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Estimates of Discarding by the Newfoundland Offshore Fleet in 1982

by

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Abstract

Observers on Newfoundland trawlers provided data for estimates of discarding and total removals for 7 commercial species constituting 17 of the 27 1982 offshore fisheries. As well, data for non or semi-commercial species were collected on a set by set basis. These data were used to pinpoint problem areas of discarding. The estimates of discarding did not exceed 15% by weight for any of the commercial stocks.

For cod, annual discard rates were all low ranging between 0.4% in 3Ps and 3.5% in 3NO. Redfish was the least discarded species and did not exceed 3% by weight. In 2+3K where the rate was 2.6%, discarded fish were mainly bycatch in other fisheries such as shrimp where juvenile redfish were taken. American plaice was the most highly discarded species. In 2+3K, 12.6% by weight of the directed catch was dumped, amounting to about 800,000 individuals. In 3Ps, 10.0% of the catch by weight was discarded (600,000 fish) while the largest amount of discarding in terms of numbers occurred in 3LNO (9 million fish or 4.0% of the catch by weight). In the same area, 5.5% or 2.9 million yellowtail were discarded. A considerable portion of the 7.8% discarded turbot were juveniles taken with shrimp, as was the case for the redfish discards in the 2J+3KL cod fishery. For witch, discard rates were quite low (3.4% for 2J+3KL and 3.7% for 3NO) and were mainly from the shallower range of depths fished. Shrimp were not intentionally discarded but about 0.4% of the catch was lost during the processing procedures. The three major semi or non-commercial species discarded were skate (3432 t), wolffish (1024 t) and white hake (210 t). Other species included grenadier, capelin, squid, crab, pollock and eelpouts.

Introduction

In 1982, 200,957 metric tonnes consisting of cod, redfish, plaice, yellowtail, witch, turbot, white hake and shrimp were recorded in the landing statistics for Newfoundland vessels greater than 90 feet in length. These catch data, used to assess the various offshore stocks, underestimate fishing mortality because they do not include amounts of discarded species. Also, they yield little or no information on removal and subsequent discarding of non- or semi-commercial bycatch. Fish taken in a commercial operation and then released are most often dead or dying due to the rough treatment during the catching procedure. Hence, they are lost to the population and are effectively equivalent to removals. Also, the problem is intensified because the unmarketable younger year classes generally dominate in the discarded component of the catches and this leads to larger numbers of individuals lost per unit weight discarded. Loss of "pre-recruits" to fishing will therefore reduce amounts of commercial sized fish available in future years and these losses have not been accounted for in past fishing mortality estimates.

Prior to 1977 very little information was available with respect to discarding during operations of the Canadian offshore fleet. Stevenson (1978) produced the first analysis of discarding, a general descriptive report using data from fishing logs. However, these data probably underestimate amounts of released fish because the appropriate information is not often recorded by

those involved in the fishing operation. Subsequently, Stevenson (1980-83) in a series of detailed studies examined discarding patterns for the 1979-82 plaice fishery (identified in the 1978 study as an area where discarding was high). The study was quantitative and reliable because data were collected on board selected vessels by teams of biological technicians stationed who were independent of the commercial operation. Also, for the first time, from data collected by fisheries observers, an independent analysis of discarding for all offshore areas was done for 1981 (Kulka 1982). The above studies represented the first attempt at quantifying discarding practises of Canadian vessels fishing the offshore stocks.

In 1982, a similar broad analysis using observer data was carried out as part of a long term series designed to examine trends in discarding practices. It covered a wide range of fisheries mainly for areas north of the Laurentian Channel. Overall, about 7% of all sets that occurred in the offshore fishery on vessels greater than 90 feet were observed in detail and data obtained included estimates of catch, bycatch and discards. This facilitated quantification of discarding practises of the fleet.

Methods

Single observers were deployed to large offshore trawlers of the Canadian fleet for periods of 10 to 20 days in order to collect a wide variety of fisheries and related data for use in this and other studies. Detailed set records were collected including location, time and date fished, gear specifications and estimated weights of each species kept or discarded. Direct weighing of the catch was generally not feasible hence most observations were translated hold storage volumetric estimates for kept amounts. Eyeball methods were used to provide estimates for discarded fish because operational barriers and large amounts of fish prevented direct weighing. During processing of the catch, more than one of the crew will discard the unuseable, undersized commercial and non-commercial species, at several locations. Therefore, to obtain an overall estimate of discarding for a particular set the observer must watch each of the crew for a standard period of time during processing and tally amounts, by species. Average amount discarded per crew per time period observed can then be adjusted to the total processing period. In addition, to facilitate quantification of size and numbers discarded, information on lengths and age of discarded and landed fish was collected for the directed species. Numbers of discard length samples were limited due to time constraints and this information was used only to provide rough estimates of numbers discarded.

These data were then compiled by species, month and NAFO division, and the landing component of the observed catch was compared to official landed weight statistics for vessels greater than 90 feet (supplied by the Economics Branch of Fisheries and Oceans). The proportion of total landed weight of each fishery actually observed, was determined. This proportion was then applied to the corresponding observed discard weight in each area and month (observed discard \div proportion of landed weight observed) to yield discard estimates of both directed and bycatch species. These adjusted discard weights were then added to landed values to provide estimates of total removals. Calculations were done separately for each NAFO area and month and then were combined by stock, weighted by the actual landed weight rather than observed kept weight. Where there were no observations for a particular NAFO area, weighted averages of percent discard (by amount of landings) for the other areas within this stock were applied to landed weight of the unobserved area. Finally, monthly estimates of discards, by stock were combined to yield average yearly discard rates and estimated total removals. As above, missing monthly values were calculated as a weighted average of the months observed. Estimates of discarding and total removals were done only for fisheries where large proportions of areas and months contained observed data.

In the special cases of the 3LNO plaice fishery rates of discarding were calculated and plotted for each unit area so that detailed areal patterns could be examined. This enabled a comparison with Stevensons (1983) study, done in a similar fashion. Plots of daily fishing effort were also compiled to compare effort distribution with areal discarding patterns.

