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Results of Surveys Directed at Cod in NAFO Division 3Ps

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Abstract

To enhance the fisheries research database in NAFO Division 3Ps, the Groundfish Enterprise Allocation Council (GEAC) has funded surveys during the fall of 1997 directed at cod. The intent is to commence a series of annual fall surveys in 3Ps to complement current resource assessment activities carried out by the Department of Fisheries and Oceans (DFO). GEAC funded and performed the surveys with scientific guidance from DFO in the design and execution of both stratified random and grid surveys and the associated sampling. The data collected during these surveys have been subsequently analysed on behalf of the Canadian Centre for Fisheries Innovation (CFFI) acting for GEAC for the express intent of providing this information to DFO, for their databases and their assessment work. This is the first time that industry has independently conducted such a research survey with the necessary scientific advisory role of DFO. Two trips to perform these surveys were carried out from 24 November to 19 December 1997. During the trips, set details and length frequencies were logged in the DFO FFS system and otoliths were collected for subsequent aging. Catch statistics, length and age distribution, and stratified analysis estimates of cod abundance and biomass, including age distribution estimates are presented.

Résumé

Afin d'améliorer la base de données de recherche sur les pêches pour la Division 3Ps de l'OPANO, le Conseil des allocations aux entreprises d'exploitation du poisson de fond (GEAC) a financé des relevés de la morue, à l'automne 1997. L'objectif est de mettre en œuvre une série de relevés annuels automnaux dans 3Ps, pour compléter les évaluations actuelles de la ressource faites par le ministère des Pêches et des Océans (MPO). Le GEAC a financé et réalisé les relevés, avec l'aide scientifique du MPO en ce qui concerne la conception et l'exécution des relevés suivant des techniques d'échantillonnage aléatoire stratifié et en quadrillage ainsi que des échantillonnages connexes. L'analyse des données recueillies lors des relevés a été effectuée au nom du Canadian Centre for Fisheries Innovation pour le compte du GEAC, dans le but explicite de transmettre les renseignements ainsi obtenus au MPO, qui l'inclura à ses bases de données et l'utilisera pour ses travaux d'évaluation. C'est la première fois que l'industrie entreprend un relevé de recherche indépendant, avec l'aide nécessaire des conseils scientifiques du MPO. Deux sorties ont été effectuées à cet effet entre les 24 novembre et 19 décembre 1997, au cours desquelles des renseignements sur les stations et les fréquences de longueur ont été enregistrés dans le système FFS du MPO. Des otolithes ont aussi été prélevés pour déterminer l'âge des prises. Ce document présente des données sur les prises, la répartition de la taille et des âges ainsi que des estimés à partir des analyses stratifiées sur l'abondance et la biomasse de la morue et sur la répartition des âges.

Introduction

To enhance the fisheries research database in NAFO Division 3Ps, the Groundfish Enterprise Allocation Council (GEAC) has funded surveys during the fall of 1997 directed at cod. The intent is to commence a series of annual fall surveys in 3Ps to complement current resource assessment activities carried out by the Department of Fisheries and Oceans (DFO). GEAC funded and performed the surveys with scientific guidance from DFO in the design and execution of both stratified random and grid surveys and the associated sampling. The data collected during these surveys have been subsequently analysed on behalf of the Canadian Centre for Fisheries Innovation (CCFI) acting for GEAC for the express intent of providing this information to DFO, for their databases and their assessment work. This is the first time that industry has independently conducted such a research survey with the necessary scientific advisory role of DFO. Two trips to perform these surveys were carried out from 24 November to 19 December 1997. During the trips, set details and length frequencies were logged in the DFO FFS system and otoliths were collected for subsequent aging.

Under contract to CCFI, AGRA Earth & Environmental has taken the data logged using the DFO FFS system, combined with the aged otoliths, created digital data files appropriate for inclusion in the DFO (VAX computer system) databases, and performed a first analysis of the survey results. This document presents these results.

Methods and Materials

Grid and Stratified Random surveys were carried out in 3Ps by the M.V. Pennysmart. Reference [1] presents a report on the two trips. A summary of the trips is presented below.

Trip 1: Grid Survey

Trip 1 was carried out from 19 November to 5 December 1997. The Pennysmart sailed from Marystown for operation in 3Ps, St. Pierre Bank, Halibut Channel, Green Bank, and Western Gullies. The initial grid survey was intended to determine distribution and abundance of various groundfish species with respect to position and depth. Set details, length, sex, and otolith information were sampled.

Tows of duration 60 minutes using an Engels 96 high lift trawl with a 135 mm diamond mesh cod end (not lined) were conducted. The trawl was fitted with rock hopper foot gear and Bergen #7 trawl doors. Performance of the trawl was checked onboard using SCANMAR net sensors.

A total of 44 successful grid tow sets were completed. Five additional grid survey sets (#s 85-89) were performed at the end of the stratified random trip described below.

The scientific party onboard for Trip 1 included Greg Pynn (TIC), Wade L. Bailey, Keith Tipple, Kevin Young, and Peter Hennebury.

Trip 2: Stratified Random Survey

Trip 2 was carried out from 5 to 19 December 1997, with the same area of interest, gear, and sampling focus as Trip 1, although the Burgeo Bank was not sampled. The other difference to note is that the tows were of 30 minutes duration.

A total of 84 successful stratified random tow sets were completed. Five additional grid survey sets (#s 85-89) were performed at the end of the trip to supplement trip 1.

Data were logged using FFS with the length and otolith sampling carried out on board. Data entry of the resulting ages were input using FFS.

