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HADDOCK STOCKS IN THE ICNAF CONVENTION AREA
by Marvin D. Grosslein

Introduction

The distribution of haddock in the ICNAF Convention Area was described earlier in a general review of the stocks of important commercial species (Wise and Jensen, 1960). More up-to-date summaries of the knowledge of haddock stocks in Subareas 3, 4, and 5 were presented at the 1961 Annual ICNAF Meeting (Ann. Meeting, Standing Comm. on Res. and Stat., 1961). The purpose of the present report is to document those summaries, particularly the map of haddock stock divisions.

Subarea 1

Haddock were recorded off West Greenland only once or twice in the last century (Taning, 1958). They were taken for the first time at Sydprøven, at the southern tip of Greenland, in 1929, and since then several other captures have been reported (Hansen, 1949). The northernmost catch of haddock was made in Disko Fjord in 1944. More recently small landings of haddock have been recorded annually from West Greenland (see ICNAF Statistical Bulletins).

Subarea 2

Haddock are taken in negligible quantities off Labrador. Nothing is known about the stocks in this subarea (Wise and Jensen, 1960).

Subarea 3^{1/}

There appear to be at least three haddock stocks in the Newfoundland area as shown in Figure 1: the western Newfoundland stock (4R and northern part of 3P), the St. Pierre Bank stock (3P), and the Grand Bank stock (3O-3N). Occasionally a few haddock are to be found on Flemish Cap, but these may have drifted as larvae from the Grand Bank stock.

The western Newfoundland stock is small, and it is taken incidentally by the cod fishery in that area. Little is known about the life history of haddock off western Newfoundland.

The main commercial fishery occurs on the Grand Bank stock which apparently does not mingle extensively with the smaller St. Pierre Bank stock as indicated by year-class differences. For example, the strong 1952 and 1955 year classes supported a large Grand Bank fishery, but these same year classes did not appear on St. Pierre Bank in numbers sufficient to support a commercial fishery. Tagging of about 1000 haddock caught by otter trawls has yielded no returns.

^{1/} Much of material presented by W. Templeman in ICNAF document 33, Third Annual Meeting, 1953. Changes and additions were included in material provided by Templeman in personal communication, March 1961.

In summer the St. Pierre Bank haddock stock is found chiefly in shallow areas of that Bank, but some fish move to the Burin peninsula. The greatest summer concentration of the Grand Bank stock is found on the southeast shoal of the Grand Bank. However, there is a general northward movement during the summer, and in some years concentrations appear on the east coast of Newfoundland. In winter the haddock stocks of St. Pierre Bank and Grand Bank move to the southwestern slopes of these banks (Figure 1).

On St. Pierre Bank and Grand Bank haddock spawning begins in May, reaches a peak in June, and may extend into the first part of July.

The average size of haddock on St. Pierre Bank is greater than on Grand Bank, and it is believed that this may be partly due to a more rapid growth rate on St. Pierre Bank. Growth of the 1949 year class from subdivisions 3N and 3O is shown in Figure 2. Haddock growth in Subarea 3 is substantially slower than in Subareas 4 and 5.

The average vertebral number of Newfoundland haddock is less than 53 which is significantly lower than that of neighboring Nova Scotian stocks with an average of about 54 (figure 3). This difference lends confirmation to the separation of Newfoundland and Nova Scotian stocks based on other evidence. Stock differentiation between Subareas 3, 4, and 5 also has been based on differences in vertebral counts (Clark and Vladykov, 1960).

Subarea 4^{2/}

Haddock occur along the entire Nova Scotian coast both inshore and offshore, but landings are very small from division 4R, 4S, and 4T (Martin, 1953). Subarea 4 stocks are separated from those of Subarea 3 (and the west coast of Newfoundland, 4R) by the Laurentian Channel. To the west, Subarea 4 stocks are largely separated from those in Subarea 5 by the Fundian Channel, and the deep water of the Gulf of Maine except for haddock in the Bay of Fundy region. Significant differences in vertebral counts have been found among these major groups; and the existence of sub-groups off Nova Scotia has been suggested on the basis of slight differences in vertebral counts. (Clark and Vladykov, 1960).

