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Objectives and characteristics of existing and proposed groundfish surveys by the Fisheries Research Board of Canada, Biological Station, St. John's, Newfoundland

by

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The following document attempts to provide information on the various points to be considered under topic 1 of Appendix I of ICNAF Circular Letter 70/22 concerning the Mid-term Meeting of the ICNAF Working Group on Co-ordinated Groundfish Surveys. More particularly it is concerned with the objectives and characteristics of existing and proposed groundfish survey cruises by the Fisheries Research Board of Canada, Biological Station at St. John's, Newfoundland. These will be discussed under the sub-topics as outlined in the above Appendix I.

(a) Sampling design relative to selection of stations, pattern and density of coverage through time and space.

The sampling design that has traditionally been in use on groundfish survey cruises has been a standard line system with lines having been selected generally perpendicular to the slopes of the banks in areas of well-defined fishing banks (e.g. St. Pierre Bank, Grand Bank, Hamilton Inlet Bank) as well as lines transecting the plateaus of these banks. In other areas where actual fishing banks are not so well defined, lines are generally perpendicular to the continental slope (Fig. 1). Stations are selected on these lines at standard depths of 25-30 fath intervals

on the slopes of banks or continental shelves and usually at regularly spaced intervals on the plateaus of banks. Particular depths and stations fished on particular cruises will depend on the species being sought, the time available, the weather conditions, etc. For example, standard depths of 30 (or 40), 60, 80, 110, 130, 150, 175, 200, 250, 300, 350 and 400 fath have been fished on haddock cruises in the past. The lines are distributed in space with an attempt to adequately cover the habitat of the important commercial groundfish species in our area and on the slopes of banks are in the order of 30-60 miles apart. In addition fishing stations are sometimes occupied in areas where commercial trawlers are fishing at the time and also in areas where promising sounder traces appear. All of these lines have not been fished on all cruises since that would have been impossible with our vessel resources. Some of the lines shown as irregularly fished (Fig. 1) may have been occupied on occasional trips only. The lines shown as regularly fished are those that have been given top priority on cruises to these areas and for which an attempt has been made to fish some or all of them. In the past couple of years it has not been possible even to have a cruise to each area each year but some areas were only surveyed every other year. For example, ICNAF Division 30 was surveyed in 1969 but not in 1970. Because of attempted egg and larval surveys in 1969, 2J and 3K were only surveyed in a very limited manner, whereas in 1970 a more extensive coverage was possible. In the northern areas the presence of ice in the spring is an important factor in determining fishing stations.

(b) Description of trawls and trawling methods used.

A diagram of the type of trawl currently in use on our research vessel for groundfish surveys is shown in Fig. 2. This is a 41-5 otter trawl of courlene material with double braided nylon codend of 3½-inch (89 mm) mesh lined with 1 1/8-inch (29 mm) nylon mesh. The mesh size in the net ranges from 3½ to 5 inches (89-127 mm). The doors are of oak and measure 10½ by 4½ feet (3.2 by 1.4 m). Details of the footrope and headrope are shown in Fig. 3.

The trawl is towed at a speed of 3.5 knots for 30 minutes along the depth contours of the slopes and in a random direction on the plateaus of the banks. This results in a calculated distance of 1.75 mile although the actual distance could vary somewhat depending on the shape of the depth contour which is actually followed. The vessel used is the *A.T. Cameron* which is a 177-foot side trawler of 753 gross tons and 1000 horsepower with a Burmeister & Wain reversible pitch propeller. This vessel has a crew of 25 and can remain at sea for approximately 17-18 days although the length of groundfish cruises is generally 12-15 days.

(c) Biological data sought and sampling methods used.

Numbers and weights are obtained for all groundfish species and length frequencies for commercial species and any other species caught in fair abundance. Additional biological observations are obtained on sex and maturity, stomach contents, fecundity, scales and otoliths for age determination, etc. depending on the particular object of the cruise and instructions received from various investigators. Generally sex, maturity, and otoliths are obtained from cod, haddock and flounder on all groundfish cruises but only length frequencies for redfish.

Length frequencies are obtained on total catches of commercial species unless the catch is large in which case it is subsampled on deck by random selection of baskets as outlined by May and Hodder (1966). Subsampling for detailed biological study is achieved by selecting fish as they are measured by means of random numbers, although on some of the 1970 cruises some investigators used a stratified method of sampling for scale and otolith collections. In cruises where randum samples are taken, usually additional otoliths are taken in a non-random fashion to obtain sampling over the whole length range.

(d) Logistic requirements of survey operation at sea.