Results and Discussion

Estimates of discarding and total removals for offshore stocks fished by the Newfoundland fleet are presented for each area and month to illustrate areal variations and temporal trends in discarding. Monthly stock as well as year end estimates are presented as a summary of the fleet discard practices. Table 1 for cod, Table 2 for redfish, Table 3 for plaice, Table 4 for yellowtail, Table 5 for turbot, Table 6 for witch, and Table 7 for shrimp illustrate observed catch and discard data, reported landing figures and estimates of total removals derived from them. The sixth column in each of the tables, % of landed weight observed, provides an indication of the level of coverage attained for each category. Generally, larger values imply more reliable estimates of discarding and in turn better estimates of removals. The three columns farthest to the right provide total weights of discards, landings and removals respectively as estimated from observed catch figures presented in column 3 and 4. Where observed kept weights exceed reported landing the former is used in the estimate of total removals.

Estimates of discarding are presented for 7 species comprising 17 stocks. Coverage levels for the other 10 offshore stocks fished by the Newfoundland fleet in 1982 were not extensive enough to provide reliable estimates and are not included. Results for the observed stocks are discussed in the following sections. As well, discarding of major bycatch species is analysed.

Cod

The degree of discarding of undersized cod was relatively low, as in the past year (Kulka, 1982). Table 1 shows that annual stock averages range for 0.4% to 3.5% by weight. In 2GH, the rate appeared to drop significantly from 5.9% in 1981 (Kulka, 1982) to 1.1% in 1982. This may be a function of total weight landed in 1981 (35 t) as opposed to 1982 (2976 t). Expansion of the fishery prevents comparison in discard patterns between years. For this stock, in 1982, highest levels of discarding corresponded with the fall fishery (September) when catch rates were up and small fish need not be kept.

Discarding levels in the other cod fisheries, 2J+3KL (2.2%), 3NO (3.5%), 3Ps (0.4%) and 4VXW (0.4%) showed little change from the previous year. In 2J+3KL, the percentage was low but the actual numbers, 3.5 million individuals (1766 t) with an average length and weight of about 35 cm and 0.50 kg respectively, was the highest of all the cod fisheries examined. However, 3.5 million discarded individuals does not produce a significant effect on this large stock with average annual recruitment of about 500-600 million fish. Discard rates were relatively low in the first quarter during the bulk of the fishery but reached a maximum during spring and early summer as the fishing effort shifted to the south and presumably average size of fish decreased.

As indicated above, the highest rate occurred in 3NO but represented only 850,000 individuals weighing 411 t. Much of the discarding for this stock occurred during November, in the directed cod fishery. Unusually high catch rates (7 t per hour) were experienced for the 17% of the fishery that was observed during this month (8% of the fishery occurred in November). This may have been a factor leading to excessive dumping because such large catches are difficult to process.

Redfish

Four redfish stocks were examined and for most, discarding was almost nonexistent. The exception was 2.6% in 2+3K but this amounted to only 196 t or 750,000 individuals, weighing an average of 0.26 kg and measuring 25 cm. Very little of the 2.6% discarded came from the directed redfish fishery but rather was mainly bycatch discarded in the winter 2J+3KL cod fishery. The only significant discarding during the directed fishery occurred in September where some non-commercial sized redfish were taken.

American plaice / Yellowtail

Substantial discarding was observed in all 3 of the plaice fisheries covered. The relatively high rates were caused by the large numbers of unmarketable sizes caught with the adults. This is consistent with the findings of Walsh (1982) who using research vessel data found that juveniles on the Grand Banks are not well separated from adults. There appears to be a similar situation in 2+3K and 3Ps given the substantial amounts of juveniles taken in these areas as well. In 2+3K the observed discard rate was substantially higher at 12.6% than the previous year (0.9%, Kulka 1982). However, this apparent difference may reflect more the increased level of coverage in 1982 (14% up from 3% in the previous year) than an actual change in the pattern of discarding by the Canadian fleet. The bulk of the fishery took place in March in both years but almost no coverage was attained in this month in 1981. This missed month accounts for much of the difference between years because observed discard rate was very high at this time. However, in actual weight and numbers in this area, amount discarded was not large, 178 t or 800,000 individuals because catches in 2+3K were quite low. Regardless, the impact of discarding was significant on this relatively small population.

The discard rate of plaice in 3Ps was also relatively high at 10.0% which is equivalent to 150 t or 650,000 individuals. No seasonal trends were apparent and the rate was similar to that observed in the previous year (Kulka, 1982).

Plaice and yellowtail constitute a mixed fishery in 3LNO because of a considerable overlap of ranges. It is the largest flatfish fishery and an associated 4.0% (plaice) and 5.5% (yellowtail) discard rate in 1982 suggested a considerable number of individuals were being discarded. For plaice the estimated 1884 t is equivalent to 9 million discarded individuals and 659 t of yellowtail translates to 2.9 million fish. These findings were very little different from discard rates observed in 1981 (Kulka, 1982) but do differ significantly from Stevenson's (1983) findings for this fishery. In a four year examination of this fishery, Stevenson (1980-83) consistently reported high rates of discarding in the 3LNO plaice fishery, between 8.1 and 14.0% by weight. This contrasts with 4.6% in Kulka (1982) and 4.0% in the present study. The observed difference between the two independent analyses appears to be due to three major factors. First, Stevensons (1983) coverage was more restricted such that 24 of 185 or 13% of unit area/month categories were observed (pers. comm.) whereas 97 or 52% were observed in the present study (25 unit areas fished in some or all of the twelve months constituted the 185 area/month categories). Although there was considerable areal overlap between the two studies, for those 75% of unit area/month categories not covered by Stevenson (1983), there tended to be fewer juveniles caught and correspondingly lower discard rates (percentages for these categories were generally less than 5% within the 0.1 to 15.9% range observed). However, there was consistency of results for the 25% of categories common to both studies, particularly where coverage levels were high. Fig. 1 illustrates levels of discarding in the commercial fishery on the Grand Banks by unit area. It shows a similar areal pattern to Stevenson (1983), confirming consistency of results between studies. Fig. 2 shows the 1982 area fished for the observed portion of the fishery. The majority of fishing activity occurring in the northeastern sector of the bank away from areas where discarding was highest. This pattern was consistent with the previous two years observed, indicating that some of the discrepancy in overall rate (4.0% in this study versus 11.4% for Stevenson) was due to lower discard rates in the areas covered in this study but not covered by Stevenson (1983). This uneven areal pattern of discard rates also implies that changes in fishing patterns from one year to the next could affect discard rates. A second factor, the surveillance function of observers who collected the data for the present study tended to restrict discarding practices on some vessels. Given the fishery regulations which imply no legal discarding this is likely to have occurred in a number of cases. The reaction of captains to the presence of surveillance observers was varied.