In addition to Division 4R described above, two major stock divisions are recognized within Subarea 4: those east (4V-W) and west (4X) of the Scotian Gulf. There appears to be limited mixing between the 4X and 4V-W stocks, occurring chiefly along the Nova Scotian coast as 4X haddock spread eastward in summer and as 4V-W haddock move southwest in winter (McCracken, 1956). The separation of the 4X and 4V-W stocks is also confirmed by unpublished records of U.S. tagging on Browns Bank which show no returns east of Subarea 4X.

Offshore winter movements have been demonstrated by tagging east of the Scotian Gulf, but the reverse movement has not been demonstrated because of poor returns from offshore tagging. Winter surveys in 1959 and 1961 found low numbers of small haddock in 4V, and these were found chiefly along the deep water edges of the shelf. The major winter concentration is in 4W and this is substantiated by statistics of landings. In summer the 4V-W stock spreads northward into the Gulf of St. Lawrence, and haddock are found in shallower water both inshore and offshore.

2/ Except for publications cited, material supplied by F.D. McCracken in personal communication, April, 1961.

The 4X stock occupies inshore areas along western and southwestern coasts of Nova Scotia in summer, and moves southward to the vicinity of Browns and La Have Banks in winter. Segments of the 4X stock appear to be year-round residents of these offshore banks. Most returns of haddock tagged on these banks by Canada have come from the western Nova Scotia region. Similarly, about 80 percent of returns from haddock tagged by the U.S. on Browns Bank have come from the western Nova Scotia area; the remaining 20 percent came from Subarea 5.^{3/} On the other hand, less than 2 percent of returns of haddock tagged in Subarea 5 have come from 4X. While this difference suggests that there may be a greater tendency for 4X haddock to move south than for Subarea 5 fish to move north, part of the difference may be due to greater exploitation in Subarea 5Z.

Mixing is much more extensive between haddock found in Passamaquoddy Bay and Subarea 5. About half of the first-year tag returns from the 1957 fall tagging in Passamaquoddy came from Subarea 5, chiefly on Jeffrey's Ledge between Portland and Gloucester (McCracken, 1960). These haddock belong to a stock (4X-5Y) which during winter moves south concentrating on Jeffrey's Ledge (Figure 1). Some of these fish go further down to the South Channel and northwest Georges Bank in 5Z (McCracken, 1960). Only 35 percent of the first-year returns came from Passamaquoddy Bay itself, and less than 15 percent came from western Nova Scotia and Browns Bank areas. In summer these fish returned to the Bay of Fundy region as indicated by the fact that most returns again came from Passamaquoddy (McCracken, 1960). In the fall of 1957 the U.S. tagged haddock on Lurcher Shoal and on Grand Manan Banks, south and west of Digby Neck respectively. Results were similar to those from Browns Bank tagging, i.e., 75 percent of the returns came from western Nova Scotia, and 25 percent from Subarea 5 (unpublished U.S. tagging records). However, all the Subarea 5 returns were from 5Z (South Channel and Georges), and none from 5Y (including Jeffrey's Ledge) or Passamaquoddy. These data further substantiate the separation of the 4X and 4X-5Y stocks.

Peak spawning of the 4X and 4V-W stocks occurs in April. Growth of 4V-W haddock taken near Emerald and Banquereau Banks is faster than that of Grand Bank haddock, but slower than that of the 4X stock taken off Lockeport and on Browns Bank (Figure 2).

Subarea 5^{4/}

There appear to be three somewhat distinct stocks in Subarea 5: the 4X-5Y stock noted above, a stock on Georges Bank (5Z) which is east of the south channel (about 69°W), and one inshore (5Y-Z) extending at least from Nantucket Shoals just south of Cape Cod in 5Z to Jeffrey's Ledge in 5Y (Figure 1). These tentative divisions are based chiefly on a geographic distribution of tag returns without reference to time. Further clarification of the relationships between haddock in the above areas will require analysis of tag returns in relation to time and comparisons of vital statistics such as growth, mortality, etc. Since there is some mixing between the above divisions, clearly they cannot be regarded as separate stocks in the strict sense.