The scientific party onboard for Trip 2 included Wade L. Bailey (TIC), Tony McCarthy, Wayne Dalton, Kevin Young, and Lisa Chafe. Clarence Butt acted as onshore coordinator for both trips, and has noted that the biological sampling and data collections carried out were of the highest quality.

Results and Discussion

Shore-based Analysis

The set details, cod length frequencies, and age and growth data (following completion of the otolith aging for both trips by Norm Batten) were exported from FFS to create ASCII data files. The sole focus in the work presented here is for cod. Results from analysis of the collected SCANMAR data are not yet available; however, should be reviewed at a future date and any adjustment of the wingspread value of 60 feet used in the STRAP analysis performed.

The trip 2 grid surveys (sets 85 to 89) were added to the 44 sets of trip 1 and the 49 sets treated together in all subsequent 'grid' work. All of the grid set numbers and weights were standardized to a 30 minute tow to facilitate comparison with the stratified random sets. Note that the original set details still contain the 60 minute tow duration data. The cod were sampled in 1 cm length groupings and all ratio/percentages of catch measured were applied.

ACON plots of the spatial distribution of catch numbers and weights were carried out. These are presented in Figures 1 and 2 for the grid surveys and in Figures 3 and 4 for the stratified random survey tows. The grid fished (A15..R2) is

illustrated in the figures. Tables 1 and 2 present a summary of the cod set details and catch numbers and weights.

The mean cod catch for the 49 grid sets is 68 fish and a mean weight of 307 kg. The largest catch of 2561 cod and weight 13172 kg (13 tonnes) was from set 14 in grid square N2 in the Halibut Channel. Only seven other sets had catches over 100 kg.

The mean cod catch for the 84 stratified random sets is 50 fish and a mean weight of 162 kg. The largest catch of 1216 cod and weight 3363 kg was from set 23 also in the Halibut Channel. A total of 18 sets had catches over 100 kg. Figures 5a to 5c present the composition of cod lengths using the length frequencies data sets for both the grid survey and stratified random survey sets. Since the grid and stratified random length distributions differ significantly, the sets from Burgeo Bank were separated from the larger set of other (St. Pierre Bank) sets, to investigate whether this was a factor. The Burgeo Bank sets (those with grid rows 13-15: see Table 1) represent a much smaller population size (646 fish or 12% of the total 5183 grid sample). In fact, the Burgeo Bank distribution shows a smaller mean length: the population is centred around 50 cm, with hardly any fish sampled at lengths greater than about 70 cm. The fish from the St. Pierre Bank grid sets have the largest length distribution, around 79 cm (with a smaller peak near 55 to 60 cm), and the (St. Pierre Bank) stratified random sets have most of their lengths in the 55 to 65 cm range, but a similar, albeit broader, range of lengths (35 cm to just over 100 cm) is exhibited. The length distribution for the grid sets excluding the large catch set 14, is illustrated in Figure 5c, together with the Burgeo Bank grid sets.

Figures 6a to 6d present the composition of cod age using the age and growth samples for both the grid survey and stratified random survey sets. The ages range from 2 to 12 years (two fish of ages 15 and 17 were measured in the grid survey), with most in the 3 to 8 year range. There is a noticeable, greater percentage of younger fish (ages 2 to 5) from the stratified random sets, while the grid sets show a greater population of large fish (particularly at ages 6,7, 9 and older). Figures 5 and 6 therefore suggest that the grid sets sampled populations of larger cod. It is not immediately clear how much could be attributed to the area, depth or other marine environmental factors, to the catch or tow performance, or to variations in sampling of this nature.

As a brief comparison of what appears to be quite different catch results, one can compare sets 39 and 41 from the stratified random trip 2 on 12 December with sets 40 and 41 from the grid trip 1 on 3 December. These sets are located near the St. Pierre Bank slope near the grid squares H/I5 and H6. Sets 39 and 41 from trip 2 were conducted in depths of approximately 210 and 73 m respectively, and sets 40 and 41 from trip 1 were conducted in depths of approximately 187 and 160 m. Sets 39 and 41 (trip 2) recorded cod catches of

355 and 673 kg, while 'corresponding' sets 40 and 41 from trip 1 recorded catches less than 20 kg.

Stratified Random surveys analysis was carried out using the DFO stratified analysis STRAP software and applying the French Exclusion Zone around St. Pierre et Miquelon for area calculations. Table 3 presents the STRAP output of estimated abundance and biomass. The estimated total number of cod is 31 million (with limits of 4.8 and 57.1 million). The mean number of cod per standard 1.5 nautical mile tow is 52.6 (the associated 95% confidence limits are 8.2 and 97 fish). The estimated total cod biomass is 99,300 tonnes (with limits of 24,400 and 174,200 tonnes). The mean catch weight per tow is 169 kg (95% limits of 41 and 296 kg).

Table 4 presents the STRAP age composition of numbers per tow, with sexes combined. The total mean number per tow is 53.8 (consistent with the value of 52.6 noted in Table 3 and a mean of 50 in Table 2), with the greatest numbers expected at ages 5 (13.6 fish per tow), 8 (12 fish), 7 (10 fish), and 4 (9.4). Given the low number of fish at age 6, it would appear that the 1991 year class sampled is weak. Conversely 1992 (age 5) and 1989 (age 8) are much stronger. These results are consistent with the simple presentation in Figure 6c.

Reference [1] includes a summary of the largest catches of groundfish species in addition to cod.

The author would like to thank Joanne Morgan, Eugene Murphy, Gary Somerton, and Noel Cadigan of DFO, for their assistance and technical input in this survey work.