The time required per station depends on the depth being fished and the weather conditions, while the number of stations per day will depend also on the number of hours of daylight available (since only

daylight fishing is undertaken at present), and the steaming time between stations and lines. On the average it requires 1½-2 hours to occupy a station including both fishing and hydrographic observations. In the winter to spring cruises when daylight hours are fewest, an average of 5-6 sets per day can be achieved in reasonable fishing weather, whereas in the summer to fall cruises with more daylight hours, it is possible to fish more sets per day. At present the technical personnel required for a groundfish cruise is 4 technicians in addition to the scientist. These work one 12-hour shift if available daylight is less than 12 hours, or two shifts of 2 technicians each and overlapping shifts if more than 12 hours daylight are available, depending on the work to be done on the cruise. The crew assist in the sorting and weighing of catches and in hydrographic observations.

(e) Logistic requirements of data processing ashore.

Except for processing of special biological data such as stomach analyses or fecundity estimates, the routine data from a groundfish cruise can be considered in three parts: the set detail sheets (Figs.4 and 5) showing the number and weights of species caught, the depths fished, gear used, etc.; the length frequency sheets (Figs.6 and 7); the age and growth data (Fig.8). The set detail sheets are coded and punched on IBM cards (Fig.9) at the end of every year under the present set-up. This requires about 1 man-day to punch and verify the cards for an average trip of 50 sets. The length frequencies are processed manually and are summarized by each investigator as is necessary. The age and growth data are transferred to IBM sheets (Fig.8) immediately following the cruise and after the ages have been determined from the otoliths and/or scales, the data are punched on IBM cards (Fig.9) for processing. The time required for the latter is very difficult to measure since each investigation determines its own ages and codes its own data, but it requires about one man-day to punch and verify 600-700 age and growth cards representing 600-700 specimens. The machine processing facilities consist of one IBM punching machine, one IBM

verifier, one IBM sorter and one IBM tabulating machine coupled with a summary punching machine. The personnel consists of one full-time punch operator and one part-time machine operator. Facilities are also available from the university on IBM System 360 and 1130 computers.

(f) Accuracy of abundance indices.

One or more documents should be available at the meeting on the relationship between abundance indices of year-classes of pre-recruit fish from survey cruises and the abundance indices of these same fish when they enter the commercial fishery.

References

May, A. W. and V. M. Hodder. (1966). Deck sampling of research vessel catches. Journal Fisheries Research Board of Canada, Vol. 23, No. 7, pp. 1083-1088.