^{3/} Unpublished U.S. tagging records.

^{4/} Information on Subarea 5 haddock stocks based chiefly on unpublished tagging records of the Woods Hole Laboratory.

The 5Z stock on Georges Bank appears to be a resident population since 95 percent of returns from haddock tagged on Georges Bank come from "Georges Bank" (the area east of 69° and south of 42°20" chosen arbitrarily for tag return summaries). Extensive tagging indicates that movement of 5Y-5Z haddock is limited chiefly to the inshore grounds between Nantucket Shoals and Jeffrey's Ledge. Some fish move out to Georges Bank, particularly the northwestern part, but such movement is not extensive. Of haddock tagged just off Cape Cod about 80 percent of returns were reported west of 69°, although only about 35 percent of Subarea 5 haddock landings come from grounds west of 69°. Only about 5 percent of these returns were reported on Georges Bank east of 68°.

Inshore haddock tagging between Cape Cod and Cashes Ledge (due east of Jeffrey's Ledge) has yielded practically no returns north of 43°30'. This suggests that the 5Y-5Z stock may be less migratory than the 4X-5Y stock. Further analysis of tag returns in relation to landings in 5Y may clarify this question.

The winter locations of the presumed stocks in the Gulf of Maine coincide generally with the locations where spawning concentrations of haddock and haddock eggs were found on U.S. survey cruises (Figures 1 and 4). This at least tends to confirm the separate identity of four Gulf of Maine spawning groups.

Growth of 5Z haddock appears to be more rapid than any other haddock stock studied so far (Figure 2).

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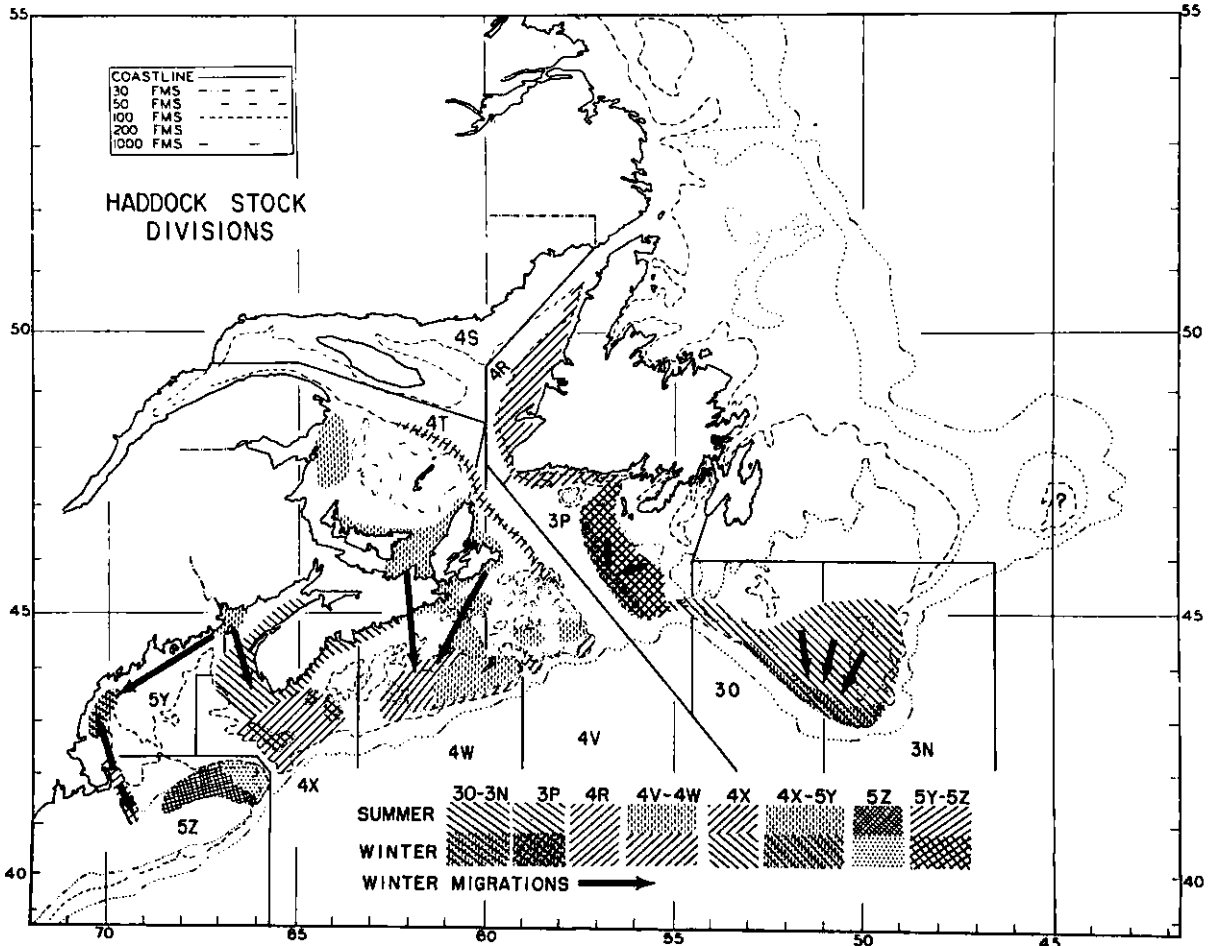