References

[1] Bailey, Wade, L. January 6, 1998. "Final Report. M.V. Pennysmart, Trip No. 1 and Trip No. 2, November 24 to December 19, 1997. Grid Survey and Stratified Random Survey." Prepared by K.D.F. Consulting Ltd, St. John's, for Canadian Centre for Fisheries Innovation, St. John's.

Table 1 Summary of Cod Catches for Grid Survey Sets, NAFO Division 3Ps, 25 Nov - 18 Dec 1997.

Vessel	Trip	Set	Year	Month	Day	Grid or StrLin	Division	UnitArea	Set Location		Standardized '30 min' Tow Catch		Set Duration (min)	Tow Distance (n.mi.)	GearOp	Original '60 min' tow Catch		Mean Weight (kg)
									Lat (N)	Long (W)	# of Fish	Weight (kg)				# of Fish	Weight (kg)	
49	1	1	97	11	25	R2	3Ps	N32	45.12	54.56	26.0	126.9	60	3.2	1	52	253.7	4.9
49	1	2	97	11	25	R4	3Ps	N32	45.36	54.58	1.0	3.4	60	2.9	1	2	6.8	3.4
49	1	3	97	11	25	Q3	3Ps	N32	45.26	54.87	0.5	2.4	60	2.9	1	1	4.8	4.8
49	1	4	97	11	25	P2	3Ps	N32	45.09	54.99	9.0	22.0	60	2.9	1	18	44.0	2.4
49	1	5	97	11	26	O3	3Ps	M32	45.18	55.19	70.5	288.4	60	2.9	1	141	576.8	4.1
49	1	6	97	11	26	P4	3Ps	M32	45.39	55.06	1.5	5.4	60	3.4	1	3	10.8	3.6
49	1	7	97	11	26	O5	3Ps	M31	45.56	55.22	6.0	18.9	60	3.0	1	12	37.8	3.2
49	1	8	97	11	26	P6	3Ps	M31	45.75	55.10	3.0	14.0	60	3.1	2	6	28.0	4.7
49	1	9	97	11	26	O7	3Ps	M31	45.85	55.22	1.5	3.1	60	2.9	1	3	6.2	2.1
49	1	10	97	11	26	N6	3Ps	M31	45.73	55.44	0.5	3.8	60	2.9	1	1	7.6	7.6
49	1	11	97	11	26	M5	3Ps	M31	45.65	55.67	176.5	378.4	60	3.1	1	353	756.8	2.1
49	1	12	97	11	26	N4	3Ps	M32	45.45	55.46	1.0	2.2	60	3.0	1	2	4.4	2.2
49	1	13	97	11	26	M3	3Ps	M32	45.30	55.59	7.0	25.4	60	3.0	1	14	50.8	3.6
49	1	14	97	11	26	N2	3Ps	M32	45.04	55.41	2561.9	13172.0	43	2.0	1	3672	18879.9	5.1
49	1	15	97	11	27	M1	3Ps	M33	44.96	55.62	4.5	16.3	60	2.9	1	9	32.6	3.6
49	1	16	97	11	27	K1	3Ps	L33	44.90	56.01	2.0	6.5	60	2.8	1	4	13.0	3.3
49	1	17	97	11	27	L2	3Ps	M32	45.07	55.94	2.5	6.8	60	2.9	1	5	13.6	2.7
49	1	18	97	11	27	K3	3Ps	M32	45.22	56.00	4.0	12.2	60	3.1	1	8	24.4	3.1
49	1	19	97	11	28	L4	3Ps	M32	45.43	55.93	12.5	66.7	60	2.9	1	25	133.4	5.3
49	1	20	97	11	28	L5	3Ps	M31	45.53	55.92	48.5	143.8	60	3.0	1	97	287.6	3.0
49	1	21	97	11	30	G7	3Ps	L31	45.95	56.97	2.5	8.7	60	2.9	1	5	17.4	3.5
49	1	22	97	12	1	F8	3Ps	K30	46.10	57.07	0.5	0.3	60	3.1	1	1	0.6	0.6
49	1	23	97	12	1	G9	3Ps	L30	46.18	56.90	0.5	0.9	60	3.1	1	1	1.8	1.8
49	1	24	97	12	1	E10	3Ps	K30	46.36	57.28	2.0	4.1	60	3.1	1	4	8.2	2.1
49	1	25	97	12	1	E11	3Ps	K29	46.55	57.40	2.0	4.3	60	3.1	1	4	8.6	2.2
49	1	26	97	12	1	F12	3Ps	K29	46.77	57.12	1.5	3.3	60	3.1	1	3	6.6	2.2
49	1	27	97	12	1	F13	3Ps	K29	46.89	57.21	5.5	10.6	60	2.9	1	11	21.2	1.9
49	1	28	97	12	1	E14	3Ps	K28	47.07	57.36	1.0	1.0	60	3.1	1	2	2.0	1.0
49	1	29	97	12	1	E15	3Ps	K28	47.23	57.43	35.0	51.5	60	2.9	1	70	103.0	1.5
49	1	30	97	12	1	C15	3Ps	K27	47.68	57.74	11.5	16.4	60	3.1	1	23	32.8	1.4
49	1	31	97	12	2	A14	3Ps	J28	47.14	58.04	129.5	239.7	60	3.2	1	259	479.4	1.9
49	1	32	97	12	2	B13	3Ps	K29	46.93	57.98	66.0	102.3	60	2.9	1	132	204.6	1.6
49	1	33	97	12	2	C14	3Ps	K28	47.02	57.79	72.0	110.5	60	3.1	1	144	221.0	1.5
49	1	34	97	12	2	D13	3Ps	K29	46.98	57.57	2.5	3.8	60	3.1	1	5	7.6	1.5
49	1	35	97	12	2	D12	3Ps	K29	46.79	57.54	0.0	0.0	60	2.7	1	0	0.0	
49	1	36	97	12	2	C11	3Ps	K29	46.67	57.70	0.0	0.0	60	2.8	1	0	0.0	
49	1	37	97	12	2	D10	3Ps	K30	46.48	57.54	0.0	0.0	60	2.9	1	0	0.0	
49	1	38	97	12	2	E9	3Ps	K30	46.33	57.33	0.0	0.0	60	3.0	1	0	0.0	
49	1	39	97	12	3	H8	3Ps	L30	46.09	56.79	8.2	25.9	44	2.2	1	12	38.0	3.2
49	1	40	97	12	3	H6	3Ps	L31	45.81	56.79	4.0	11.0	60	3.0	1	8	22.0	2.8
49	1	41	97	12	3	I5	3Ps	L31	45.65	56.61	7.0	17.7	60	3.0	1	14	35.4	2.5
49	1	42	97	12	3	K7	3Ps	L31	45.97	56.04	1.5	7.2	60	3.1	1	3	14.4	4.8
49	1	43	97	12	3	M7	3Ps	M31	45.90	55.69	1.5	8.3	60	3.3	1	3	16.6	5.5
49	1	44	97	12	4	Q2	3Ps	N32	45.10	54.77	0.5	0.9	60	2.9	1	1	1.8	1.8
49	2	85	97	12	17	L7	3Ps	M31	45.90	55.92	4.5	17.3	60	2.8	1	9	34.6	3.8
49	2	86	97	12	17	K6	3Ps	L31	45.74	56.10	4.5	40.5	60	2.9	1	9	81.0	9.0
49	2	87	97	12	17	M6	3Ps	M31	45.74	55.71	3.0	18.4	60	2.9	1	6	36.8	6.1
49	2	88	97	12	18	O4	3Ps	M31	45.59	55.42	7.0	23.4	60	2.7	1	14	46.8	3.3
49	2	89	97	12	18	P5	3Ps	M31	45.57	55.09	2.5	8.7	60	3.1	1	5	17.4	3.5
									Minimum		0	0	43	2		0	0	0.6
									Maximum		2561.86	13172.04	60.00	3.40		3672.00	18879.92	9.00
									Mean		67.67	307.25	59.33	2.96		105.63	461.89	2.97
									Median		3.00	10.60	60.00	3.00		6.00	21.20	3.05
									Standard Error		7.46	38.32	0.07	0.00		10.70	54.91	0.04
									Total		3316.04	15055.29	2907.00	144.80		5176.00	22632.61	145.69
									Count		49	49	49	49		49	49	45

