

THIRD ANNUAL MEETINGVital Statistics of Cod and Haddock in Sub-area 4

by W. R. Martin

In order to make best use of our groundfish resources we must understand the population dynamics of each resource and this depends on the collection of vital statistics of sizes and ages of fish caught and indices of abundance. Such basic data enable us to measure recruitment, growth and total mortality. Total mortality must be subdivided into natural and fishing mortalities and this can be done through tagging experiments or analyses of vital statistics for different levels of fishing intensity. It is the purpose of this paper to describe Canadian progress in this field by making particular reference to analyses of cod and haddock data which have been collected for the relatively discrete populations found off western Nova Scotia (Subdivisions O and N of Sub-area 4A). The report will also serve to indicate the very considerable gaps in our knowledge.

In order to collect the basic data required for this investigation, the Fisheries Research Board of Canada employs field technicians based at the important fishing ports on the Canadian mainland. They follow both the inshore and offshore fisheries by recording effort data in relation to catches landed and by sampling fish for size and age information. The offshore fishery is followed closely in order to obtain precise statistics for each of the offshore areas fished; the inshore fishery is sampled less thoroughly by collecting data from only a small representative group of fishing ports from the Gaspé peninsula to western Nova Scotia. The catch and effort data are compiled and published at a central office in Halifax and the size and age samples are investigated at the laboratory in St. Andrews, N. B. The collection of these data was started in 1946 and the accumulated information is now providing preliminary measurements of recruitment, growth and total mortality.

The vital statistics collected at Lockeport, N. S., for the small-boat line fishery landing at that port are presented in this report in order to demonstrate population dynamics for an area of intensive year-round fishing, adjacent to Sub-area 5 where it has been determined that regulation of fishing may be expected to increase the yield from the fishery. The data have been grouped by years and by quarters (February-April, May-July, August-October and November-January). Percentage age compositions, with the number of otolith age determinations in brackets, for each quarter of a six-year period (1947-52), have been translated to numbers of fish of each age taken per tub of line trawl fished (each tub of gear consists of 12 lines and each line is 50 fathoms long). The landing-per-tub data are based on statistics of landings covering about half the boats landing at Lockeport and are assumed to be closely related to abundance. The resultant summaries have been averaged by quarters and by years and by the overall average number of each age per tub as shown in Figures 1 and 4. The same size and age data have been used to determine growth rates as related to those

of adjacent fishing grounds. Analyses for cod and haddock, the only important species landed at Lockeport, are based on over 3,000 age determinations for each species.

### Recruitment

Figure 1 presents catch-per-tub data by quarters and averages for the entire period. The data are presented in order to describe recruitment of cod and haddock to the fishery. Cod are first recruited to the fishery at the age of two years but they are not fully recruited until they are four years of age. They first enter the fishery in numbers during the fourth quarter of the third year of life and become fully recruited during the fourth quarter of the fourth year of life. Haddock first appear in landings at the age of two years but they are not fully recruited before they are five years of age. In both cod and haddock it may be noted that relatively old fish are taken in the first quarter of the year and young fish in the fourth quarter.

### Growth

Growth of cod and haddock for the Lockeport fishery is shown in Figures 2 and 3 in relation to growth rates for adjacent areas.

It may be observed that Lockeport cod grow more rapidly than those of fishing grounds to the east in Sub-area 4. They reach medium size (2.5 lb.) at the age of four years and large size (10 lb.) at the age of nine years. These cod mature at the age of seven years and a gutted weight of about six pounds. Gutted weight increases by about 42% between the ages of four and five years and about 32% between the ages of seven and eight years.

Lockeport haddock grow more slowly than cod from the same area and more slowly than Georges Bank haddock. They are not recruited to this line fishery until they are about 1.5 lb. gutted weight and accordingly only the largest two- and three-year old haddock are recruited to the fishery. Haddock of four to nine years are sampled effectively by the fishery and the growth shown for fish of these ages is believed to be well described by the growth curve. Large old haddock may not be readily available to the fishery since they may move to deeper and less accessible grounds. If this is not the case we must conclude that growth is greatly reduced above the age of eight years. The growth curve is plotted in relation to growth for Georges and Nova Scotian banks as recorded in the Second Annual Report of the Commission. Lockeport haddock mature at the age of four years and a gutted weight of less than two pounds and they reach large size (2.5 lb.) at the age of five years. Gutted weight increases by about 42% between the ages of four and five years, about 31% between five and six years and about 15% between seven and eight years.

