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Catch Rate Variations in the French Winter Cod Fishery

by

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Introduction

Commercial catch rate series are commonly used as indicies of abundance in stock assessments. The important assumption made when interpreting this type of data set at face value is that catchability remains constant over time. Usually scientists assume a direct linear relationship between catch per unit effort and stock abundance. However, the importance of environmental effects on the distribution of fish and their availability to commercial fishing gear may be important yet it is rarely considered. It is often very difficult to estimate these effects or to encorporate consideration of environmental factors in catch rate analyses.

In this paper attention is drawn to a recent phenomenon in the winter cod fisheries in NAFO Divisions 4RS and Subdivisions 3Pn and 4Vn. High catch rates in January and February of 1984 cannot be explained by stock abundance changes alone.

Materials and Methods

Canadian fisheries observers have been deployed on French vessels fishing cod in the Gulf of St. Lawrence and Subdivision 4Vn since 1979. The observers collect information regarding position, time, depth, and catch composition on a set by set basis, among other things. Data from 1981-1984 for the large French freezer trawler from the Scotia-Fundy Region Observer Program were used in this study.

Catch per unit effort (CPUE) on a yearly basis was calculated separately for the two stock areas, 4RS-3Pn and 4TVn. The yearly CPUE values were calculated as the sum of cod catch divided by the sum of hours fished. The geographic distribution of CPUE was examined by summing catch and effort by 10' squares of latitude and longitude, dividing, and plotting. The depth distribution of the fishery was examined by plotting percent of catch by 50 m depth zones.

Results

Yearly observed catch, effort, and CPUE for the 4RS, 3Pn fishery and the 4Vn fishery are given in Tables 1 and 2 respectively. Coverage of the 1981 fisheries did not begin until February by which time most of the 4RS-3Pn quota had been taken. Therefore there was lower than usual coverage of this fishery. In 4RS-3Pn 1981-1983 CPUE varied from 2.061 t/hr to 2.418 t/hr. In 1984 CPUE increased by a factor of 6.6 to 15.286 t/hr. In 4Vn CPUE increased from 1.151 t/hr in 1981 to 2.541 t/hr in 1983, then jumped to 5.990 t/hr in 1984.

Plots of CPUE by 10' square for 1981-1984 are given in Figures 1-4 respectively. As noted before coverage of the 4RS-3Pn

fishery in 1981 was low and the distribution of the fishery presented in Figure 1 does not represent the entire fishery. In 1982 and 1983 the fishery in 4RS-3Pn was distributed from approximately 49°20'N latitude to 48°N latitude and most of the catch was taken in the 150-200 m depth range (Figure 5). In 1984 the fishery was restricted to areas south of 49°N latitude in 200-320 m of water. CPUE per 10' square was as high as 56 t/hr in 1984 while the highest value in any other year was 4 t/hr. While CPUE was much higher in 1984 fishing was not as widely distributed as in 1982 or 1983. According to observer reports the vessels fished near the ice front and while in previous years the fish tended to move in a southerly direction as the fishery progressed, in 1984 the concentrations of fish tended to remain in the same place.

In Subdivision 4Vn the fishery has generally been distributed along the edge of the Laurentian Channel from St. Pauls Island in the north to Scatarie Bank in the south (Figures 1-4). Most of the catch is taken in the 100-249 m depth range, with the 150-199 m range being the highest in each year. The highest levels of CPUE were found in the vicinity of St. Pauls Island in 1982-1984 CPUE was fairly evenly distributed through the rest of the area except in 1984 when high levels of CPUE were realized on Scatarie Bank in the south of 4Vn. As in 4RS-3Pn the fishery did not cover as many 10' squares in 1984 as in the previous three years.

Discussion

The 1984 French winter cod fishery experienced very high catch rates, higher than any of the fishing captains could remember (observer reports). CPUE for the 4RS-3Pn fishery increased by a factor of 6.6 in one year. Similarily in 4Vn CPUE increased by 2.4 times. In both areas the fisheries tended to be both deeper and more concentrated in area than in previous years. It is unlikely that an increase of this magnitude could be solely due to an increase in stock abundance and it is possible that some environmental influences may be partly responsible for this increase.

Table 1. Observed catch, effort, and catch per unit effort by Metro-France vessels of the 4RS-3Pn cod stock.

Year	Catch (t)	Effort (hrs)	CPUE
1981	560	232	2.418
1982	3991	1936	2.061
1983	5806	2506	2.317
1984	7368	482	15.286

Table 2. Observed catch, effort, and catch per unit effort by Metro-France vessels of the 4TVn cod stock.

