

**ON CONDITIONS OF FORMATION OF GREENLAND HALIBUT  
(*REINHARDTIUS HIPPOGLOSSOIDES*) CONCENTRATIONS IN  
THE OPEN NORTHWEST ATLANTIC**

by

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**ABSTRACT**

This paper presents results of deep sea fisheries investigations carried out during 60-80s onboard the former Soviet Union vessels in the areas of the Flemish Cap Bank and the Grand Newfoundland Bank. The abundance variation trend in Greenland halibut catches is considered.

Information on environmental changes in the Northwest Atlantic during the last three decades is given. Data from deep sea surveys in Canadian waters are reported. Reasons for formation of commercial aggregations outside the 200-mile Canadian zone as well as for decline in halibut biomass in traditional fishing areas are investigated. Prospects of halibut fisheries in the open Northwest Atlantic are analysed.

**INTRODUCTION**

Deep sea aggregations of Greenland halibut in the Northwest Atlantic have been first revealed during cruises carried out by the USSR scouting vessels more than three decades ago. By results from research and scouting operations the commercial fishery on this important fish species was further arranged in the areas of West Greenland, Baffin Land, Labrador and Northern Newfoundland Bank. Development of the deep sea fishery has allowed to increase continually the halibut catch taken by the USSR and bring it to 30 thou.t (55% of the total catch by all countries) in 1975. With an alteration of the international fisheries jurisdiction in 1978 the fishery in these areas is regulated by quotas annually allocated by Canada and Greenland.

In late 80s, aggregations of Greenland halibut were also found outside the 200-mile economic zones on the slopes of the Flemish Cap Bank and Grand Newfoundland Bank (GNB). Since 1990-1991 a large-scale fishing has been carried out by the vessels from Spain, Portugal and other countries.

Review of investigations and fisheries carried out by research and scouting vessels

History of investigations on fish stock of fishery at high depth off the Flemish Cap Bank and GNB (outside the 200-mile zones existing) originates from the second half of 60s when the USSR research and scouting vessels began to investigate the continental slope of Canada.

In July-August 1965, hauls were taken at 600-730m depth on the south-eastern slopes of the Flemish Cap Plateau during a cruise of the research and scouting vessel "Krem1". Catches constituted 1.2-2.5 t per 2-hour-trawling. No halibut were in catches.

In October 1977, during a cruise of the research and scouting vessel "Torzhok" the north-eastern slope of the GNB, the northern and south-eastern slopes of Flemish Cap Bank were investigated. Catches from 950-1200m depth taken per 3-hour-trawling did not exceed 1 t of roundnose grenadier. Single specimens of halibut were registered in catches.

Comprehensive deep sea investigations off the Flemish Cap Bank were carried out onboard the RV "Artemida" during February-March 1978. On the north-eastern and south-western slopes of the bank the grenadier catches from 970-1250m made up to 0.3-0.7 t per 1 trawling hour. Single specimens of halibut occurred in catches.

High depth off the GNB and Flemish Cap Bank (600-1100m) were also investigated from time to time in the course of annual trawl surveys onboard the RV "Persey-III" (1971-1978), however, Greenland halibut (mainly its juveniles) were registered in catches only in minor amounts or not registered at all.

Thus, no halibut commercial aggregations were found during Russian research and scouting operations performed in the open Northwest Atlantic in 60-70s. Results from foreign investigations (Bowering et al., 1996) also evidence a lack of any essential aggregations of halibut during this period on the slopes of the Flemish Cap Bank and GNB.

An upward trend of abundance of halibut outside the 200-mile zone of Canada was noted in late 70s - mid-80s during the trawl surveys onboard the RVs "Persey-III", "Suloy", "N.Kononov" and "Genichesk" when catches taken at 400-700m attained 100-300 spec. per 1 trawling hour.

In January 1983, deep sea transects of the continental slope of the GNB and Flemish Cap Bank were checked during the cruise of research and scouting vessel "M. Verbitsky", where 10 hauls were performed with a bottom trawl at 900-1850m. Maximum catches of deep sea fish did not exceed 0.5t/hr and were taken on the Flemish Cap Bank south-eastern slope (990-1020m) and off the Flemish Pass Deep (1100-1200m). Halibut and roundnose grenadier were equally represented in catches, with bycatch of roughhead grenadier, deep sea shark and skate being 20%.