### Year-classes

Variation in year-class strength is shown in Figure 4 for both cod and haddock. It will be noted that greater year-class variation is found in haddock than in cod. The year-classes 1943, 1946 and 1948 have been of greatest importance to the cod fishery and that of 1943 has dominated the haddock fishery during the 1947-52 period. The average catch of each age per tub fished is shown and these data have been used to measure mortalities.

Mortalities

The data presented in Figure 4 have been plotted in Figure 5 in order to determine annual mortality rates.

It may be noted that all abundance indices for the age groups four to nine years fall on a straight line. Cod would appear to be fully recruited at the age of four years and from this age on the total mortality rate appears to be about 37%. Haddock, on the other hand, do not appear to be fully recruited to the fishery until they are about six years of age. The haddock mortality rate appears to be about 40% beyond this age.

It is now important to measure fishing mortality for cod and haddock off western Nova Scotia and a program has accordingly been initiated during 1953 to tag cod and haddock with the best methods available. The results of this study will, however, not be available for some years.

It is expected that the continued collection of vital statistics together with the development of tagging methods to assess fishing mortality will lead to an understanding of the population dynamics of the cod and haddock populations of the western part of Sub-area 4. It will be of interest to determine the optimum age at first capture and the optimum fishing intensity which may be expected to produce a well-balanced fishery.

Similar studies of the data now being collected for other populations within Sub-area 4 will be valuable and we might well begin with a study of haddock populations on offshore Nova Scotian grounds. It is understood that the United States Fish and Wildlife Service has collected a considerable amount of material on this problem which, together with Canadian data, should lead to reliable conclusions concerning the need for regulation of fishing in Sub-area 4.

