	3,469	117,247	45,367	12,113	1,207	1,144	124	51	0	0	0	180,723	46.5
94	2,668	33,911	14,896	3,952	1,751	82	120	16	0	0	0	57,396	22.0
95	618	7,861	3,453	916	406	19	28	4	0	0	0	13,305	5.1
96	1,601	20,347	8,938	2,371	1,050	49	72	10	0	0	0	34,438	13.2
97													
	604,545	2,950,718	4,468,891	19,427,210	17,076,774	4,282,149	515,784	74,458	15,735	7,462	1,892	49,425,618	44,681
Discards	1.22%	5.97%	9.04%	39.31%	34.55%	8.66%	1.04%	0.15%	0.03%	0.02%	0.00%		
Population			28.89%	24.17%	19.07%	12.72%	7.50%	4.03%	1.91%	0.90%	0.81%		

∞

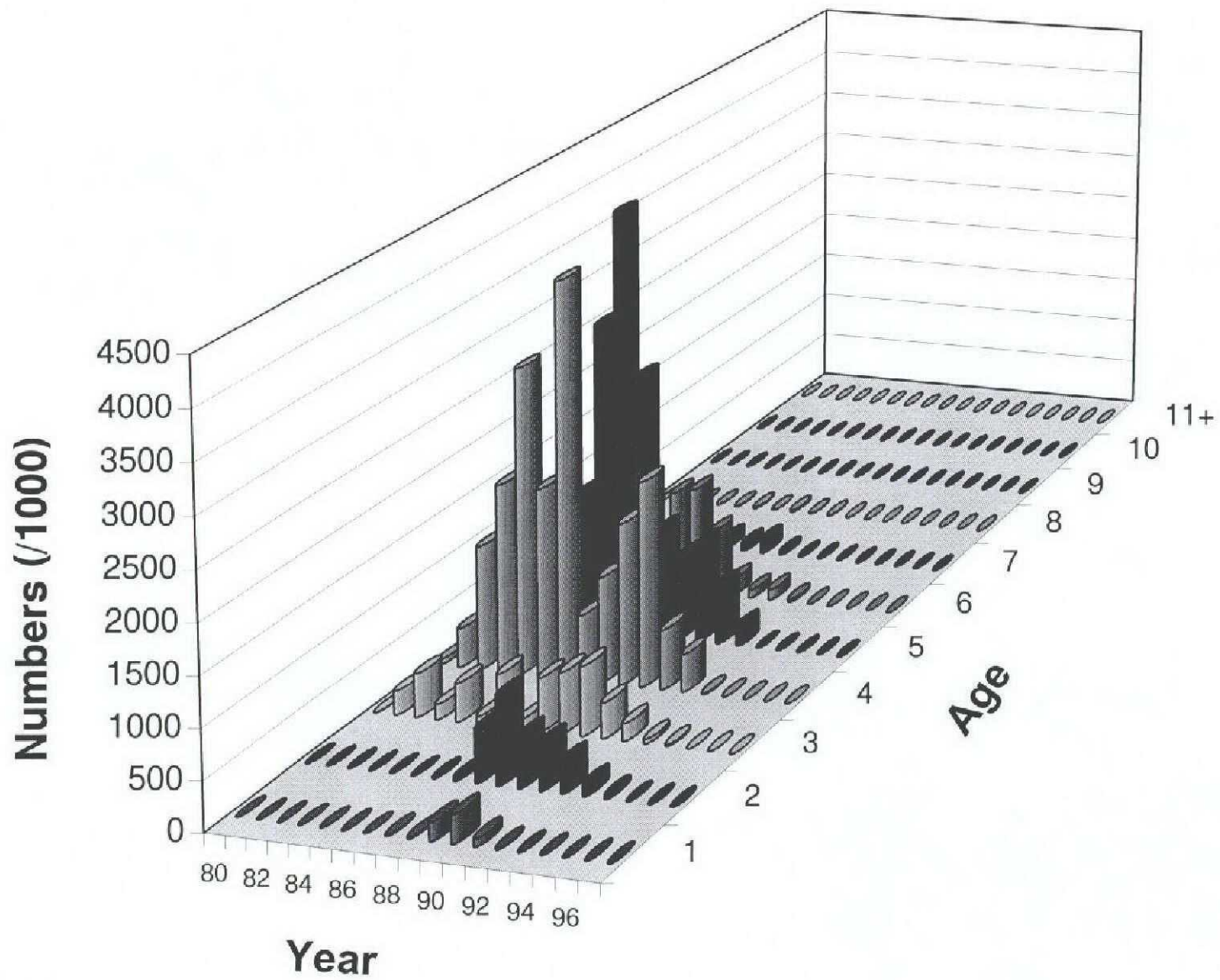


Figure 1 - Catch at age number for cod discarded from the cod and shrimp directed fisheries in NAFO Divs. 2J, 3K and 3L.