Figure 1. Haddock stock division in the ICNAF Convention Area.

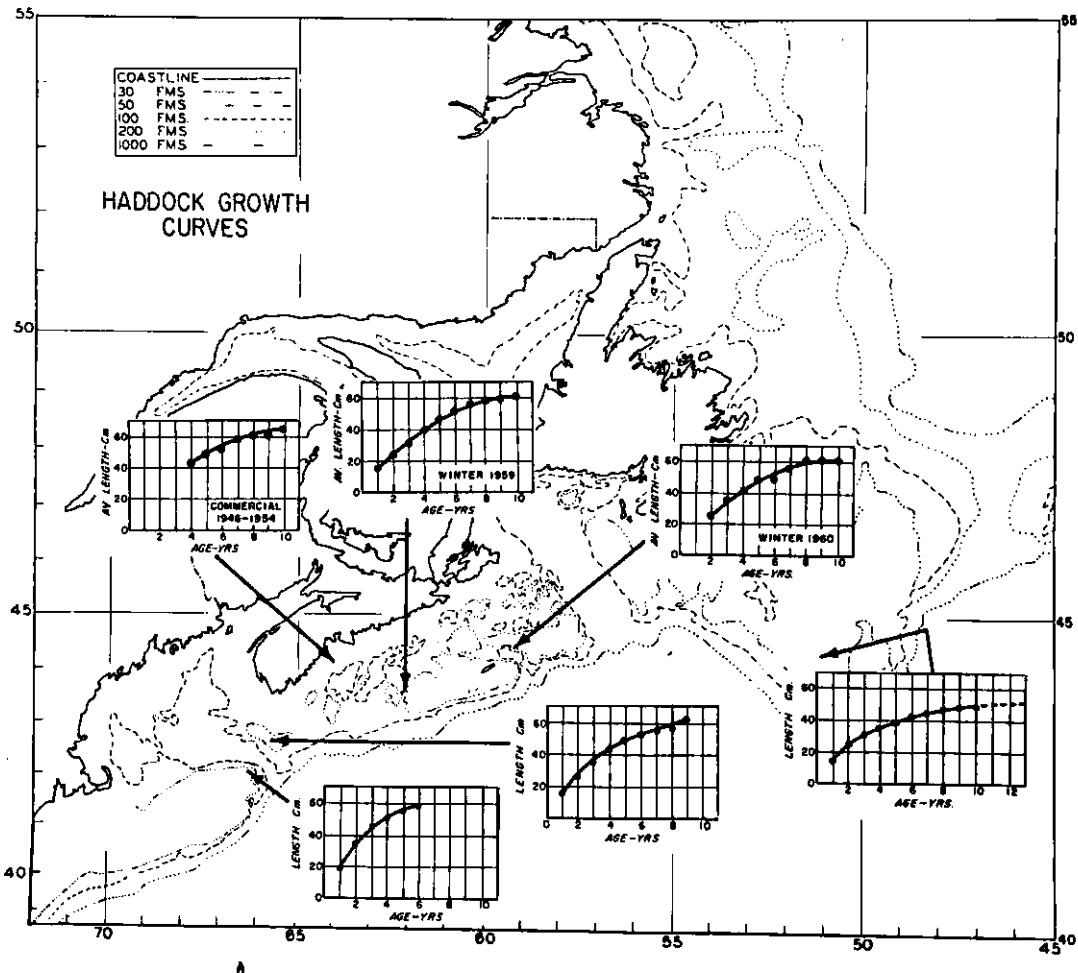


Figure 2. Haddock growth curves in the ICNAF Convention Area.