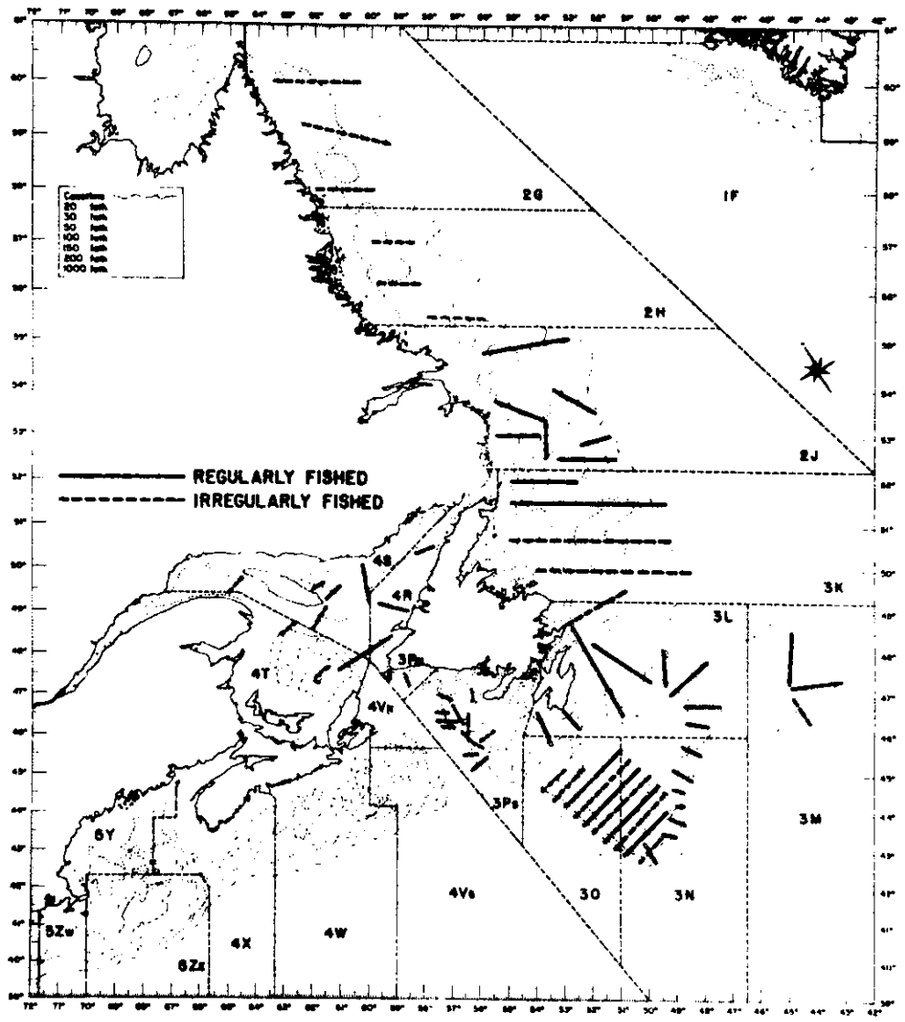

Fig. 1. Standard lines fished on groundfish survey cruises of A.T.Cameron.

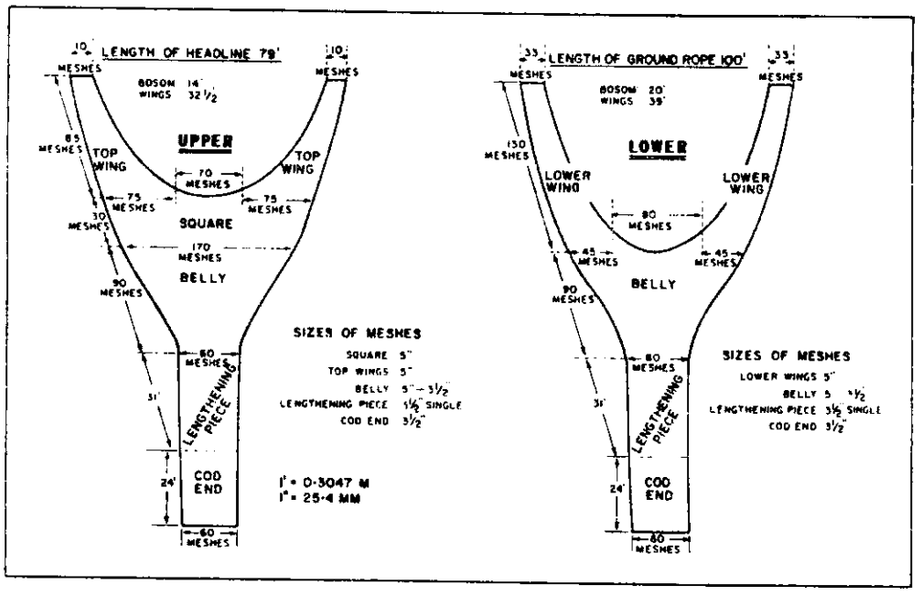

Fig. 2. Diagram of 41-5 otter trawl used by A.T.Cameron on groundfish survey cruises.

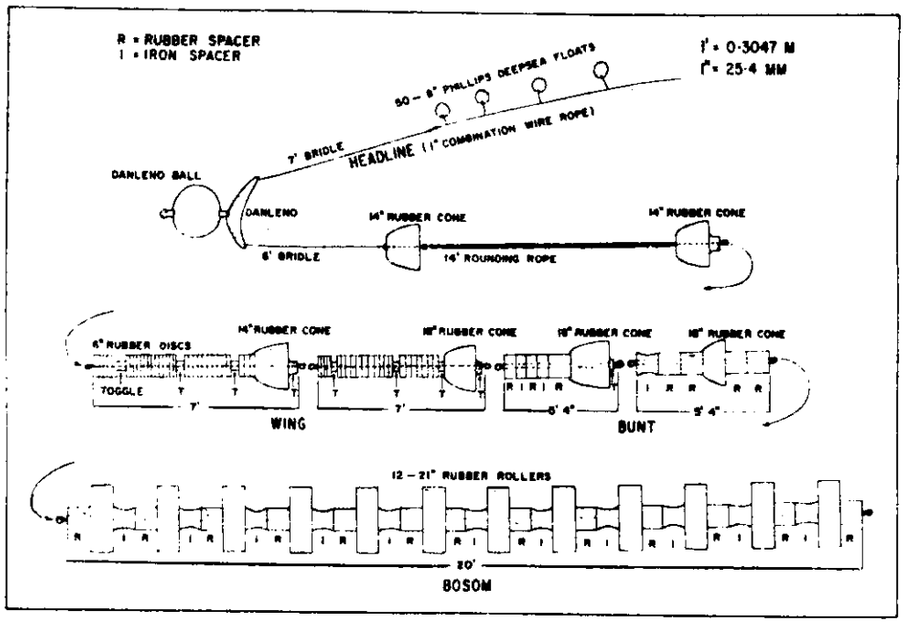

Fig. 3. Details of headrope and footrope used by A.T.Cameron on groundfish survey cruises.