A third reason for the apparent discrepancy in 3LNO plaice discard rates between the two independent studies is the manner in which the data were collected. In this study, individually deployed observers used eyeball methods to estimate amounts being dumped and these observations had to be made for several locations at once. This made it quite difficult to observe all activity hence the possibility of underestimation. Values for Stevensons (1983) analysis on the other hand were derived mainly from direct weighings reducing the error and the possibility of bias.

Given the above reasons it is felt that the percent of discarding estimated in this study may be low. However, the estimate of 4.1% from this study is thought to be more representative for the actual areas fished because of higher coverage. As such, the 1982 rate of discarding probably lies between 4.0% from this study and 11.4% from Stevenson (1983). Regardless, discarding is responsible for a significant loss from the 76 million 3-6 year-olds estimated in the 3LN population for these year classes by Brodie and Pitt (1983). The 30 portion not included in this population estimate was lightly fished (see Fig. 2). Again this mortality goes unrecorded in the official statistics.

Other flatfish

In the 2+3KL turbot fishery, the observed rate of discarding was 7.8% (763 t or about 1.3 million individuals). A considerable portion of this amount was the result of discarding of small turbot taken as bycatch in the shrimp and other fisheries in the late summer and fall. Discard rate in the directed turbot fishery itself was closer to 3-4%, centered mainly in the southern and more shallow areas fished.

Discarded witch amounted to only 26 t or 3.4% of the catch weight and no seasonal pattern was apparent. In 3NO, the amount of this species discarded was also low at 66 t or 3.7%. Discard rates were higher than the previous year for both fisheries but actual amounts were still low.

Shrimp

Only 7.6 t of shrimp were discarded for the 1999 t of landed weight in 2HJ. This is consistent with the previous years findings (Kulka, 1982). Almost all shrimp discarded were broken and unuseable or had accidentally fallen under the sorting and cooking machines and were consequently washed away. No discarding of undamaged shrimp was observed but the bycatch consisting mainly of juvenile turbot and redfish were discarded.

Other species

Three major non or semi-commercial species comprised the discarded portion of the bycatch in the offshore fisheries listed in Tables 1-7. They were as follows; 3432 t of skate or 100% of the total catch of this species, 1024 t of wolfish species or 39% of the total caught, and 210 t of white hake or 44% of the total caught. Other bycatch species such as grenadier, capelin, squid, crab, eelpouts, sculpins, and pollock constituted of about 200 additional tonnes, mostly discarded.

Skate, the most common non-commercial bycatch was taken mainly with plaice (2095 t), cod and yellowtail on the Grand Banks at all times of the year. It amounted to an average of about 2% of the total catch by weight for these directed fisheries. Three wolfish species were taken; spotted which was usually kept, striped which was discarded about 50-60% of the time and northern which was mainly discarded. White hake, a bycatch of cod and redfish fisheries on the Grand Banks, was taken mainly in the southern areas. Discarding was heaviest when taken with redfish.

Conclusions

In 1982 for observed offshore stocks, the estimated weight of discarded commercial and noncommercial species was 11,100 t (constituting 66% by weight of commercial species). Approximately 5.6% of total biomass caught was returned to the sea through discarding. Taking into account 72,000 t of offshore landings for stocks not observed, it is estimated that about 15,500 t were discarded in the total offshore Newfoundland fishery (vessels greater than 90'LOA). This result is quite similar to the 14,000 t specified by Kulka (1982) in the previous years analysis. Again, it is stressed that this value must be regarded as a minimum estimate because of deterrence of discarding brought about by the surveillance aspect of the observers' job. In the 90% of unobserved fishing activity the rate of discarding is likely higher because of the absence of observers. Percent of all removals discarded by numbers of

individuals is about 15% or 3 times the estimate by weight because most discards are juveniles. This represents a significant component of mortality not accounted for in the evaluation of exploited stocks and a significant loss of future commercial biomass.

References

- Brodie, W. B., and T. K. Pitt. 1983. American plaice in NAFO Division 3L, 3N and 3O - A stock assessment update. NAFO SCR Doc. 83/VI/58.
- Kulka, D. W. 1982. Estimates of discarding by Newfoundland offshore vessels in 1981. CAFSAC Res. Doc. 82/34, 22p.
- Stevenson, S. C. 1978. A descriptive report on the discarding of fish by the Canadian offshore fishery in ICNAF Subareas 2 and 3. ICNAF Res. Doc. 78/VI/67.
1980. Summary of discarding and estimated of the total removals by Canadian trawlers during the 1978 and 1979 Divisions 3LNO American plaice fishery. NAFO SCR Doc. 80/VI/86.
1981. Summary of discarding and estimates of total removals by Canadian trawlers during the 1980 Divisions 3LNO American Plaice fishery. NAFO SCR Doc. 81/VI/55.
1982. Summary of discarding and estimates of total removals by Canadian trawlers during the 1981 Divisions 3LNO American plaice fishery. CAFSAC Res. Doc. 82/19.
1983. Summary of discarding and estimates of total removals by Canadian trawlers during the 1982 Divisions 3LNO American plaice fishery. NAFO SCR Doc. 83/VI/27, Serial No. N678, 7 p.
- Walsh, S. J. 1982. Distribution and abundance of pre-recruit and commercial-sized American Plaice on the Grand Bank. J. Northw. Atl. Fish. Sci. Vo. 3, No. 2, 149-158.