First reportings on halibut trawl fishery off the Flemish Pass Deep appeared in late 80s. In 1990-1991 a large-scale fishery was carried out there at the depths to 1500m by the vessels from Spain, Portugal and other countries. In subsequent years the fisheries area extended and covered Divs. 3LMN; trawling depth increased to 1700-1800m (Junquera et al., 1992).

In 1990-1995, total yearly halibut catch taken in the open Northwest Atlantic by the EEC countries, Japan, Panama and by other states varied from 12.4 to 57.6 thou.t (Bowering et al., 1996).

## DISCUSSION

Results from analysis for the data available indicate that aggregations of commercial density halibut outside the 200-mile zone of Canada have formed recently, probably, about a decade ago. The main reason of increase in biomass of halibut on the slopes of Flemish Cap Bank and GNB is evidently a

shifting of its area southwardly under an influence of general cooling in the Northwest Atlantic. Since 1970s the climate in the NWA has been affected by three large-scale coolings, i.e. early in 70s, in the first half of 80s and early 90s (Colbourne, Narayanan, Princenberg, 1994), which were characterized by a drop in temperature not only of surface but also deep sea waters of the Labrador Sea (Stein, Borovkov, 1996). Reduction in heat content of waters has first resulted in redistribution of halibut main aggregations from relatively low depths (600-800m) in 1968-1971 to 800-1500m in 1975-1983 (Chumakov, Bowering, Ernst, 1988). Trend of cooling was further followed by a reduction in biomass and density of halibut aggregations in its area northern part. Signs of the process mentioned were first registered during autumn-winter 1984 when no commercial aggregations of halibut were found in traditional fishing areas of the Baffin Land and Northern Labrador. A drop in density of halibut aggregations in these areas has also been proved by subsequent investigations (Chumakov, Savvatimsky, 1987). In late 80s - early 90s a considerable decrease in halibut stock was also marked off the Southern Labrador and Northern Newfoundland Bank (Bowering, Power, 1993), in this case, a shifting of southern boundaries of this species area to the area of Nova Scotia inclusive (Annual Report of the NAFO, 1994).

It should be noted that the last cooling taken place in the NWA early in 90s essentially affected the biology and distribution of most other commercial fish species. In particular, growth rate of capelin has essentially reduced during recent years, its spawning occurred a month later than usually, the area of the species distribution shifted to the south of the Nova Scotia coast and eastwards to the Flemish Cap Bank area (Nakashima, 1994; Frank, Simon, Carscadden, 1994). According to results from observations made by Russian research and scouting vessel "Ozernitsa" in 1996 and by the data from foreign investigations (Iglesias, de Cardenas, Paz, 1994), American plaice and long-rough dab began to occur in catches from the depths, unusual for these species, below 800m and even to 1400m depth. Unfavourable environmental conditions, probably, also caused a prolonged depression of abundance and reduction in growth rate, as well as essential decrease in depth of cod distribution and redfish inhabiting the area at the Atlantic coast of Canada (Sinclair, 1994; Bochkov, Troyanovsky, 1996).

Shifting of halibut area under an impact of variation in environmental conditions was also noted earlier. Thus, general climate warming taken place during 30s of the current year has resulted in halibut redistribution northwards and in cessation of its fishery at the western coast of West Greenland (Chumakov, 1977).

## CONCLUSION

Analyzing long-term prospects of halibut fishery it should be noted that its possibility itself and fishing efficiency in the open NWA will apparently be estimated not only by fish stock status but also by climatic factors. In particular, there are good reasons to believe that conditions for formation of halibut aggregations off the Flemish Cap Bank and GNB will be maintained under availability of negative anomalies of water temperature in the NWA. With a rise in heat content of the Labrador Current waters to the norm or higher a gradual shifting of halibut area to the north is possible and, as a consequence, decline in biomass of its aggregations and efficiency of fishery outside the 200-mile zone of Canada.

Considering the trend of warming in the NWA it could be suggested that redistribution of halibut northwardly will further take place as well as decline in biomass of its aggregations outside the 200-mile zone of Canada. However, the measures undertaken by NAFO to regulate fishery on halibut in

the international waters, as well as appearance of a few abundant yearclasses (Report of Scientific Council, 1996) should positively influence the status of its stocks in the nearest years and will support further fishery in this area.

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