Notes: (1) Five Grid sets from Stratified Random survey Trip 2 are included
(2) GearOp =1 no damage, =2 some damage to net, catch not affected
(3) Vessel 49 is the M.V. Pennysmart

Table 3 Stratified Analysis Estimated Cod Abundance and Biomass

COD GEAC 3PS 1997 No Zone
 ANALYSIS FOR TRIP 2 1997
 VESSEL 49
 ICNAF 3P
 SPECIES 0438

NUMBERS						
STRATUM	NO. SETS	TOTAL	AV./SET	UNITS	TOTAL NO	VAR.
310	2	32.50	16.25	9255.	150401.	153.13
311	2	92.94	46.47	17903.	831921.	1864.31
312	2	89.00	44.50	16281.	724523.	2520.50
313	2	79.56	39.78	11147.	443443.	663.85
314	8	11.14	1.39	61748.	85975.	1.03
315	5	195.39	39.08	52357.	2046053.	1417.60
316	2	647.00	323.50	11147.	3606065.	72580.50
317	2	38.93	19.47	11620.	226204.	307.92
318	2	77.79	38.89	8715.	338949.	640.31
319	8	2095.15	261.89	66477.	17409906.	213081.33
320	11	550.69	50.06	79988.	4004420.	7906.81
321	10	23.81	2.38	73503.	175029.	7.85
323	6	28.77	4.80	47020.	225468.	27.06
325	9	7.01	0.78	63775.	49666.	2.70
326	2	3.00	1.50	11215.	16822.	4.50
705	2	15.61	7.80	13174.	102799.	12.59
706	4	72.00	18.00	28509.	513169.	351.33
707	2	11.65	5.83	4999.	29125.	47.79
		TOTAL			AVERAGE	
	TOTAL	UPPER	LOWER	MEAN	UPPER	LOWER
	30979938.	57109456.	4850420.	52.61	96.99	8.24

EFFECTIVE DEGREES OF FREEDOM= 8
 STUDENTS T-VALUE= 2.31 ALPHA=0.05

WEIGHTS						
STRATUM	NO. SETS	TOTAL	AV./SET	UNITS	TOTAL NO	VAR.
310	2	56.81	28.41	9255.	262920.	348.10
311	2	174.09	87.04	17903.	1558328.	9900.00
312	2	149.20	74.60	16281.	1214594.	4086.08
313	2	203.09	101.54	11147.	1131912.	3177.04
314	8	33.96	4.24	61748.	262118.	14.73
315	5	1066.84	213.37	52357.	11171418.	64252.97
316	2	2218.01	1109.01	11147.	12362116.	1138253.88
317	2	164.66	82.33	11620.	956658.	4971.73
318	2	209.06	104.53	8715.	910962.	9066.27
319	8	5792.51	724.06	66477.	48133468.	1601469.25
320	11	2600.05	236.37	79988.	18906740.	233912.69
321	10	40.98	4.10	73503.	301178.	13.89
323	6	43.57	7.26	47020.	341414.	56.35
325	9	12.63	1.40	63775.	89487.	5.91
326	2	6.40	3.20	11215.	35887.	20.48
705	2	42.01	21.01	13174.	276722.	20.25
706	4	184.80	46.20	28509.	1317134.	1597.63
707	2	38.57	19.29	4999.	96415.	482.72
		TOTAL			AVERAGE	
	TOTAL	UPPER	LOWER	MEAN	UPPER	LOWER
	99329488.	174227408.	24431584.	168.69	295.89	41.49