Year	Catch (t)	Effort (hrs)	CPUE
1981	1322	1148	1.151
1982	2234	953	2.344
1983	2568	1031	2.491
1984	3802	635	5.990

FIGURE 1:

CATCH RATE DISTRIBUTION (T/HR)
METRO FRANCE VESSELS
1981
OBSERVER DATA

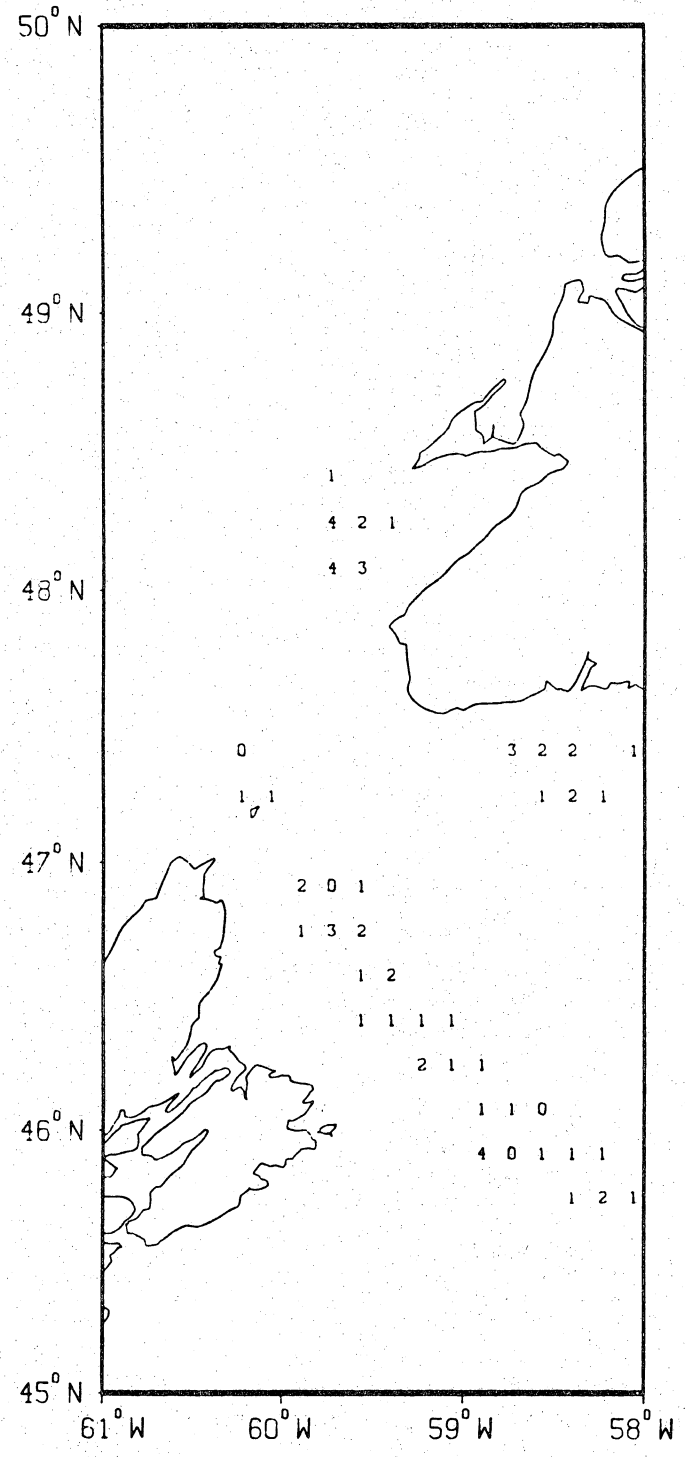


FIGURE 2:

CATCH RATE DISTRIBUTION (T/HR)
METRO FRANCE VESSELS
1982
OBSERVER DATA

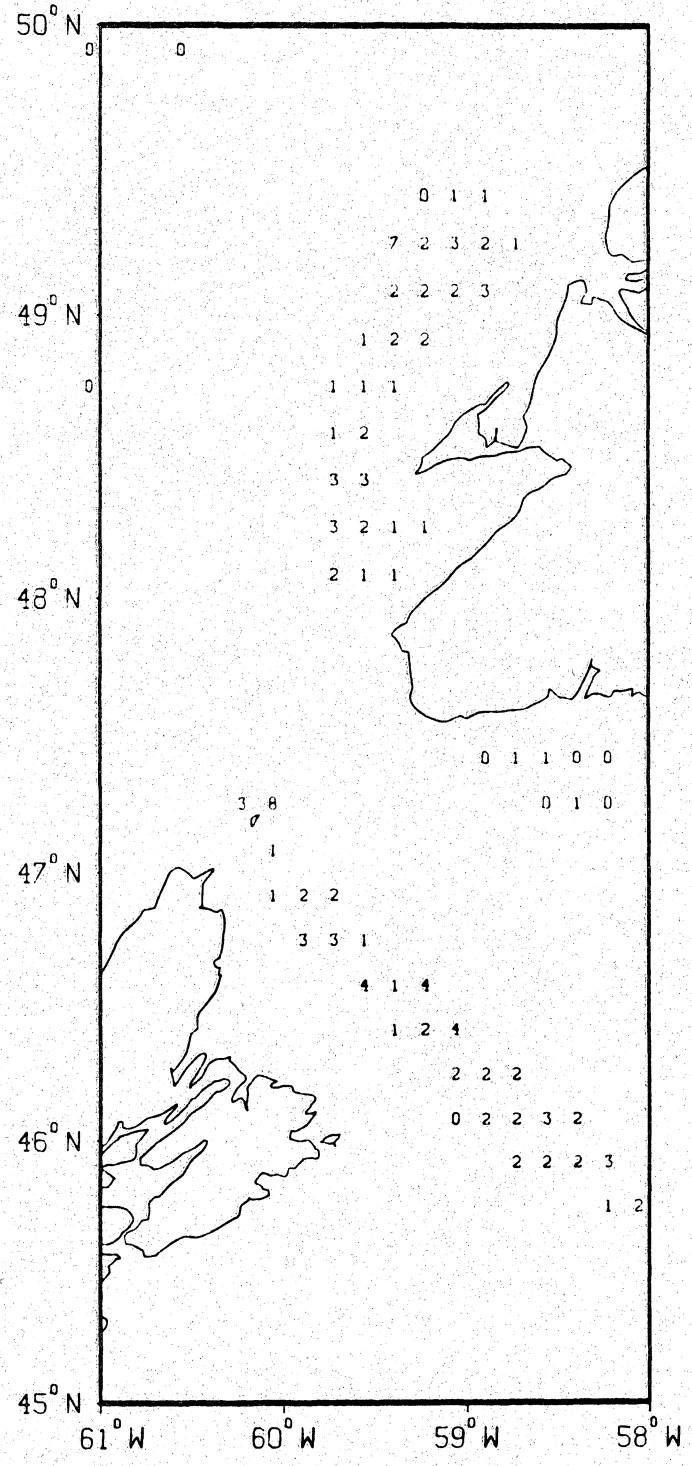


FIGURE 3: CATCH RATE DISTRIBUTION (T/HR)