Table 1. Estimates of discarding in the offshore Newfoundland cod fisheries in 1982.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
June	2H(2GH)	68.65	0	0	22.00	0	312	312
July	2H(2GH)	0	-	-	0	-	340	-
Aug	2H(2GH)	37.37	0.10	0.27	3.12	3.25	1199	1202
Sept	2H(2GH)	61.17	1.55	2.47	6.16	25.16	993	1018
Oct	2GH	0	-	-	0	-	31	-
Dec	2H(2GH)	0	-	-	0	-	101	-
1982	2GH	167.19	-	1.12	5.70	33.77	2976	3010
Jan	2J	76.85	0.10	0.13	23.15	0.43	332	333
	3K	0	-	-	0	-	330	-
	3L	42.59	0	0	1.74	0	2428	2428
	2J+3KL	119.44	-	0.13	3.87	4.02	3090	3095
Feb	2J	1166.40	7.71	0.66	11.52	66.95	10129	10196
	3K	10.04	0.06	0.59	1.19	5.04	844	849
	3L	4.33	0	0	1.52	0	285	285
	2J+3KL	1180.77	-	0.64	10.49	71.99	11258	11330
Mar	2J	1201.34	11.80	0.97	9.21	128.14	13046	13174
	3K	77.15	0.35	0.45	3.31	10.58	2331	2342
	3L	74.05	0.51	0.68	2.14	23.80	3456	3480
	2J+3KL	1352.54	-	0.85	7.18	162.52	18833	18996
Apr	2J	977.47	36.52	3.60	7.71	473.52	12674	13148
	3K	96.22	19.12	16.58	3.44	556.39	2800	3356
	3L	257.18	5.87	2.23	10.51	55.85	2447	2503
	2J+3KL	1330.87	-	5.71	7.43	1085.76	17921	19007
May	2J	266.84	0.85	0.32	13.10	6.49	2037	2044
	3K	268.00	5.28	1.93	12.73	41.47	2105	2147
	3L	134.92	1.88	1.37	5.25	35.82	2571	2606
	2J+3KL	699.76	-	1.23	10.42	83.78	6713	6797
June	2J	344.65	14.01	3.91	15.62	89.71	2207	2297
	3K	9.45	0.45	4.55	7.62	5.91	124	130
	3L	181.43	0.79	0.43	7.93	9.95	2287	2297
	2J+3KL	535.53	-	2.24	11.60	105.58	4618	4724
July	2J	0	-	-	0	-	19	-
	3K	0	-	-	0	-	66	-
	3L	48.44	0.10	0.21	2.51	4.05	1929	1933
	2J+3KL	48.44	-	0.21	2.41	4.23	2014	2018
Aug.	2J	0	-	-	0	-	337	-
	3K	0	-	-	0	-	60	-
	3L	13.52	0.14	1.03	2.33	6.01	580	586
	2J+3KL	13.52	-	1.03	1.38	10.12	977	987
Sept	2J	11.41	0	0	2.67	0	427	427
	3K	2.79	0	0	5.17	0	54	54
	3L	3.01	0.05	1.66	1.51	3.32	200	203
	2J+3KL	17.21	-	0.49	2.53	3.32	681	684
Oct	2J	0	-	-	0	-	235	-
	3K	0	-	-	0	-	186	-
	3L	21.82	0.47	2.11	1.41	33.43	1552	1585
	2J+3KL	21.82	-	2.11	1.11	42.31	1973	2015
Nov	2J	0	-	-	0	-	107	-
	3K	8.18	0.27	3.19	9.51	2.84	86	89
	3L	314.80	7.05	2.19	6.17	114.17	5098	5212
	2J+3KL	322.98	-	2.21	6.10	119.37	5291	5410
Dec	2J	0	-	-	0	-	24	-
	3K	50.80	0.34	0.66	12.89	2.63	394	397
	3L	181.80	2.60	1.41	3.72	69.92	4889	4959
	2J+3KL	232.60	-	1.35	4.38	72.88	5307	5380
1982	2J+3KL	5875.74	-	2.20	7.47	1765.88	78676	80442

Table 1. (Cont'd.)

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Feb.	3N	0	-	-	0	-	68	-
	30	43.60	0	0	6.60	0	661	661
	3NO	43.60	-	0	5.98	0	729	729
Mar	30(3NO)	0	-	-	0	-	450	-
Apr	3NO	0	-	-	0	-	124	-
May	3N	10.60	0.21	1.94	5.52	3.80	192	196
	30	191.67	4.49	2.29	5.42	82.79	3534	3617
	3NO	202.27	-	2.27	5.43	86.59	3726	3813
June	3N	10.86	0	0	4.5	0	262	262
	30	0	0	0	0	-	1688	-
	3NO	10.86	-	-	0.56	-	1950	-
July	3N	5.61	0.01	0.18	2.17	0.46	258	259
	30	0	-	-	0	-	218	-
	3NO	5.61	-	0.18	1.18	0.85	476	477
Aug	3N	17.57	0.12	0.68	3.80	3.16	462	465
	30	0	0	0	0	-	5	-
	3NO	17.57	-	0.68	3.76	3.20	467	470
Sept	3N	12.86	0.29	2.21	6.30	4.60	204	209
	30	2.55	0	0	16.97	0	15	15
	3NO	15.41	-	2.10	7.04	4.60	219	224
Oct	3N	7.34	0.01	0.14	1.50	0.67	490	491
	30	1.32	0.01	0.08	3.77	0.27	35	36
	3NO	8.66	0.02	0.18	1.65	0.94	525	526
Nov	3N	74.65	0.23	0.31	32.04	0.72	233	234
	30	56.65	23.28	29.11	10.51	221.50	539	761
	3NO	131.30	-	22.33	17.01	222.22	772	995
Dec	3NO	0	-	-	0	-	150	-
1982	3NO	435.28	-	3.47	4.54	344.40	9588	9932
Mar	4Vs(4VWX)	286.16	2.14	0.74	9.89	21.62	2892	2914
Apr	4VS	2.04	0	0	0.31	0	656	656
	4W	3.46	0	0	20.33	0	17	17
	4VWX	5.50	0	0	0.82	0	673	673
May	4Vs(4VWX)	0	-	-	0	-	581	-
June	4VS	0	-	-	0	-	201	-
	4W	0	-	-	0	-	44	-
	4X	0	-	-	0	-	9	-
	4VWX	0	-	-	0	-	254	-
July	4Vs(4VWX)	0	-	-	0	-	5	-
Oct	4Vs(4VWX)	0	-	-	0	-	316	-
Nov	4VS	5.89	0	0	11.93	0	217	217
	4W	0	-	-	0	-	1	-
	4VWX	25.89	-	-	11.88	0	218	218
Dec	4Vs(4VWX)	56.00	0	0	18.92	0	296	296
1982	4VWX	373.55	-	0.41	7.14	21.62	5235	5257
Jan	3PS	0	-	-	0	-	22	-
Feb	3PS	43.70	0	0	14.86	0	294	294
Mar	3PS	115.48	1.98	1.69	32.44	6.10	356	362
Apr	3PS	5.55	0	0	0.71	0	783	783
May	3PS	0	-	-	0	-	356	-
June	3PS	0	-	-	0	-	7	-
July	3PS	0	-	-	0	-	7	-
Aug	3PS	2.09	0.09	3.90	17.44	0.52	12	13
Sept	3PS	1.57	0.10	6.11	17.39	0.57	9	10
Oct	3PS	11.56	0	0	23.60	0	49	49
Nov	3PS	29.29	0.01	0.03	8.27	0.12	354	355
Dec	3PS	0	-	-	0	-	191	-
1982	3PS	209.24	-	0.39	8.58	9.60	2440	2450