EFFECTIVE DEGREES OF FREEDOM= 10
 STUDENTS T-VALUE= 2.23 ALPHA=0.05

Table 4 Stratified Analysis Age Composition, Numbers per Standard Tow

COD GEAC 1997 3PS No Zone (S1 BY AGE)
 ANALYSIS FOR TRIP 2 1997
 VESSEL 49
 ICNAF 3P

AGE COMPOSITION-NUMBERS PER STANDARD TOW

SUMMARY TABLE
 SPECIES:SPECIES 0438

SEX:COMBINED

AGE	TOTAL NUMBERS	UPPER LIMIT	LOWER LIMIT	MEAN PER TOW	UPPER LIMIT	LOWER LIMIT	D.F.
0.0	0.	0.	0.	0.00	0.00	0.00	0
1.0	0.	0.	0.	0.00	0.00	0.00	0
2.0	171778.	263561.	79995.	0.29	0.45	0.14	4
3.0	1931800.	3300717.	562882.	3.28	5.61	0.96	8
4.0	5547038.	10084754.	1009322.	9.42	17.13	1.71	8
5.0	8020998.	15694904.	347091.	13.62	26.65	0.59	7
6.0	1776711.	3418121.	135302.	3.02	5.80	0.23	7
7.0	5905216.	11110416.	700016.	10.03	18.87	1.19	8
8.0	7046635.	12642847.	1450423.	11.97	21.47	2.46	10
9.0	790460.	1322127.	258793.	1.34	2.25	0.44	20
10.0	318176.	600660.	35693.	0.54	1.02	0.06	8
11.0	142342.	244281.	40403.	0.24	0.41	0.07	21
12.0	21642.	48188.	-4903.	0.04	0.08	-0.01	11
UNKNOWN	5447.	74644.	-63751.	0.01	0.13	-0.11	1
TOTAL	31678248.	57991572.	5364928.	53.80	98.49	9.11	8

