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The Homogeneity of Canadian Samples for Lengths and Ages
of Commercially-Caught Cod and Haddock

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(Partly based on a report by William Knight)

At present the Canadian program for sampling commercial landings of cod and haddock collects data on a maximum of about 15 individual landings made in single unit areas within ICNAP divisions, per quarter year, per gear fished. Each sample consists of a total of about 200 fish lengths and 40 otoliths for age determinations from the two or three market categories into which the fish are classed at the plant. In the following we summarize findings of a study of the nature of variation in the derived length and age distributions.

Length Distributions

Length distributions for individual samples were approximated by unimodal distributions for which mean lengths and standard deviations were calculated. Typical results of an analysis of variance are presented in the following table:

Analysis of variance to determine if catches sample the same population. Data consists of 9 samples of cod caught by otter trawl, 1960, in Division 4T.

Market category	Season	Within		Between		F	N*
		SS/df	df	SS/df	df		
large	1960 II	7.08	328	190	3	26.8	13
	1960 III	11.0	388	1100	3	100.	4
medium	1960 II	3.73	1163	64.9	4	17.4	71
	1960 III	2.08	1997	2620	3	1310.	2
small	1960 II	0.97	471	78.2	4	81.6	6
	1960 III	0.68	559	4.3	3	6.3	105

* N = within df/(F-1)

The results for this cod sampling indicate highly significant heterogeneity between samples, even within individual market categories, since the between sample mean squares are much larger than the within. Comparison of these values indicates that more efficient sampling would be obtained by taking more samples of smaller size, an estimate of the sample size which would equalize the two errors being given by the column headed N*. Similar results were obtained from a study of quarterly otter-trawl and line landings of haddock from Divisions 4V-W at various times from 1956 to 1960.

A study was made of variances of individual length-frequency classes within and between samples. In a series of six haddock samples within a single quarter of 1958 χ^2

values for length classes larger than 49.5 cm gave little indication of heterogeneity although heterogeneity was marked for all size-classes smaller than this. Calculations again indicated that between and within error variances would be equalized in samples of about 50 fish each.

Age Compositions

Accuracy of age compositions was studied on 4W otter-trawl haddock samples from six of the quarter years from 1958 to 1960. Individual age-length keys and age distributions were constructed for each sample and quarterly averages and variances calculated. A summary of the results showed that

$\sigma = 0.86 p^{0.65}$ where p_n is the relative frequency of the nth age-class ($\sum p_n = 1.00$) and σ is its standard deviation. Calculations also indicated that there was probably a large component of interaction between errors of length compositions and age-length keys contributing to the total error in the age frequencies, making isolation of the relative contributions of these two data components to the total age-frequency error problematical.

It was noted that for both lengths and ages a major component of between sample variance within quarters was contributed by one or two samples of the series. If the aberrant samples are omitted the remainder frequently show insignificant heterogeneity. Reference to the pattern of overall fishing activities and the distribution of sampled landings illustrated by the attached sheets indicates that this heterogeneity reflects the fact that fishing takes place on separate schools or concentrations of fish which may have quite different characteristics. Such a conclusion would appear to have important implications for the study of fishing effort and its identification with the appropriate measures of survival and growth rates of various stock components within ICNAF divisions.

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Fig. 1. Canadian commercial haddock fishing distribution in Division 4W and areas from which length and age samples were taken. (February 1957)