**Figure 1**

**Recruitment as measured by catch per tub of each age group**

Lockeport, LaHave and Roseway

COD

HADDOCK

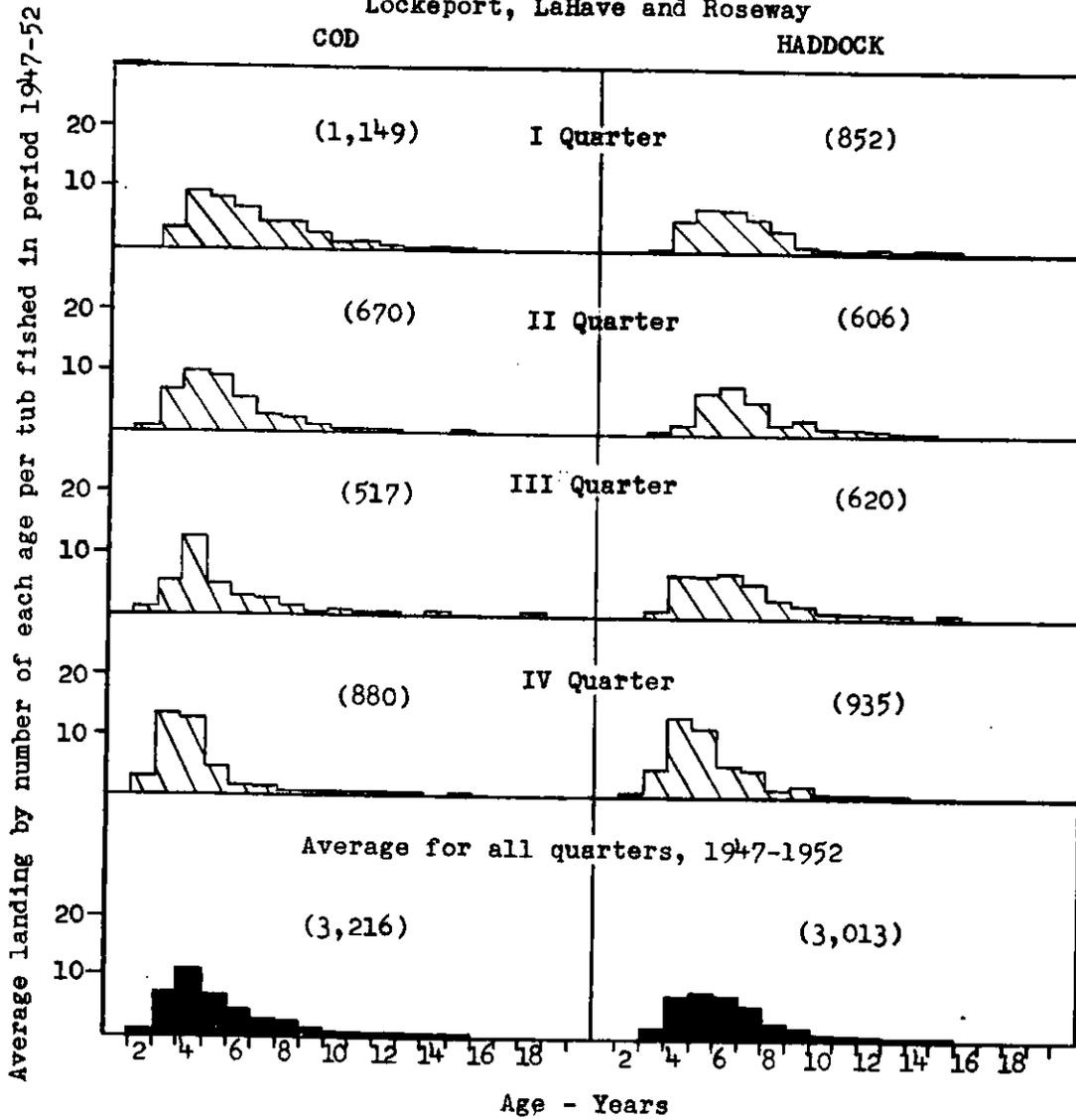


Figure 2

Variation in rate of growth of cod  
in Sub-area 4

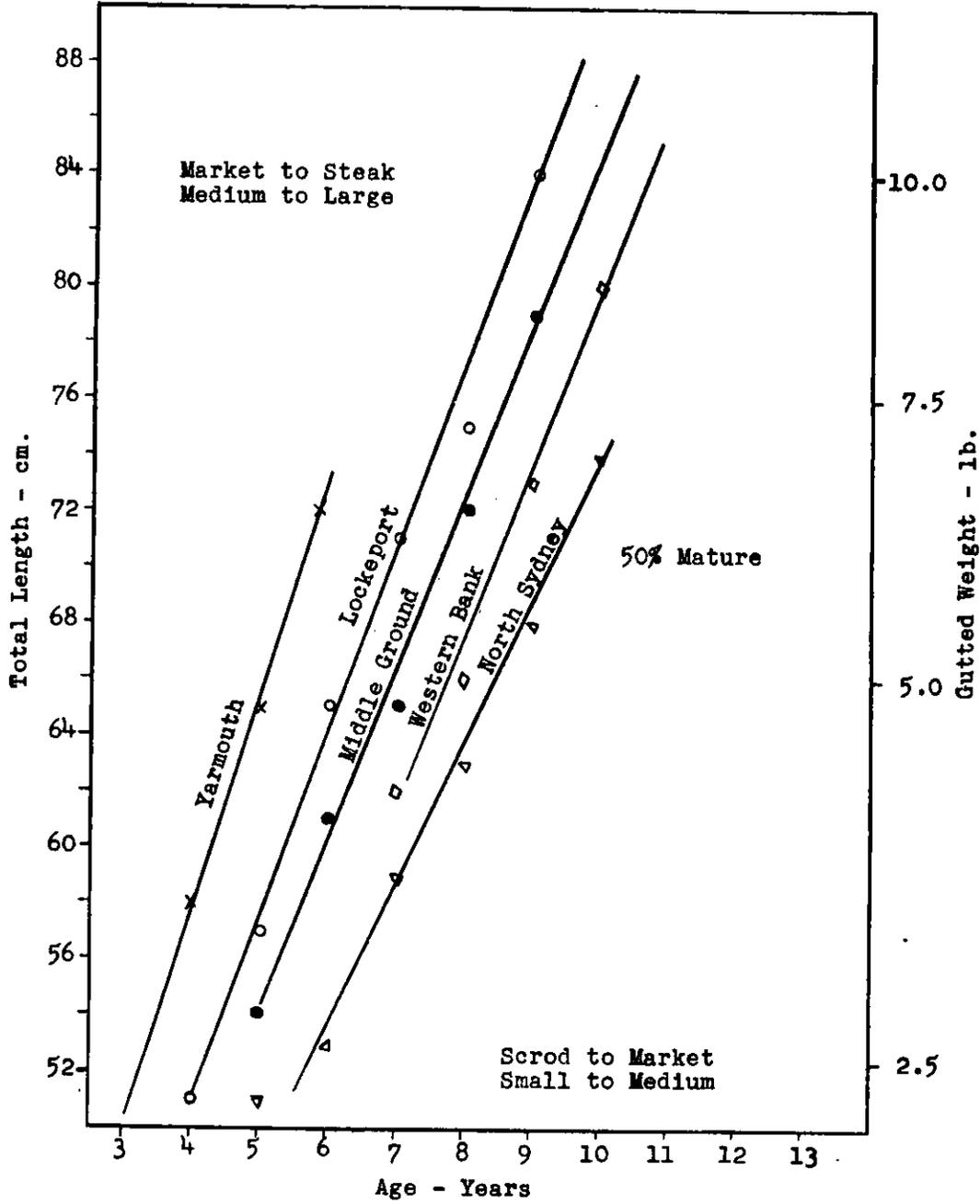