ESTIMATION TYPE:STANDARD TRANSFORMATION TYPE:NONE

CONFIDENCE LEVEL: 0.95%

****-ONE OR MORE OF THE LOWER LIMITS IN THE ABOVE

TABLE IS LESS THAN OR EQUAL TO ZERO. VARIANCE IS TOO LARGE FOR
 VALID CONFIDENCE LIMITS ****

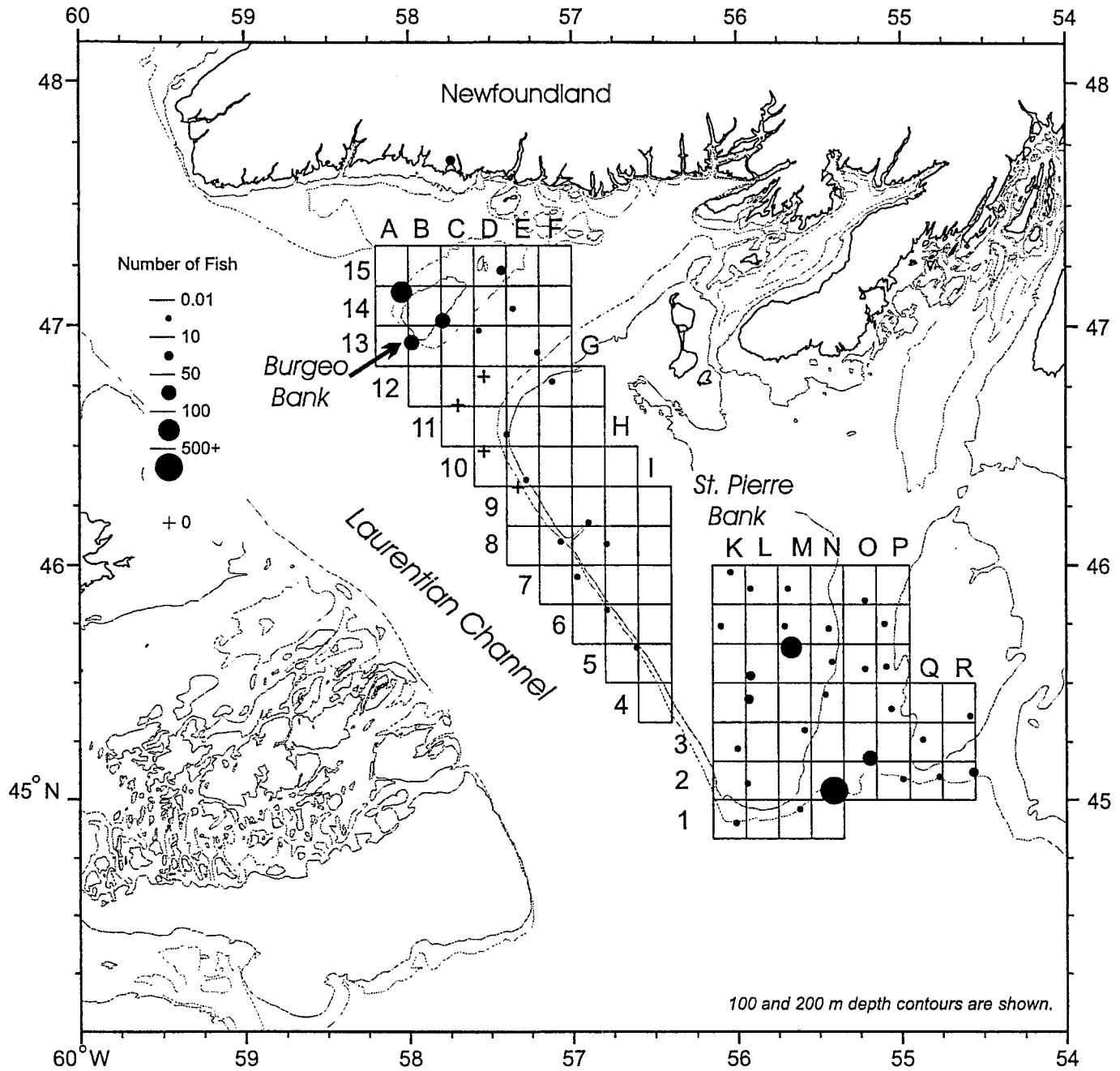


Figure 1 Distribution of Cod Catches: Number of Fish from M.V. Pennysmart Grid Surveys, NAFO Division 3Ps, 25 Nov-18 Dec 1997.

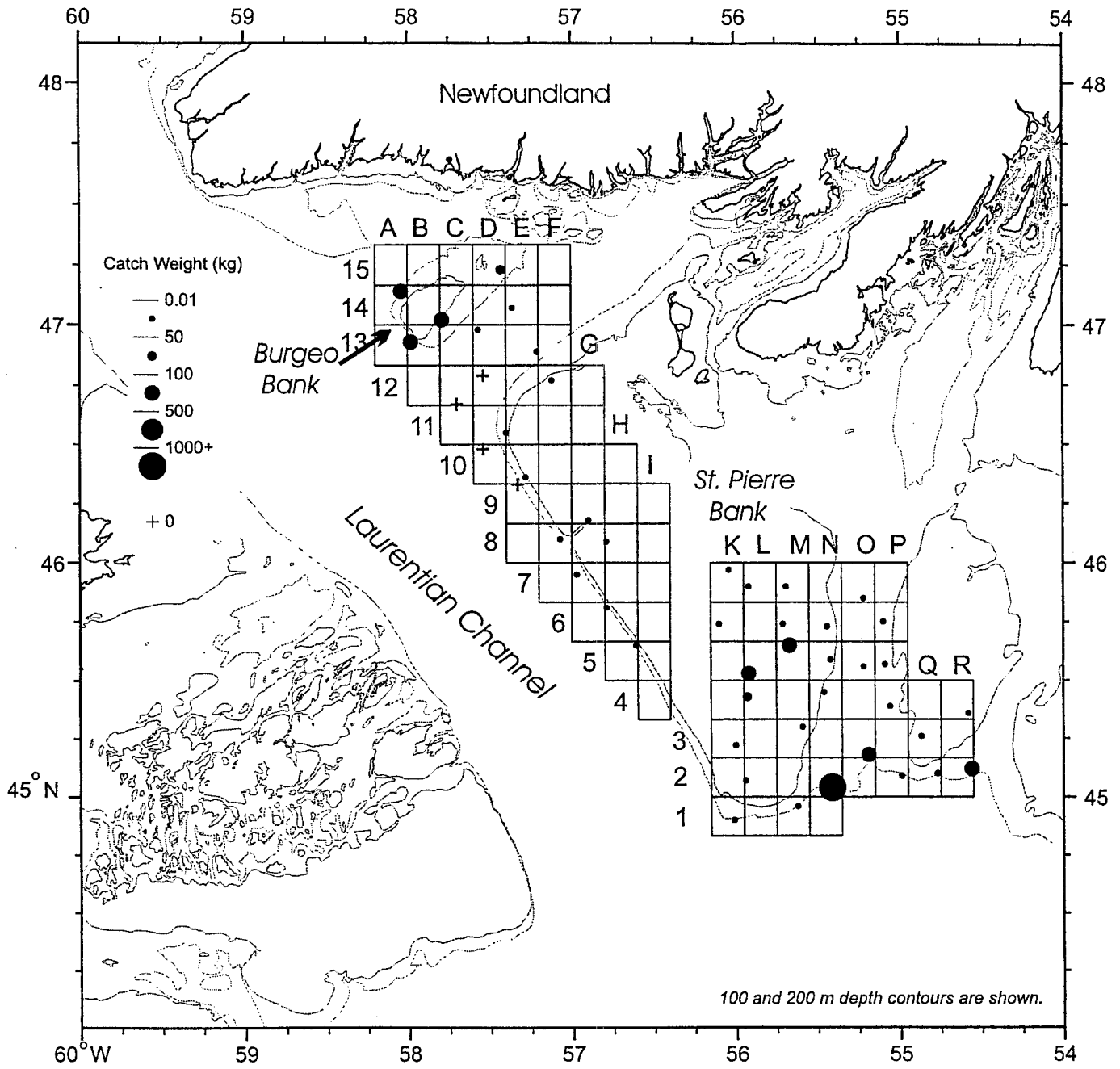


Figure 2 Distribution of Cod Catches: Catch Weight from M.V. Pennysmart Grid Surveys, NAFO Division 3Ps, 25 Nov-18 Dec 1997.