Table 2. Estimates of discarding in the offshore Newfoundland Redfish Fisheries.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Jan	2J	23.32	3.88	14.27	86.37	4.49	27	32
	3K	0	-	-	0	-	71	-
	2+3K	23.32	-	14.27	23.80	16.30	98	114
Feb	2J	15.22	0.74	4.64	6.79	10.89	224	235
	3K	1.09	0.40	26.85	0.81	49.17	134	183
	2+3K	16.31	-	14.37	4.56	60.06	358	418
Mar	2J	48.76	7.04	12.80	30.29	23.25	161	184
	3K	8.90	0.03	0.28	8.01	0.37	111	112
	2+3K	57.66	-	7.98	21.20	23.62	272	296
Apr	2J	0	-	-	0	-	56	-
	3K	31.28	0.06	0.19	5.65	1.06	554	555
	2+3K	31.28	-	0.19	5.13	1.17	610	611
May	2J	14.58	0.56	3.70	9.11	6.15	160	166
	3K	310.32	1.15	0.37	28.65	4.01	1083	1087
	2+3K	324.90	-	0.81	26.14	10.16	1243	1253
June	2H	16.68	0	0	57.52	0	29	29
	2J	42.05	0.65	1.52	18.36	3.54	229	233
	3K	59.64	0	0	25.71	0	232	232
	2+3K	118.37	-	0.76	24.16	3.54	461	465
July	2J	0	-	-	0	-	465	-
	3K	0	-	-	0	-	59	-
	2+3K	0	-	-	0	-	524	-
Aug	2J	116.76	0.05	0.04	11.23	0.45	1040	1041
	3K	11.30	0	0	20.55	0	55	55
	2+3K	128.06	-	0.04	11.69	0.45	1095	1096
Sept	2H	0	-	-	0	-	46	-
	2J	224.12	10.92	4.67	21.10	51.75	1062	1114
	3K	54.94	0	0	16.02	0	343	343
	2+3K	279.06	-	3.77	19.23	51.75	1405	1457
Oct	2J	0	-	-	0	-	29	-
	3K	0	-	-	0	-	518	-
	2+3K	0	-	-	0	-	547	-
Nov	3K(2+3K)	7.01	0	0	1.25	0	562	562
Dec	3K(2+3K)	41.80	0.15	0.36	41.80	0.36	100	101
1982	2+3K	1027.77	-	2.60	13.98	195.96	7350	7546
Jan	3L(3LN)	44.46	0	0	4.40	0	1010	1010
Feb	3L	18.95	0	0	3.64	0	520	520
	3N	0	0	0	0	-	12	-
	3LN	18.95	0	0	3.56	-	532	-
Mar	3L(3LN)	108.85	0.22	0.20	11.01	2.0	989	991
Apr	3L(3LN)	104.99	0.07	0.07	10.28	0.68	1021	1022
May	3L(3LN)	5.31	0.01	0.15	2.53	0.40	210	211
June	3L	0	0	0	0	-	246	-
	3N	3.00	0	0	3.53	0	85	85
	3LN	3.00	-	0	0.91	-	331	-
July	3L	0	0	0	0	-	445	-
	3N	0	0	0	0	-	148	-
	3LN	0	-	0	0	-	593	-
Aug	3N(3LN)	0	0	0	0	-	4	-
Sept	3L	0	0	0	0	-	290	-
	3N	14.43	0.53	3.54	24.88	2.13	58	60
	3LN	14.43	-	3.54	4.15	12.78	348	361
Oct	3L	144.35	0	0	18.58	0	777	777
	3N	2.62	2.93	52.79	13.10	22.37	20	42
	3LN	146.97	-	2.73	18.44	22.37	797	819
Nov	3L	1.00	0.14	12.26	0.75	18.76	134	153
	3N	0	0	0	0	-	10	-
	3LN	1.00	-	12.26	0.69	20.16	144	164
Dec	3L(3LN)	3.12	0.02	0.48	1.05	1.43	298	299
1982	3LN	451.08	-	1.04	7.19	66.11	6277	6343

Table 2. (Cont'd.)

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Jan	3PS	0	0	0	0	-	4	-
Feb	3PS	0	0	0	0	-	1	-
Mar	3PS	1.37	0.39	21.94	22.16	3.13	11	14
Apr	3PS	0	0	0	0	-	12	-
May	3PS	0	0	0	0	-	49	-
June	3PS	15.28	0	0	27.29	0	56	56
July	3PS	0	0	0	0	-	133	-
Aug	3PS	80.30	0	0	22.31	0	360	360
Sept	3PS	42.82	0.09	0.20	37.23	0.24	115	116
Oct	3PS	24.56	0.01	0.01	13.79	0.07	178	179
Nov	3PS	55.40	0	0	31.12	0	178	178
Dec	3PS	3.20	0	0	35.56	0	9	9
1982	3PS	222.93	-	0.38	20.23	4.19	1106	1110
Feb	4VN	0	-	0	0	-	1	-
Mar	4VN	0	-	0	0	-	4	-
May	4VN	0	-	0	0	-	1	-
June	4VN	100.83	0	0	22.66	0	445	445
July	4VN	6.10	0	0	2.12	0	288	288
Aug	4VN	87.20	0.06	0.07	11.07	0.54	788	789
Sept	4VN	48.37	0	0	6.06	0	798	798
Oct	4VN	1.97	0	0	0.30	0	657	657
Nov	4VN	8.42	0	0	1.30	0	647	647
Dec	4VN	0	-	0	0	-	371	-
1982	4VN	252.89	-	0.02	6.32	0.60	4000	4001