SET DETAILS

FISHERIES RESEARCH BOARD OF CANADA, BIOLOGICAL STATION, ST. JOHN'S

SET DETAILS

Vessel			2	Trip		Set	13-15
GEAR	NET	Type of net	3-6	DATE	Year		16-17
		Material			Month		18-19
		Mesh sizes (range)			Day		20-21
		Floats		TIME (NST)	Start	Midpoint	22-25
		Doors			End	Duration	26-27
		Wire length			Speed / Dir.	Distance	28-29
	COVER	Material			Depth intended fath	Mean	30-32
		Mesh size			Depth fished fath	Range	33-34
		Lining			How obtained	Btm. temp.	35-37
		Cover			Temp. depth fath	Btm. sal.	38-40
	Special Notes				Type of bottom		41
POSITION	Start	ICNAF	7-8		Light condition		42
	End	Unit	9-11		Wind dir.	Wind force	43-44
					Sea		45
Type of Set			12		Operation of gear, damage and general remarks		46
DECCA	Start						
	End						
LORAN	Start				Observers		
	End				Bridge	Lab.	

Fig. 4. Groundfish set details sheet (front).

SPECIES	CODE	CATCH			MEASURED			SAMPLES		
		BASK.	NO.	WT.	BASK.	NO.	WT.	SEA	ICE	SPEC.
Cod										
Haddock										
Redfish, mentella										
marinus										
doubtful										
Redfish Total										
Am. Plaice										
Witch										
Halibut										
Thorny Skate										
Smooth Skate										
Total catch (lb)										
Invertebrates-										
Total Catch Invert. (lb)										

Fig. 5. Groundfish set details sheet (back).

COD LENGTH FREQUENCY

Vessel	Set	Date	Depth	Beginning Position Lat. Long.	Locality
Division Square		Temp°C.	Time NST	Bask. Meas.	Bask. Caught	Measured by Recorded by

		63
		64
20		65
21		66
22		67
23		68
24		69
25		70
26		71
[illegible]		72
[illegible]		73
[illegible]		74
[illegible]		75
[illegible]		76
[illegible]		77
[illegible]		78
34		79
35		80
36		81
37		82
[illegible]		83
[illegible]		84
[illegible]		85
[illegible]		86
[illegible]		87
[illegible]		88
[illegible]		89
[illegible]		90
46		91
[illegible]		92
[illegible]		93
[illegible]		94
[illegible]		95
[illegible]		96
[illegible]		97
[illegible]		98
[illegible]		99
[illegible]		100
[illegible]		101
[illegible]		102
[illegible]		103
[illegible]		104
[illegible]		105
[illegible]		
[illegible]		

Fig. 6. Length frequency sheet for unsexed groundfish species (cod).

LENGTH FREQUENCIES

ICNAF SUB. A	Locality:-		Date:-	Boat	Trip	Year	Set
	Unit Area:-	Line:-					
Depth:-	Position:	Time GST	Temperature	Measured by:-			
				Recorded by:-			
Baskets Measured	Baskets Caught	Main cod-end					
		Cover					

	TOTALS					TOTALS			
	MALE	FEMALE	M	F	T	MALE	FEMALE	M	F	T
10						46				
11						47				
12						48				
13						49				
14						50				
15						51				
16						52				
17						53				
18						54				
19						55				
20						56				
21						57				
22						58				
23						59				
24						60				
25						61				
26						62				
27						63				
28						64				
29						65				
30						66				
31						67				
32						68				
33						69				
34						70				
35						71				
36						72				
37						73				
38						74				
39						75				
40										
41						MALE				
42						FEMALE				
43						TOTAL				
44										
45										

Fig. 7. Length frequency sheet for sexed groundfish species.