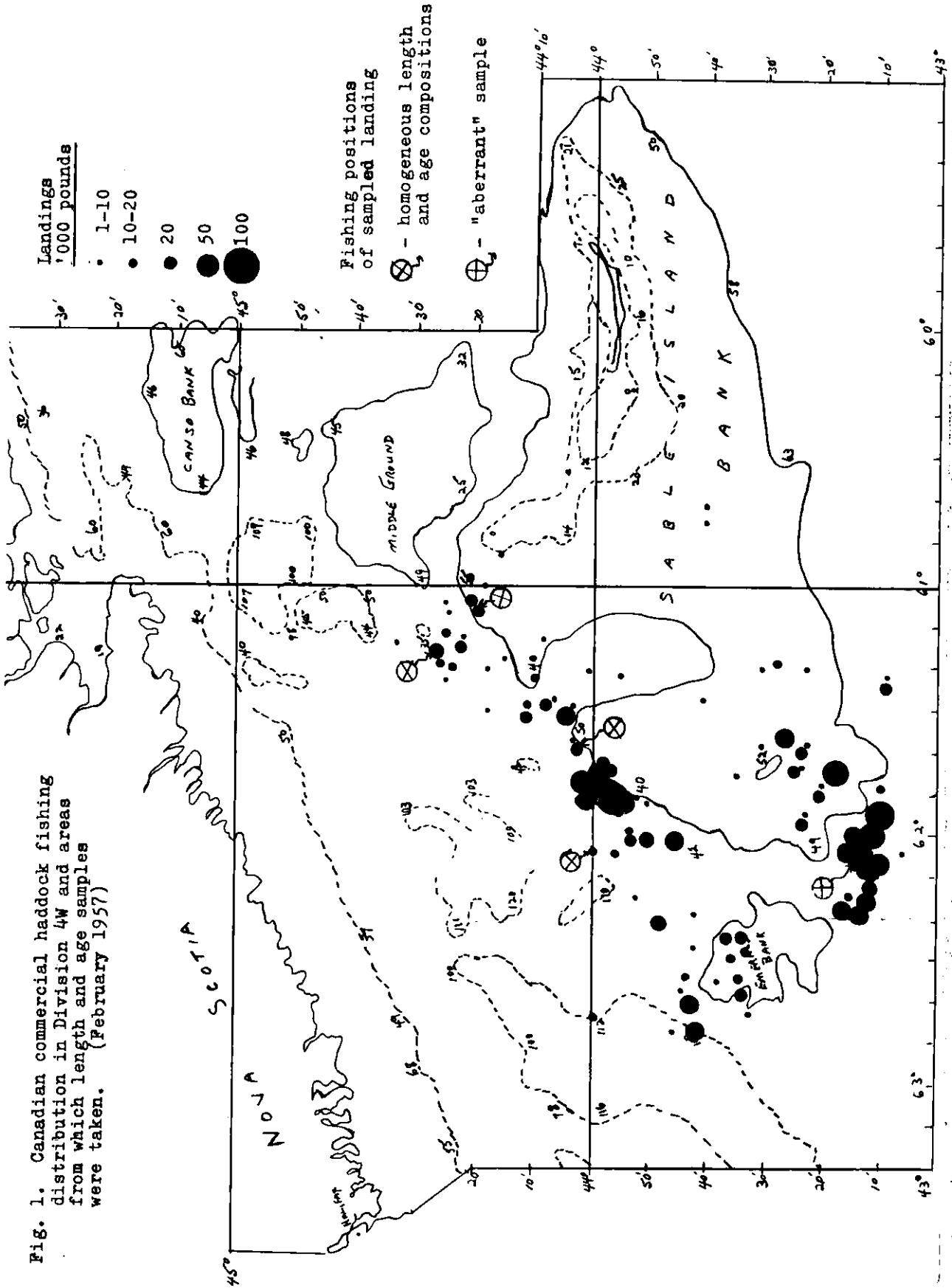


Fig. 1. (March 1957)

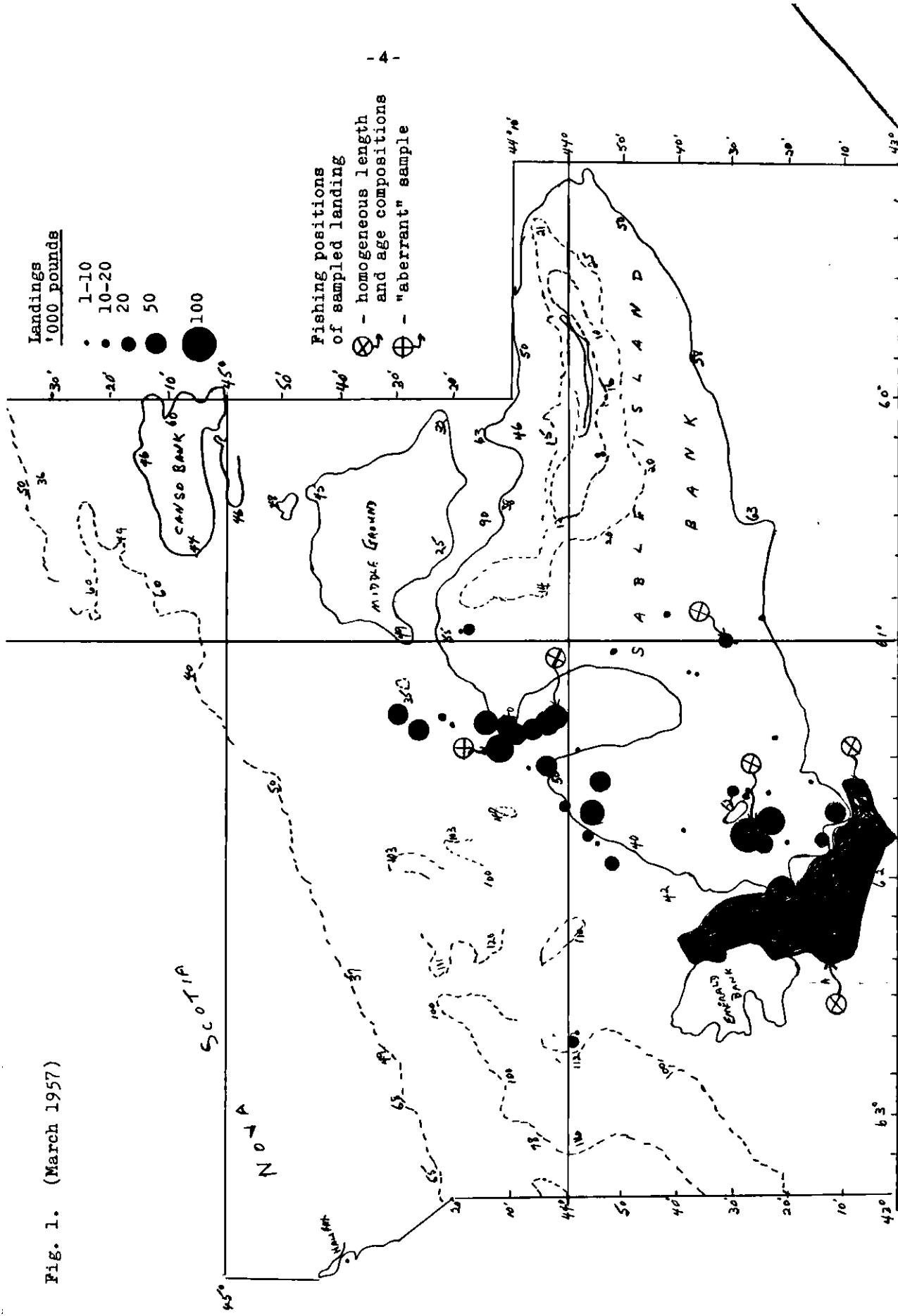


Fig. 1. (April 1957)