Table 3. Estimates of discarding in the offshore Newfoundland plaice fisheries.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Jan	3K(2+3K)	1.18	0.03	2.48	4.37	0.69	27	28
Feb	2J	2.67	0.27	9.14	5.80	4.65	46	51
	3K	124.01	21.80	14.95	52.32	41.66	237	279
	2+3K	126.68	-	14.06	44.76	46.31	283	329
Mar	2J	1.46	0.80	35.40	7.30	10.96	20	31
	3K	0	-	-	0	-	150	-
	2+3K	1.46	-	35.40	0.86	93.15	170	263
Apr	2J	0	-	-	0	-	11	-
	3K	6.65	0.12	1.77	2.15	5.59	310	316
	2+3K	6.65	-	1.77	2.07	6.28	321	327
May	2J	4.53	0.08	1.73	45.30	0.18	10	11
	3K	6.25	0.55	8.09	2.53	21.74	247	269
	2+3K	10.78	-	7.86	4.19	21.92	257	279
June	2H	0	-	0	0	-	4	-
	2J	26.30	0.44	1.65	35.07	1.26	75	76
	3K	0	-	0	0	-	2	-
	2+3K	26.30	-	1.65	32.47	1.36	81	82
July	3K(2+3K)	0	-	0	0	-	2	2
Aug	2H	0	-	0	0	-	4	-
	2J	0	-	0	0	-	2	-
	3K	0	-	0	0	-	2	-
	2+3K	0	-	0	0	-	8	8
Sept	2H	2.35	0.16	6.37	4.20	3.81	56	60
	2J	0	-	0	0	-	9	-
	3K	0	-	0	0	-	11	-
	2+3K	2.35	-	6.37	0	5.17	76	81
Oct	2J	0	-	0	0	-	1	-
	3K	0	-	0	0	-	5	-
	2+3K	0	-	0	0	-	6	6
Nov	3K	0	0	0	0	-	2	-
	2+3K	0	-	0	0	-	2	-
Dec	2J	0	-	0	0	-	2	-
	3K	0	-	0	0	-	1	-
	2+3K	0	-	0	0	-	3	6
1982	2+3K	175.40	-	12.58	14.19	177.90	1236	1414
Jan	3L	0	-	0	0	-	22	-
	3N	0	-	0	0	-	3	-
	3LNO	0	-	0	0	-	25	25
Feb	3L	84.75	4.10	4.62	26.90	15.24	315	330
	3N	0	-	0	0	-	3	-
	3O	0	-	0	0	-	107	-
	3LNO	84.75	-	4.61	19.94	20.56	425	446
Mar	3L	0	-	0	0	-	592	-
	3O	0	-	0	0	-	523	-
	3LNO	0	-	0	0	-	1115	1115
Apr	3L	179.04	1.78	0.98	13.37	13.31	1339	1352
	3N	0	-	0	0	-	46	-
	3O	0	-	0	0	-	46	-
	3LNO	179.04	-	0.98	12.51	14.23	1431	1445
May	3L	549.19	30.52	5.26	14.47	210.90	3795	4006
	3N	17.63	2.80	13.70	5.31	52.73	332	385
	3O	71.00	5.17	6.79	3.56	145.42	1997	2142
	3LNO	637.82	-	6.26	10.42	409.05	6124	6533
June	3L	270.45	10.64	3.79	5.90	180.38	4585	4765
	3N	68.29	2.39	3.38	17.12	13.96	399	413
	3O	2.08	0	0	0.18	0	1149	1149
	3LNO	340.82	-	3.07	5.56	194.34	6133	6327
July	3L	281.19	8.47	2.92	5.38	157.45	5227	5384
	3N	59.86	0.48	0.80	2.29	20.97	2615	2636
	3O	0	-	0	0	-	48	-
	3LNO	341.05	-	2.22	4.32	179.51	7890	8070

Table 3. (Cont'd.)

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Aug	3L	319.14	13.45	4.05	14.39	93.48	2218	2312
	3N	157.09	5.29	3.26	5.87	90.11	2676	2766
	3O	44.00	9.98	18.49	36.36	27.45	121	149
	3LNO	520.23	-	4.04	10.37	211.04	5015	5226
Sept	3L	189.98	6.53	3.32	7.40	88.30	2569	2657
	3N	278.12	4.64	1.64	15.50	29.93	1794	1824
	3O	16.30	0.18	1.09	10.25	1.76	159	161
	3LNO	484.40	-	2.59	10.71	119.99	4522	4642
Oct	3L	104.06	5.67	5.17	3.83	147.93	2715	2863
	3N	327.21	5.25	1.58	10.47	50.14	3125	3175
	3O	12.03	0.44	3.53	5.49	8.01	219	227
	3LNO	443.30	-	3.29	7.32	206.08	6059	6265
Nov	3L	250.58	16.30	6.11	8.90	183.24	2817	3000
	3N	125.61	4.37	3.36	17.30	25.26	726	751
	3O	49.25	5.14	9.45	19.09	26.93	258	285
	3LNO	425.44	-	5.8	11.19	235.43	3801	4036
Dec	3L	280.09	30.28	9.76	15.30	197.95	1831	2029
	3N	0	0	0	0	-	235	-
	3O	0	0	0	0	-	206	-
	3LNO	280.09	-	9.76	12.33	245.62	2272	2518
1982	3LNO	3736.94	-	4.03	8.14	1883.77	44812	46696
Jan	3PS	0	-	0	0	-	49	-
Feb	3PS	0	-	0	0	-	4	-
Mar	3PS	0	-	0	0	-	202	-
Apr	3PS	6.73	.31	4.40	2.24	13.82	300	314
May	3PS	0	-	0	0	-	115	-
June	3PS	0	-	0	0	-	6	-
Aug	3PS	18.93	2.28	10.75	21.51	10.60	88	99
Sept	3PS	17.78	2.41	11.94	32.93	7.32	54	61
Oct	3PS	3.06	0.05	1.61	15.30	0.33	20	21
Nov	3PS	6.02	1.05	14.85	1.70	61.57	353	415
Dec	3PS	13.90	1.30	8.55	9.08	14.31	153	167
1982	3PS	66.42	-	10.03	4.94	149.88	1344	1494