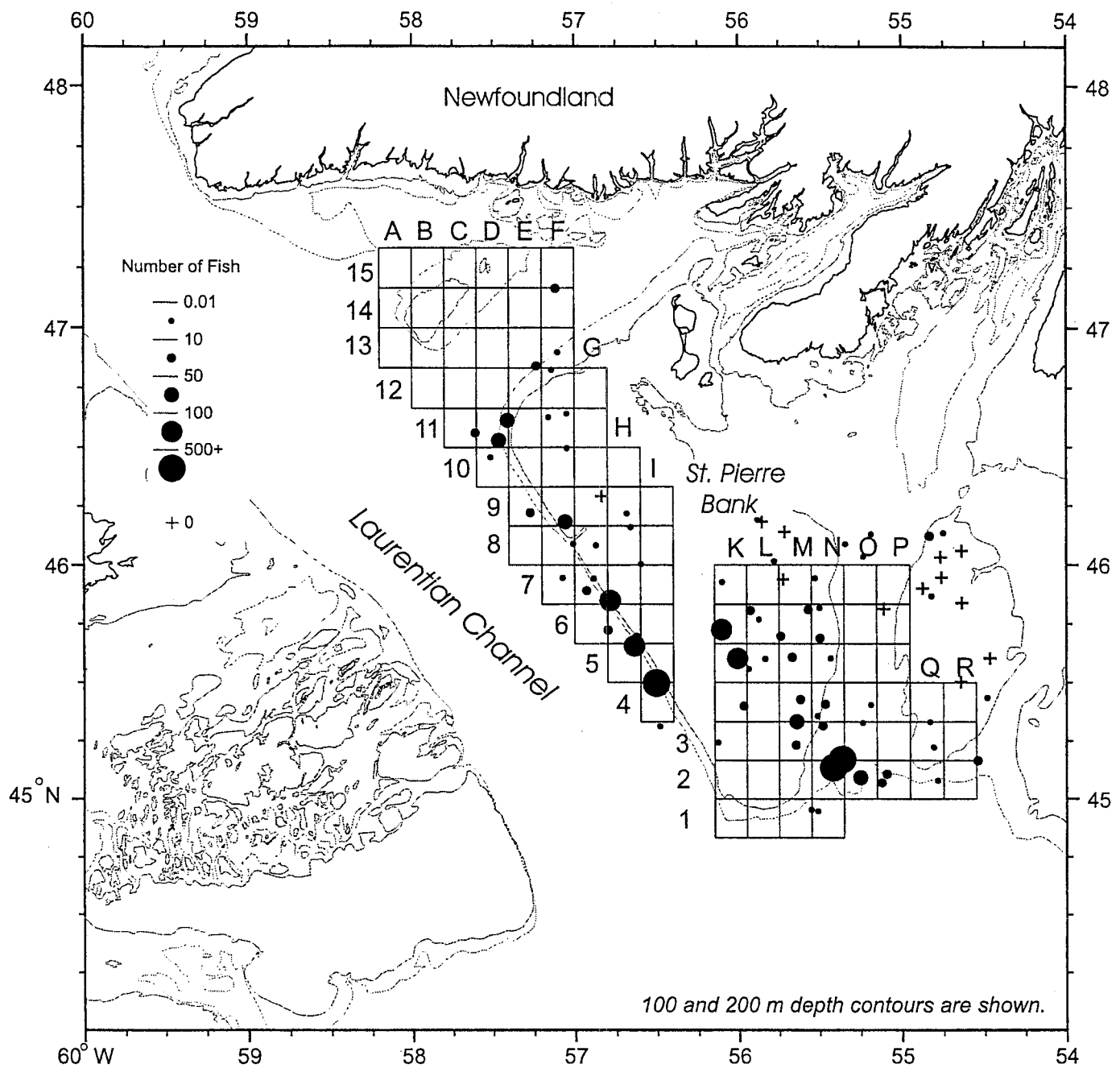


Figure 3 Distribution of Cod Catches: Number of Fish from M.V. Pennysmart Stratified Random Surveys, NAFO Division 3Ps, 25 Nov-18 Dec 1997.