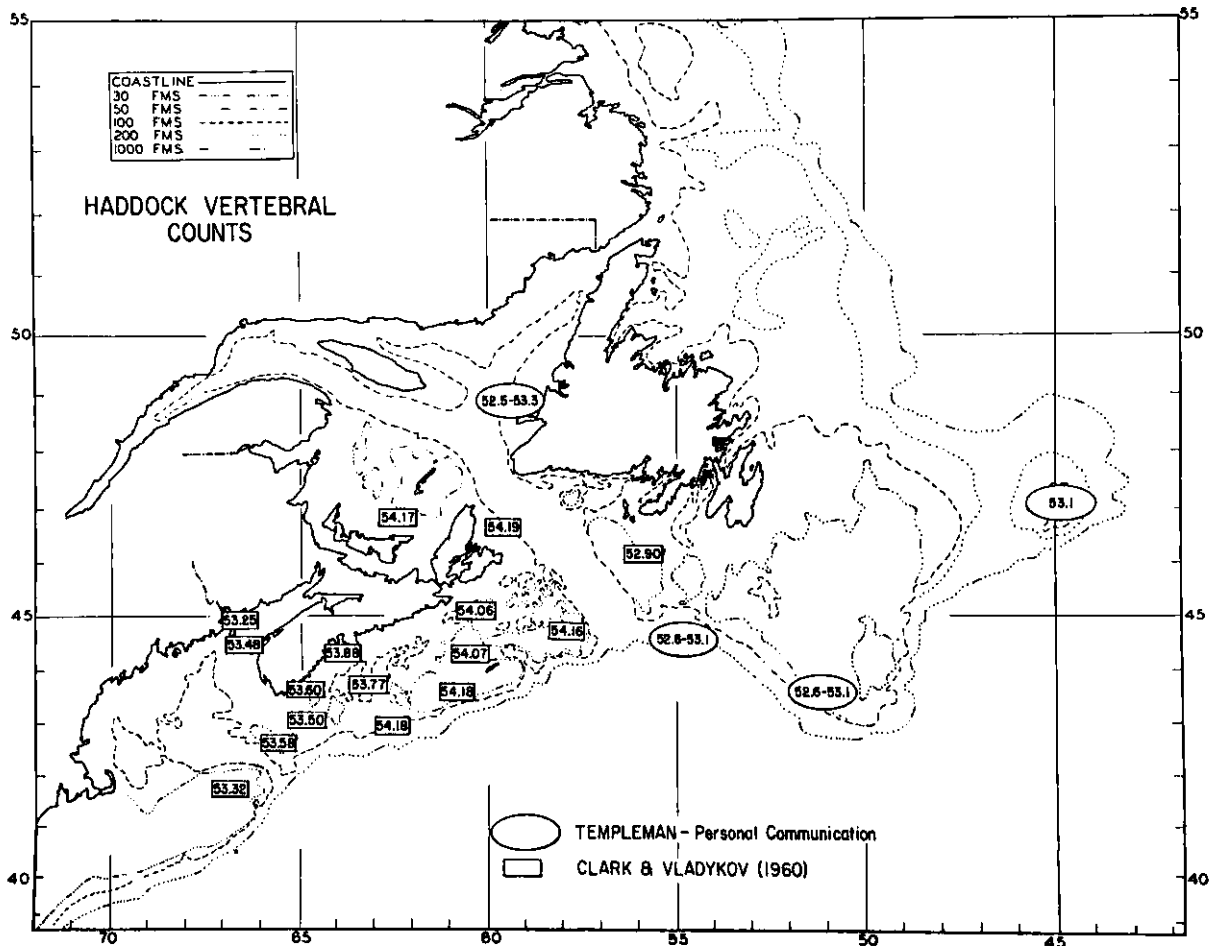


Figure 3. Haddock vertebral counts in the ICNAF Convention Area.

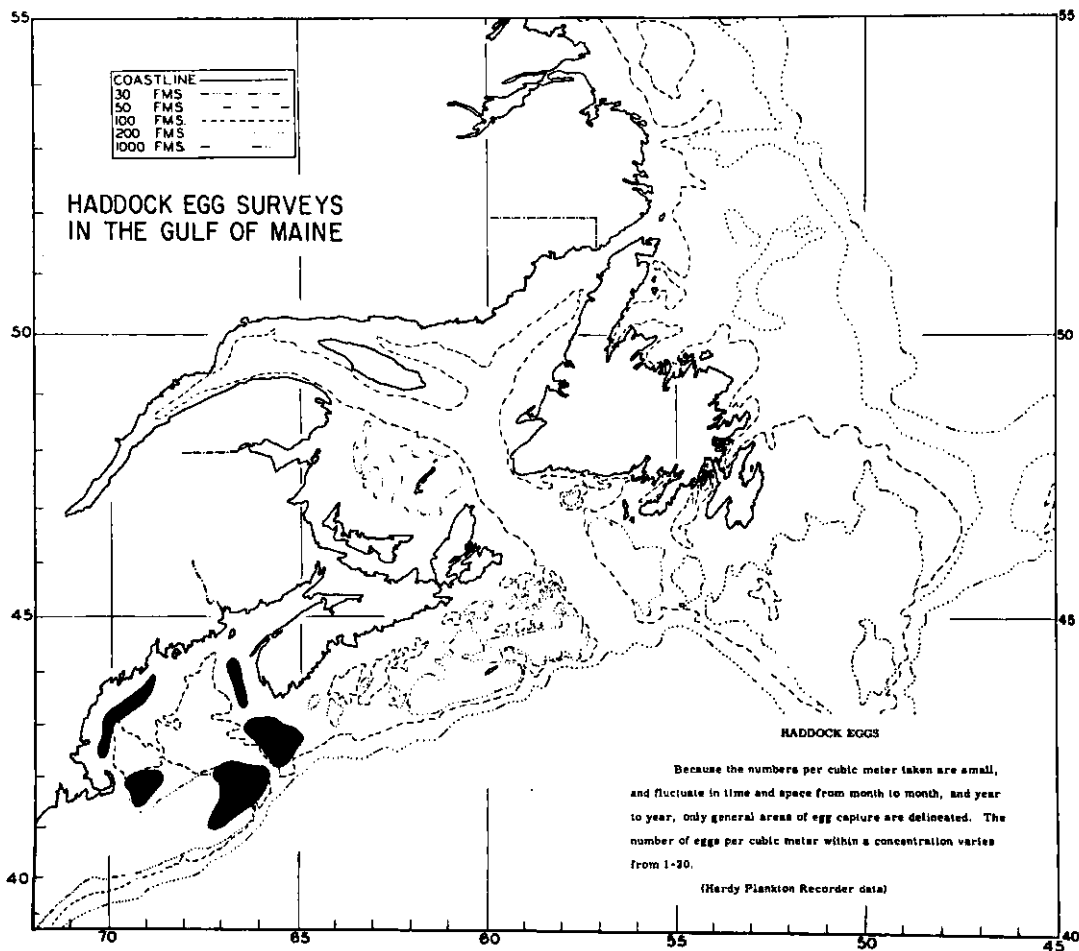


Figure 4. General areas of haddock egg concentration from Hardy Plankton Recorder surveys in the Gulf of Maine.