METRO FRANCE VESSELS
1983
OBSERVER DATA

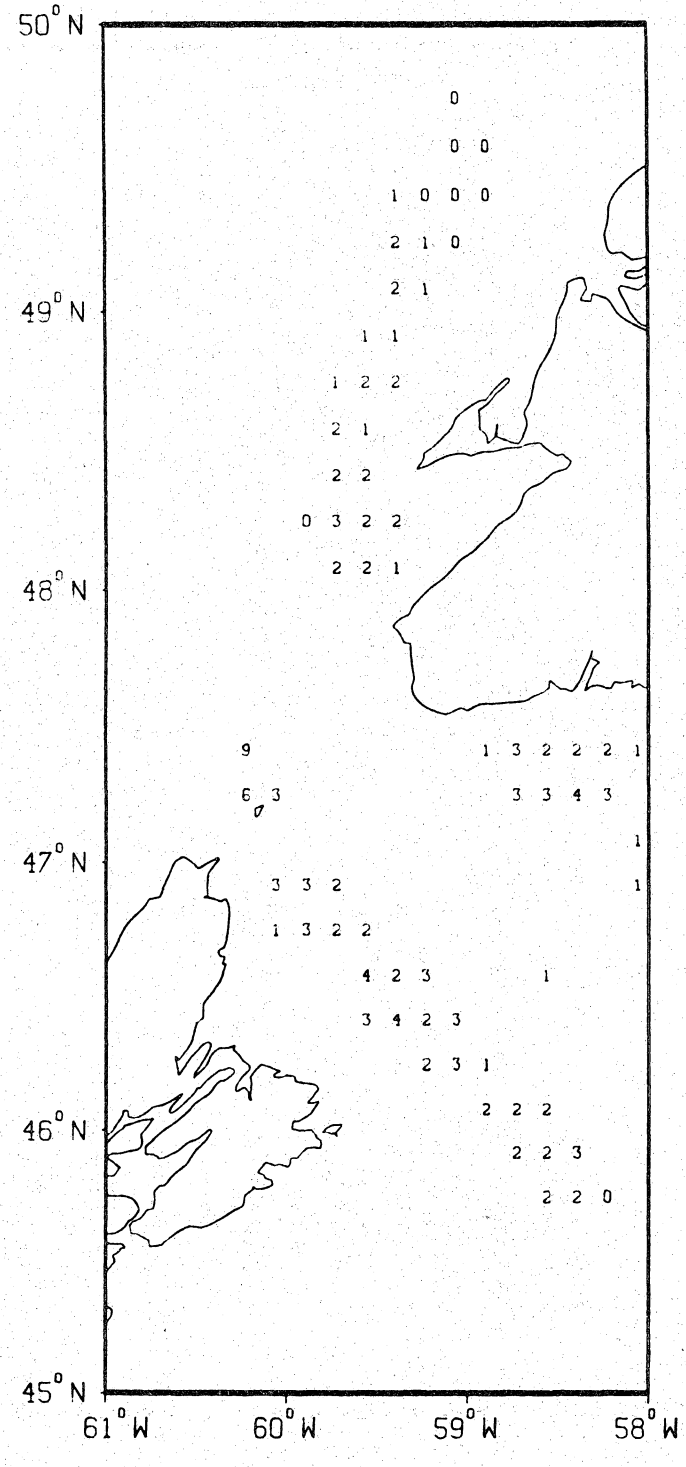
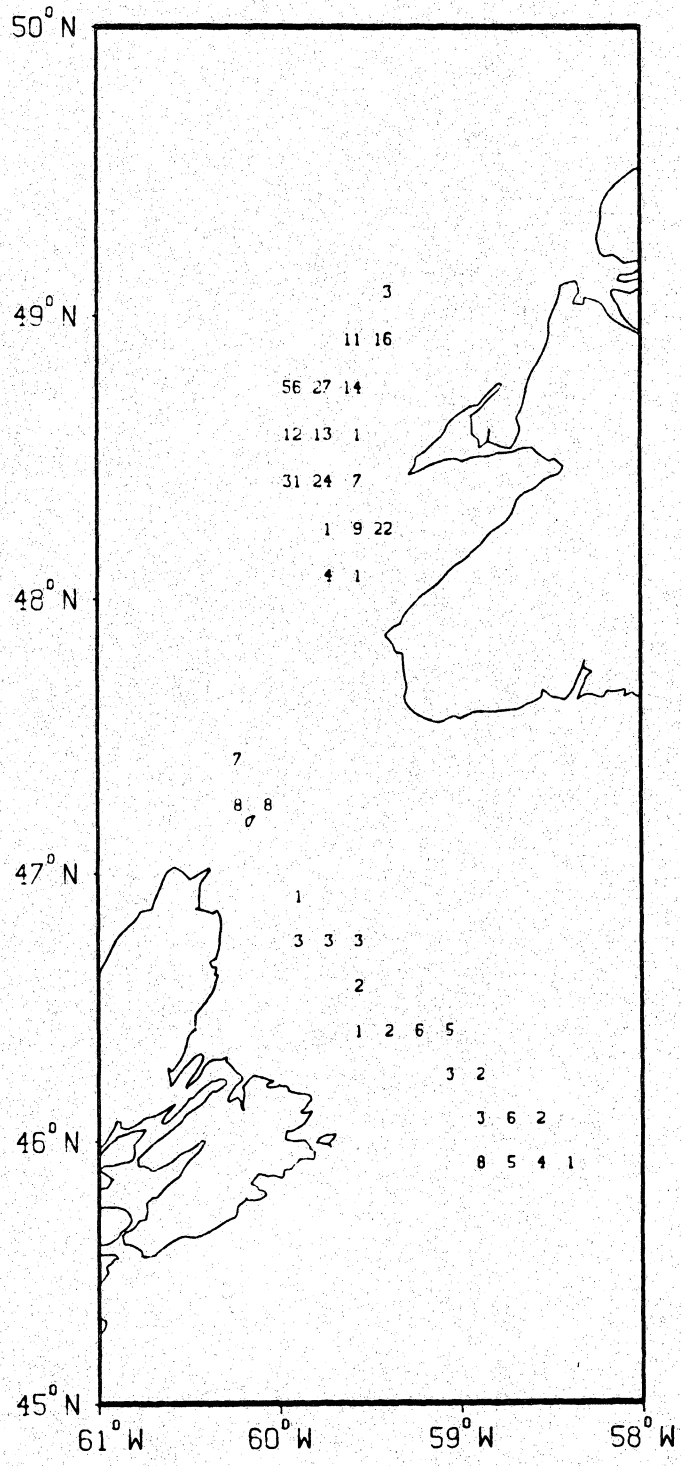