Figure 3

Variation in rate of growth of haddock in Sub-areas 4 and 5

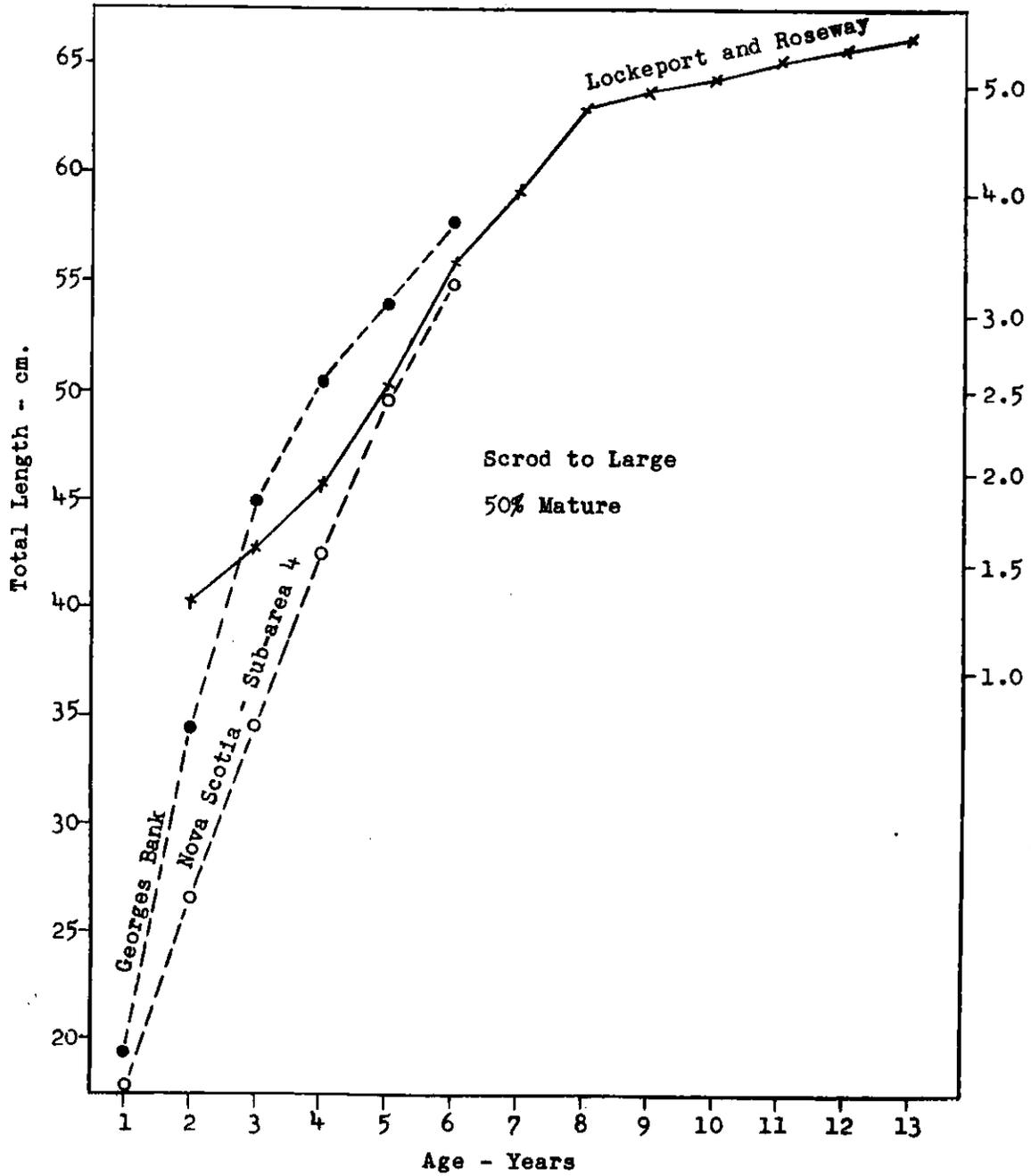


Figure 4

Variation in year-class strength and average age composition  
as number landed per tub fished  
 Lockeport, LaHave and Roseway