GROUNDFISH AGE AND GROWTH

SPECIES (1-3)	SHIP (4)	SET (5-7)	TRIP	COLL.	
YEAR (8-9)	MONTH (10-11)	DAY (12-13)	LAT. LONG.	COPIED	CHECKED
ICNAF (14-15)	UNIT (16-18)	GEAR (19-22)	MAT. CHECK	ADJUST.	CHECKED
DEPTH (23-25)	TEMP (26-28)	SAMPLE TYPE (29)	NO. IN SAMPLE (30-32)	EDITED	

SPEC. NO.	33 – 36									
LENGTH	37 – 39									
SEX AND MATURITY	40 – 41									
WEIGHT – R LB.	42 – 45									
WEIGHT – GG LB.	46 – 49									
GONAD WT. (gm)	50 – 53									
NO. VERT.	60 – 61									
AGE METHOD	62									
AGE	63 – 64									
EDGE	65									
RELIABILITY	66									
YEAR CLASS	67 – 68									
SPAWN AGE	69 – 70									
TYPE	71									
AGEING REMARKS										

Fig. 8. Groundfish age and growth sheet.

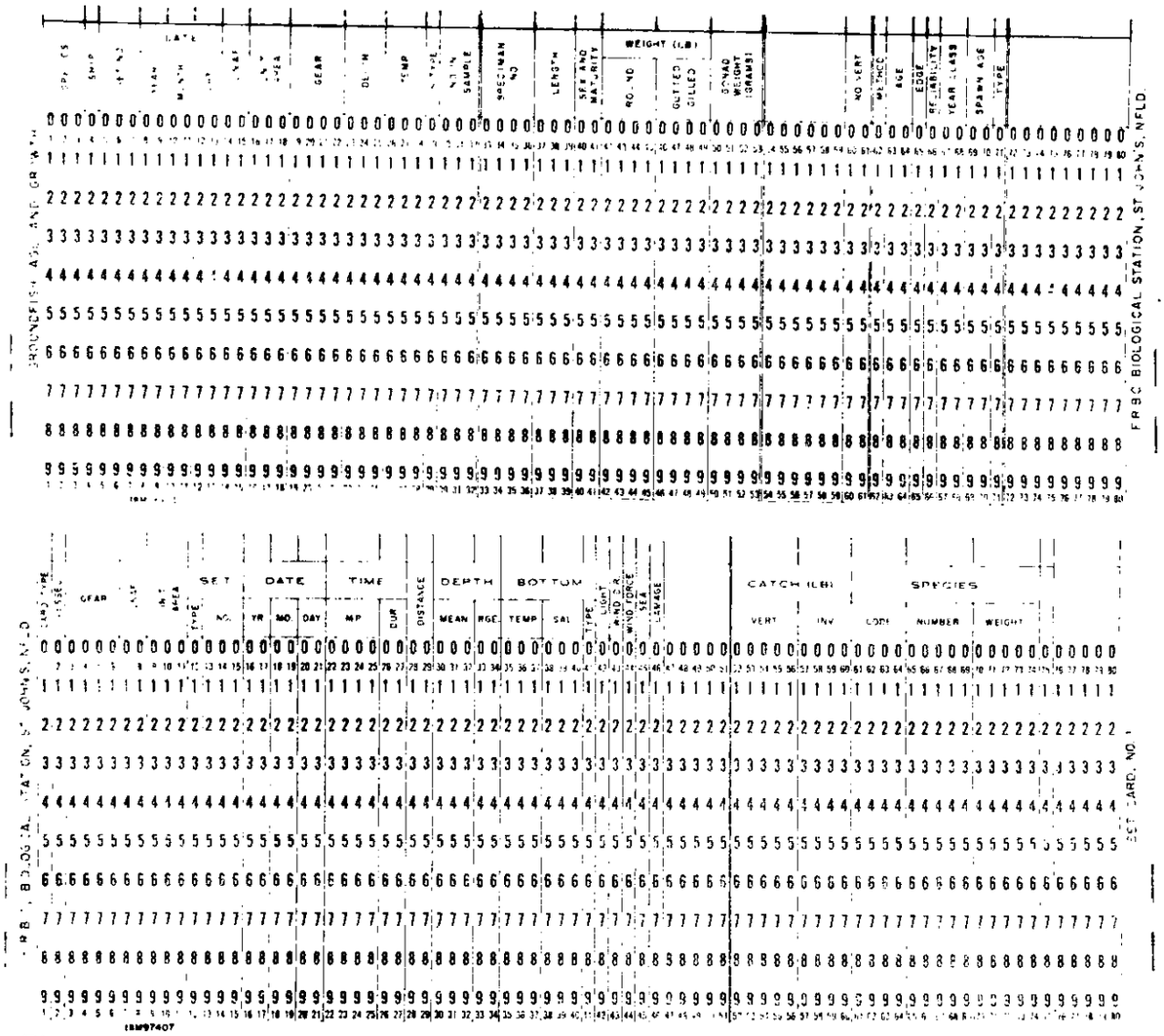

Fig. 9. Groundfish IBM cards. Top – Age and growth card. Bottom – Set details card.