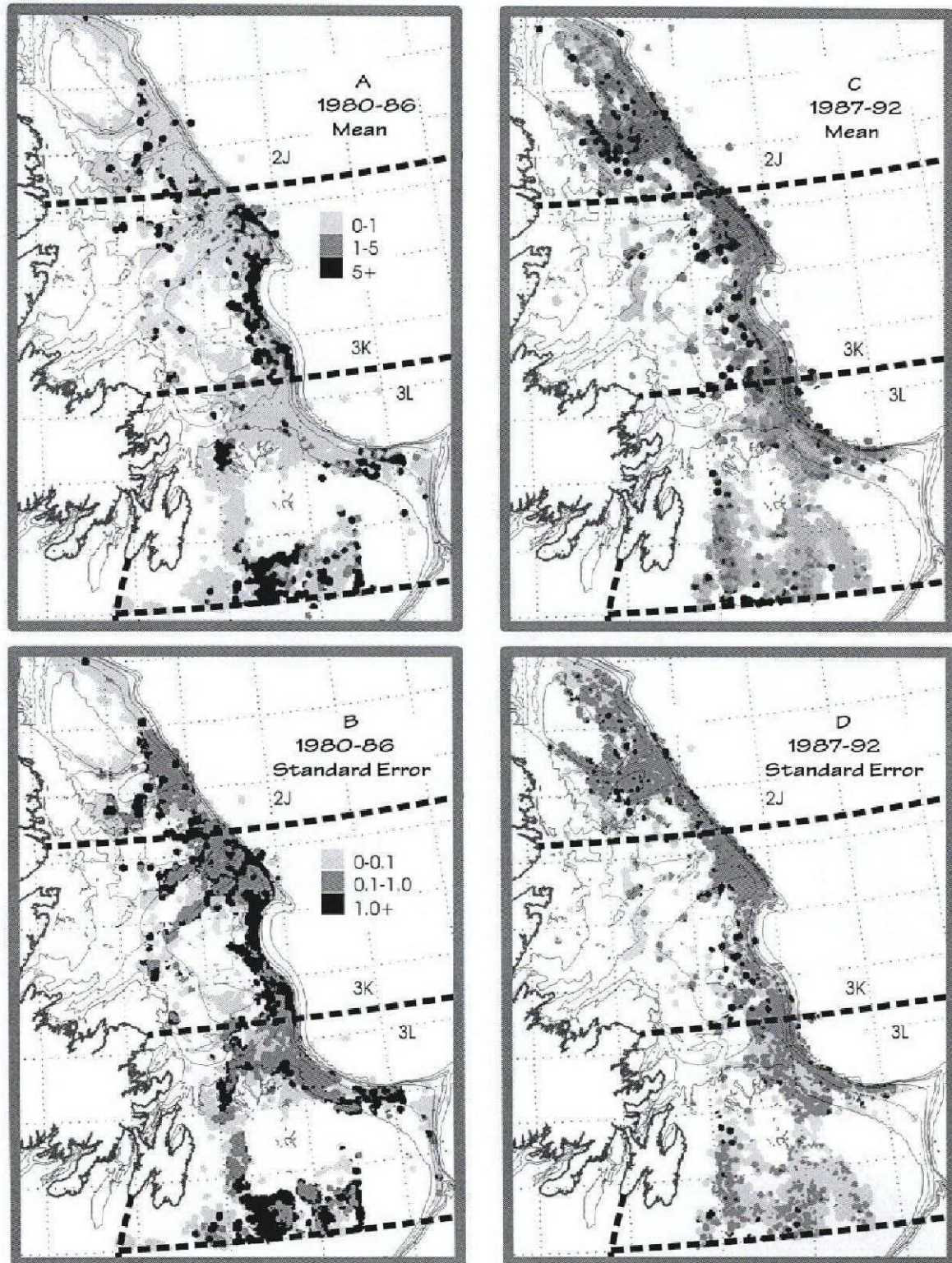


Fig. 2 - Intensity of discarding of cod over the extent of the fishing grounds for the cod directed fishery expressed as percent of total catch discarded. Upper panels (A and C) show mean discard rate. Lower panels (B and D) show corresponding variation expressed as standard error.