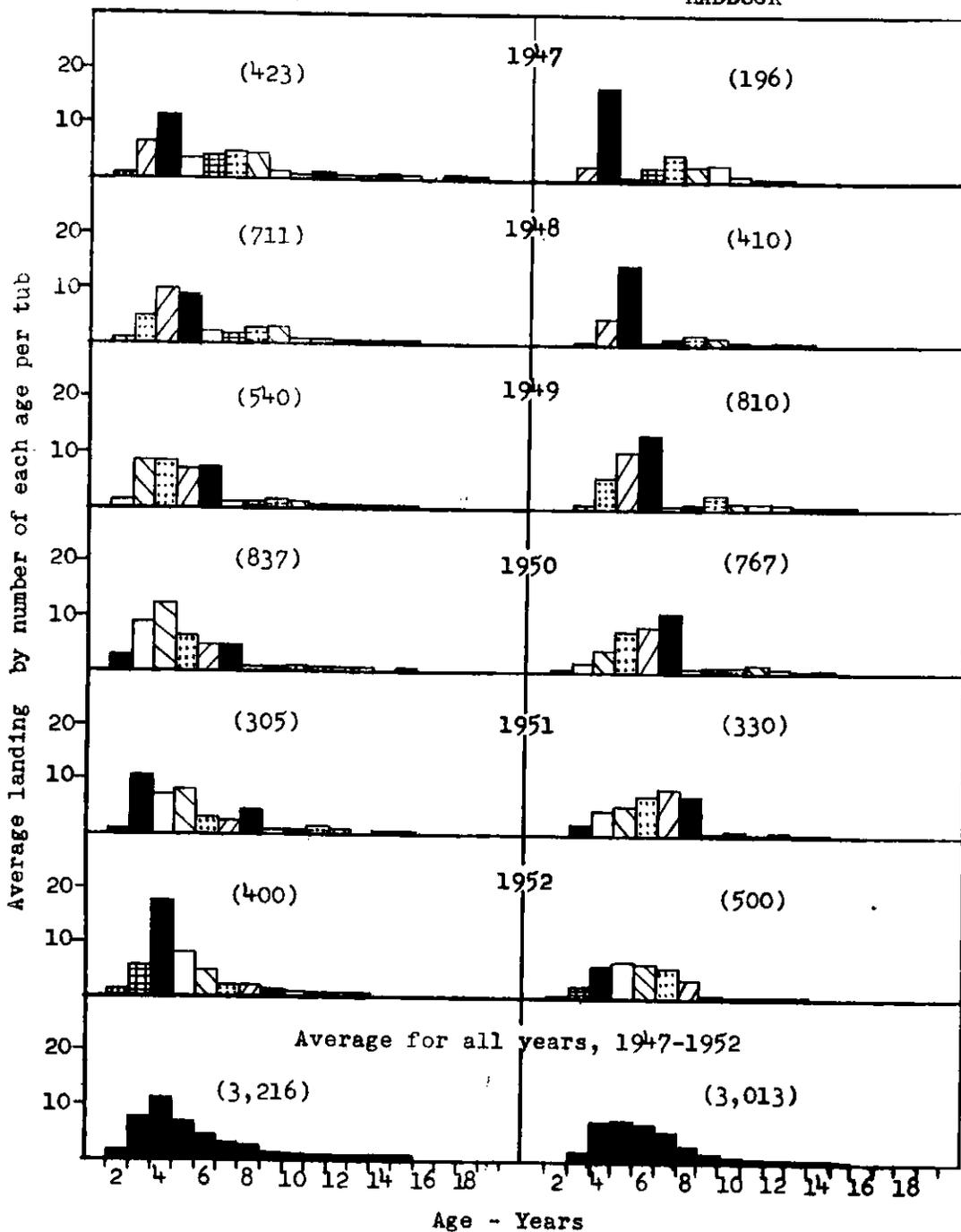


Figure 5

Average mortalities off southwestern Nova Scotia, 1947-52