FIGURE 4:

CATCH RATE DISTRIBUTION (T/HR)
METRO FRANCE VESSELS
1984
OBSERVER DATA



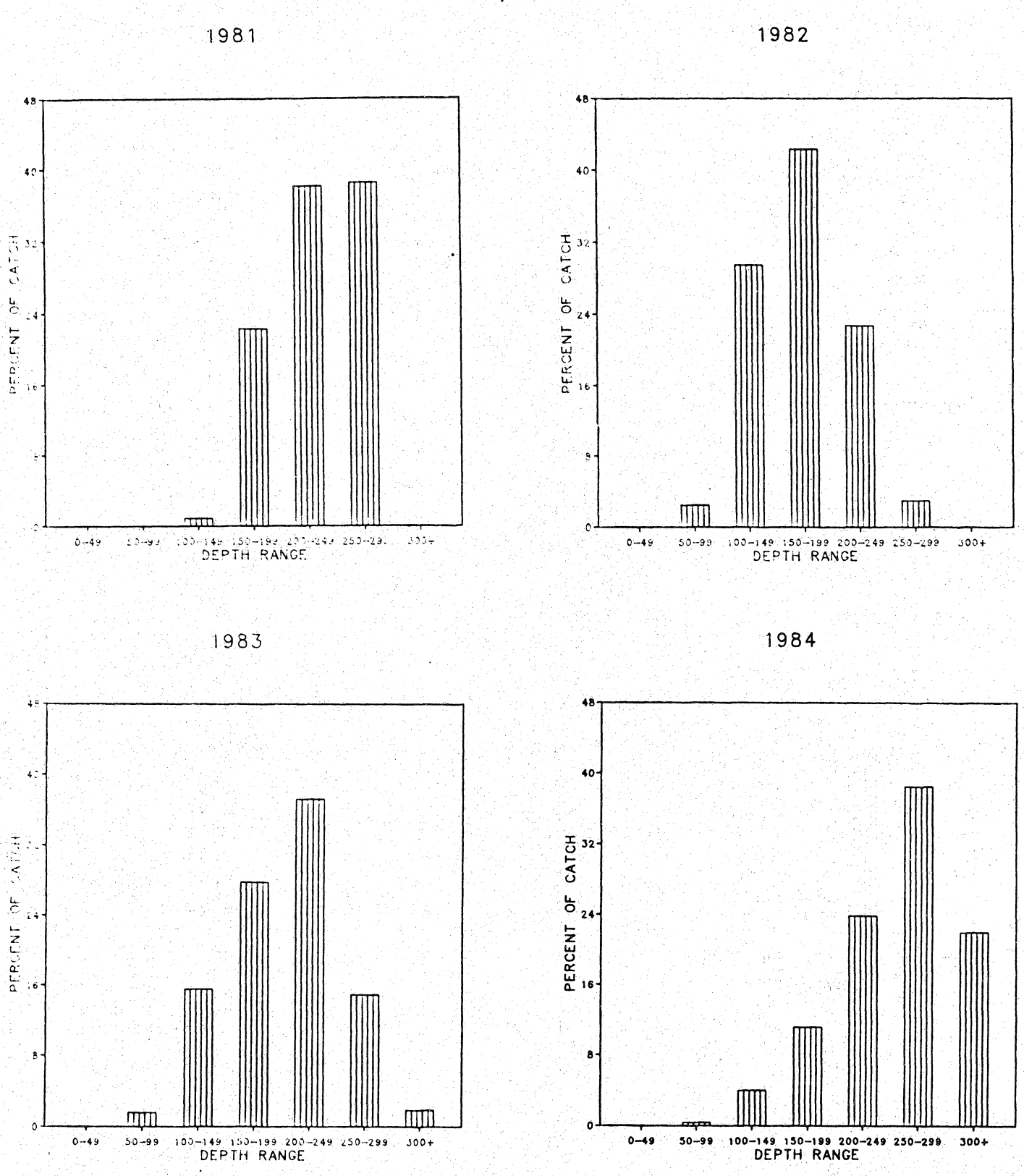


Figure 5: Depth distribution of observed cod catches in Division 4R by Metro. France vessels.