Table 4. Estimates of discarding in the offshore Newfoundland yellowtail fisheries.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Apr	3L	0	0	0	0	-	3	-
	3N	0	0	0	0	-	14	-
	3O	0	0	0	0	-	1	-
	3LNO	0	-	0	0	-	18	-
May	3L	2.95	0.30	9.23	13.39	2.24	22	24
	3N	19.38	2.64	12.00	5.34	49.45	363	413
	3O	12.26	1.04	7.78	1.60	59.55	765	825
	3LNO	34.59	-	8.82	3.01	111.24	1150	1261
June	3L	53.86	2.90	5.11	6.13	47.27	878	925
	3N	38.11	3.11	7.55	9.95	31.26	383	414
	3O	1.20	0	0	0.21	0	571	571
	3LNO	93.17	-	4.11	5.09	78.53	1832	1911
July	3L	6.50	0.79	10.84	0.91	86.41	711	797
	3N	26.72	0.01	0.04	2.44	0.41	1096	1097
	3O	0	-	0	0	-	6	-
	3LNO	33.22	-	4.59	1.83	87.11	1813	1900
Aug	3L	20.48	1.00	4.66	13.21	7.57	155	163
	3N	134.26	12.96	8.80	6.86	188.91	1957	2146
	3O	0	-	0	0	-	2	-
	3LNO	154.74	-	8.51	7.32	196.67	2114	2311
Sept	3L	8.37	0.03	0.38	8.81	0.34	95	96
	3N	109.40	1.73	1.56	8.13	21.27	1345	1366
	3O	3.78	0.03	0.68	9.46	0.31	40	41
	3LNO	121.55	-	1.46	8.21	21.92	1480	1502
Oct	3L	4.79	0.08	1.62	1.87	4.28	256	260
	3N	35.60	1.07	2.92	2.43	44.06	1466	1510
	3O	0	-	0	0	-	22	-
	3LNO	40.39	-	2.73	2.32	48.96	1744	1793
Nov	3L	0	-	0	0	-	51	-
	3N	133.87	13.04	8.88	18.14	71.89	738	810
	3O	4.35	0.89	16.98	4.53	19.64	96	116
	3LNO	138.22	-	9.89	15.62	97.13	885	982
Dec	3L	0	-	0	0	-	86	-
	3N	0	-	0	0	-	180	-
	3O	0	-	0	0	-	20	-
	3LNO	0	-	0	0	-	286	-
1982	3LNO	615.88	-	5.50	5.44	659.26	11322	11981

Table 5. Estimates of Discarding in the offshore Newfoundland Turbot Fisheries.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Jan	3KL (2+3KL)	0.53	0.33	38.37	1.77	18.68	30	49
Feb	3K (2+3KL)	2.64	0.14	5.03	4.63	3.02	57	60
Mar	3K (2+3KL)	0.91	1.23	57.48	1.0	121.65	90	212
Apr	3K (2+3KL)	13.64	0.46	3.26	4.56	10.08	299	309
May	3K (2+3KL)	38.25	0.90	3.26	8.02	11.22	477	488
Jun	3K (2+3KL)	22.39	0	0	15.66	0	143	143
Jul	3K (2+3KL)	0.35	0	0	0.17	0	202	202
Aug	2H	230.32	13.72	5.62	9.40	146.0	2451	2597
	2J	1.98	.37	15.74	0.28	131.18	702	833
	2+3KL	232.32	14.09	5.17	7.14	177.18	3253	3430
Sept	2H	130.19	6.93	5.05	8.97	77.29	1452	1529
	2J	137.02	3.55	2.53	8.54	41.56	1604	1646
	3KL	0	-	0	0	-	9	-
	2+3KL	267.21	-	3.74	8.72	119.20	3065	3184
Oct	2+3KL	2.73	0.87	24.17	0.27	300.84	994	1245
Nov	2+3KL	7.98	0.05	0.01	2.43	0.06	329	329
Dec	2+3KL	0.34	0	0	0.29	0	118	118
1982	2+3KL	589.27	-	7.77	6.51	762.69	9057	9820

Table 6. Estimates of Discarding in the offshore Newfoundland Witch Fisheries.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Jan	3K	0	-	0	0	-	3	-
	3L	0	-	0	0	-	8	-
	2J+3KL	0	-	0	0	-	11	-
Feb	2J	0	-	0	0	-	2	-
	3K	7.60	0	0	69.09	0	11	11
	3L	0	-	0	0	0	5	-
	2J+3KL	7.60	-	0	42.22	0	18	18
Mar	2J	0	-	0	0	-	3	-
	3K	3.70	0	0	7.40	0	50	50
	3L	0.02	0.01	33.33	0.11	9.5	19	29
	2J+3KL	3.72	-	11.66	5.17	9.5	72	82
Apr	2J	0	-	0	0	-	1	-
	3K	4.05	0.02	0.49	3.09	0.65	131	132
	3L	4.66	0.06	1.27	0.53	0.53	41	42
	2J+3KL	8.71	-	0.68	5.03	1.19	173	174
May	2J	1.20	0.02	1.64	13.33	0.15	9	10
	3K	30.75	0.53	1.69	13.60	3.90	226	230
	3L	0.10	.05	50.0	1.67	3.0	6	9
	2J+3KL	32.05	-	2.84	13.30	7.05	241	248
June	2J	0	-	0	0	-	5	-
	3K	0	-	0	0	-	3	-
	3L	0.75	0	0	12.50	0	6	6
	2J+3KL	0.75	-	0	5.36	0	14	14
July	2J+3KL	0.26	0.01	3.70	2.36	0.42	11	11
Aug	2H	0	-	0	0	-	1	-
	2J	0	-	0	0	-	1	-
	3K	0	-	-	-	-	-	-
	3L	1.0	0.01	-	-	0.09	9	9
	2J+3KL	1.0	-	0.01	9.10	0.11	11	11

Table 6. (Cont'd.)