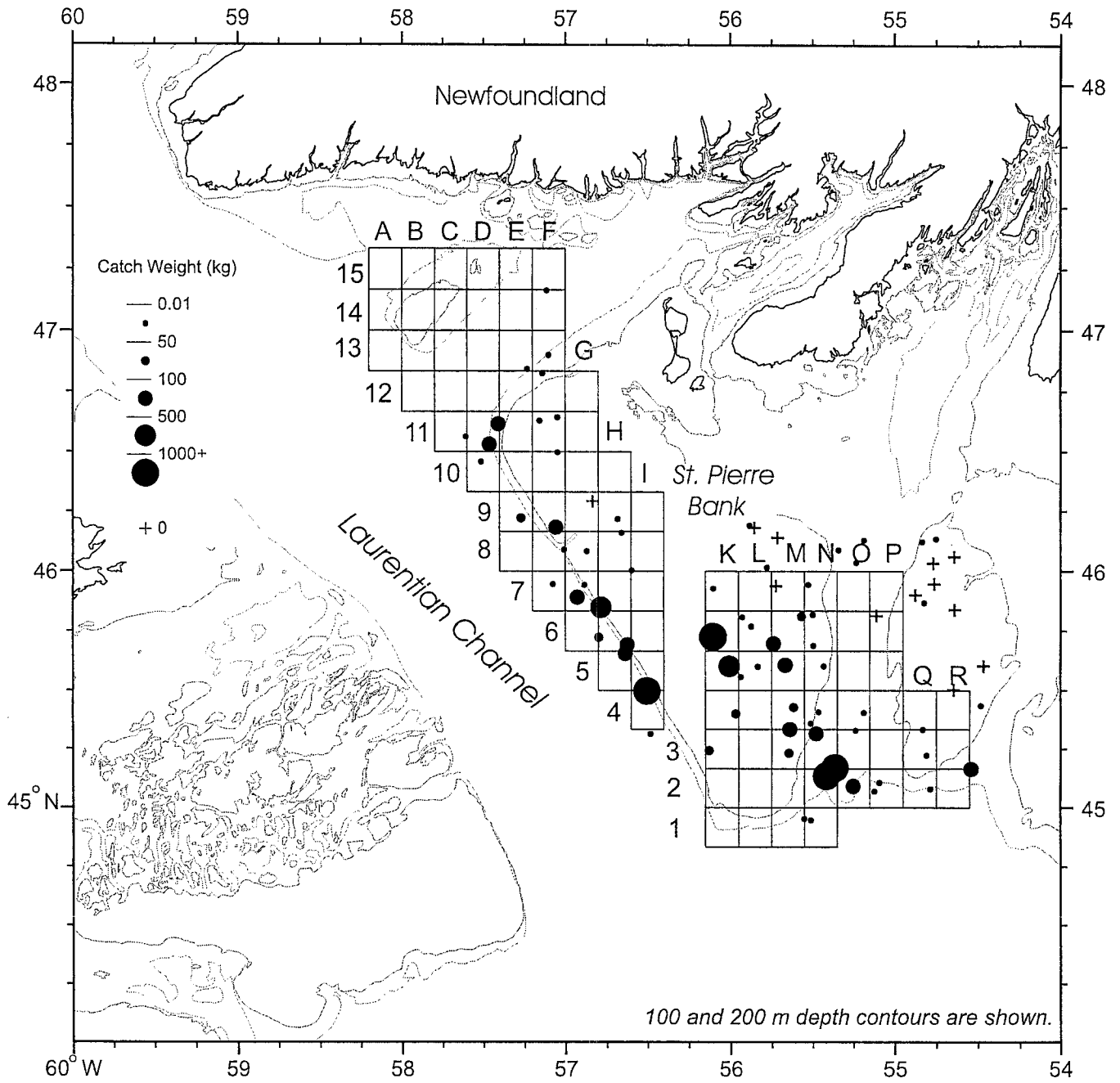


Figure 4 Distribution of Cod Catches: Catch Weight from M.V. Pennysmart Stratified Random Surveys, NAFO Division 3Ps, 25 Nov-18 Dec 1997.

Figure 5c Length Composition of Cod
3Ps Grid Surveys 25 Nov-18 Dec 1997

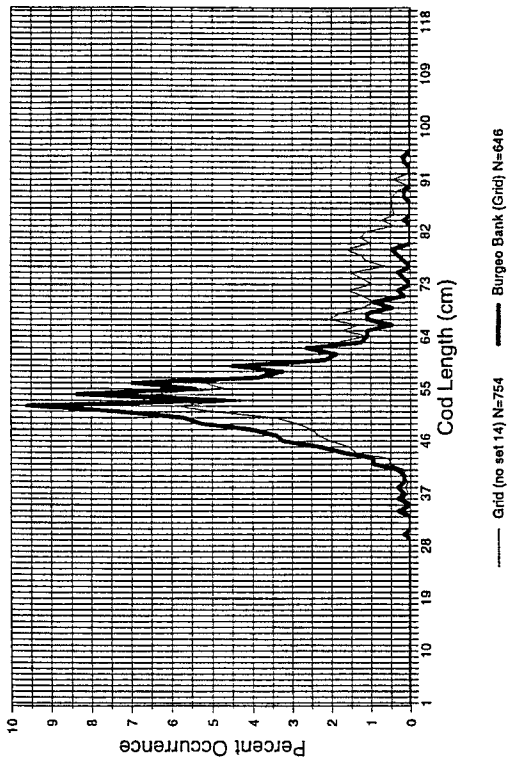


Figure 5a Length Composition of Cod
3Ps Grid Surveys 25 Nov-18 Dec 1997

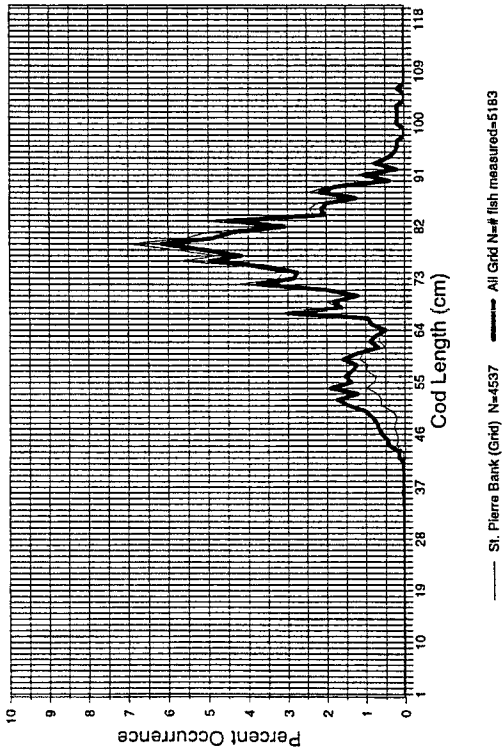


Figure 5b Length Composition of Cod
3Ps Stratified Random 25 Nov-18 Dec 1997