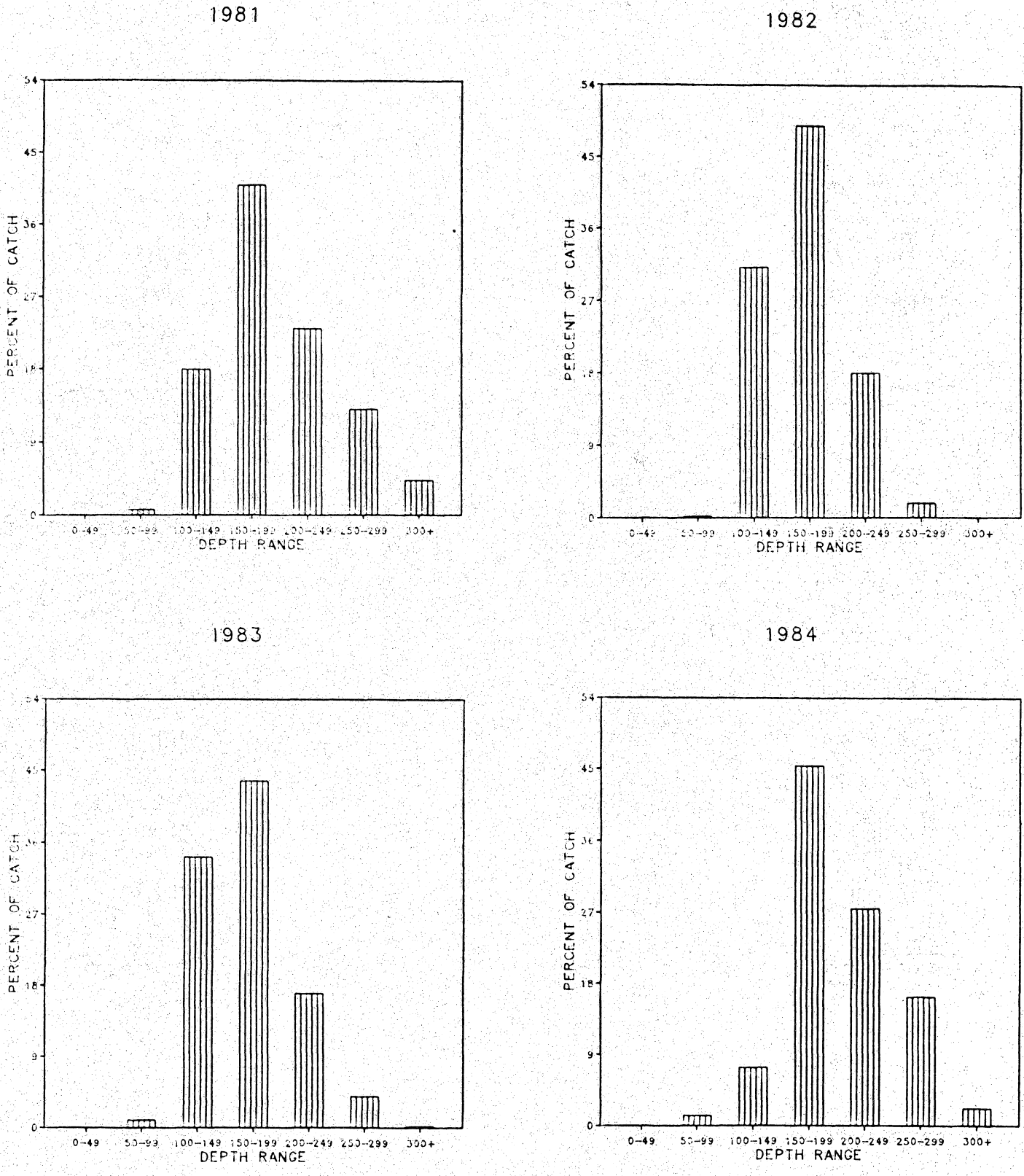


Figure 6: Depth distribution of observed cod catches in Subdivision 4Vn by Metro. France vessels.