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
Sept	2J	0	-	0	0	-	7	-
	3K	0	-					
	3L	0	-				14	-
	2J+3KL	0	-	0	0	-	21	-
Oct	3K	0	-	0	0	-	1	-
	3L	2.19	0.02	0.90	2.96	0.68	74	75
	2J+3KL	2.19	-	0.91	2.92	0.69	75	76
Nov	3K	0	-		1.32		1	-
	3L	1.02	0.06	5.20		4.26	77	81
	2J+3KL	1.02	-	5.56	1.31	4.59	78	83
Dec	3K	1.16	0	0	11.60	0	10	10
	3L	0.25	0.02	7.40	1.14	1.76	22	24
	2J+3KL	1.41	-	5.21	4.41	1.76	32	34
1982	2J+3KL	58.71	-	3.37	7.76	26.44	757	783
Jan	30(3NO)	0	0	0	0	-	2	-
Feb	30(3NO)	0	0	0	0	-	6	-
Mar	30(3NO)	0	0	0	0	-	89	-
Apr	30(3NO)	0	0	0	0	-	513	-
May	3N	1.43	0.13	8.36	47.67	0.27	3	4
	30	17.84	1.31	6.84	4.52	29.01	395	424
	3NO	19.27	-	6.84	4.84	29.28	398	427
June	3NO	0	-	0	0	-	302	-
July	3NO	0	-	0	0	-	10	-
Aug	3NO	0	-	0	0	-	8	-
Sept	3N	8.99	0.02	0.22	16.05	0.12	56	57
	30	2.43	0.02	0.65	-	0.02	2	3
	3NO	11.42	0.04	0.24	-	0.14	58	59
Oct	3N	24.32	0	0	8.47	0	287	287
	30	1.79	0	0	8.11	0	22	22
	3NO	26.11	0	0	8.45	0	309	309
Nov	3NO	0	-	0	0	-	22	-
Dec	3NO	0	-	0	0	-	11	-
1982	3NO	56.8	-	3.70	3.30	66.30	1724	1790

Table 7. Estimates of discarding in the offshore Newfoundland Shrimp Fisheries.

Month	Area	Observed kept (MT)	Observed discards	% Observed discards	% of landed wt. observed	Est. discards	Landed weight	Estimated total removals
July	2J(2HJ)	0	-	-	0	-	522	-
Aug	2H	137.56	0.55	0.40	110.0	-	(125)	138
	2J	0.47	0	0	0	0	375	375
	2HJ	138.03	-	0.40	-	-	(500)	513
Sept	2H	32.45	0.11	0.34	52.34	0.21	62	63
	2J	0	-	-	0	-	190	-
	2HJ	32.45	-	0.34	12.88	0.85	252	253
Oct	2J(2HJ)	0	-	-	0	-	307	-
Nov	2J(2HJ)	0	-	-	0	-	418	-
1982	2HJ	170.01	-	0.38	8.50	7.58	1999	2020

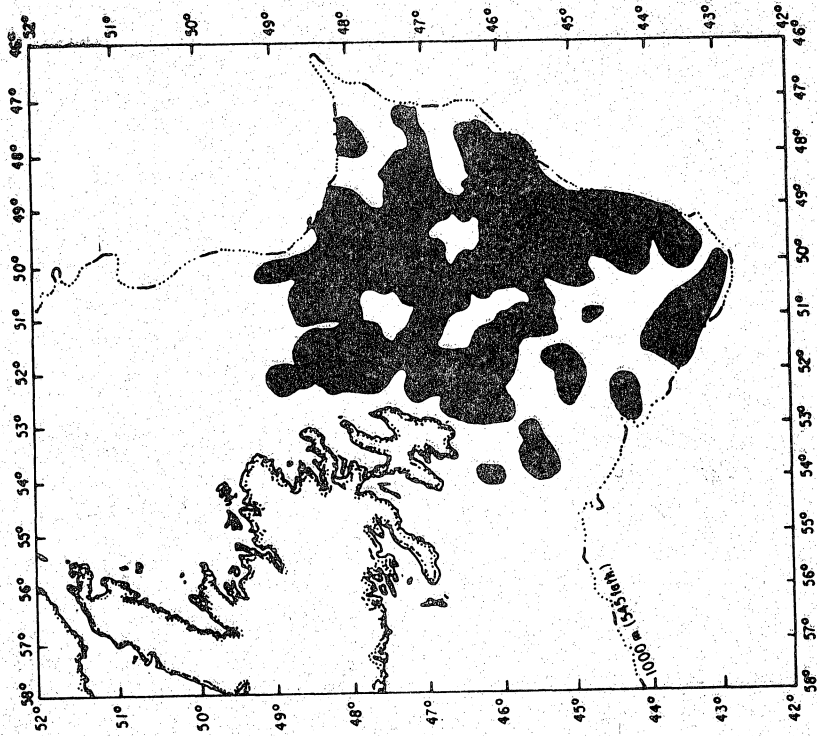


Fig. 2. Total area fished in the 1982 observed plaice fishery.

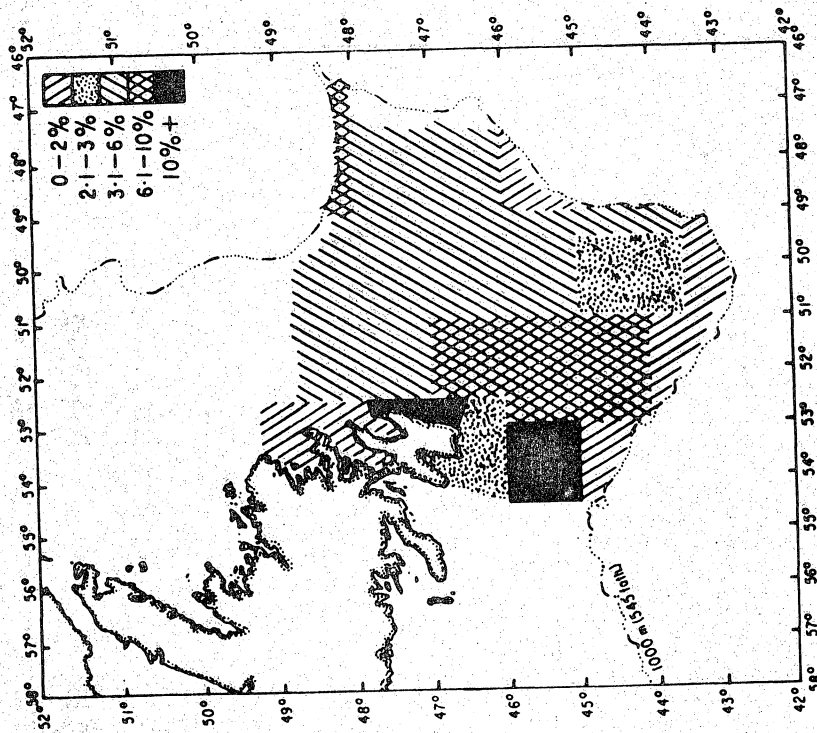


Fig. 1. Rates of discarding, by unit area in the 3LNO plaice fishery, 1982.