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Status of fisheries and research  
carried out in Subarea 4 in 1974

by

R. G. Halliday

Environment Canada  
Fisheries and Marine Service  
Biological Station  
St Andrews NB  
Canada

Pertinent Documents

Reports of research in Subarea 4 are contained in Summary Documents 12 (Japan), 13 (Spain), 15 (Canada), 16 (USA), 24 (UK), 25 (France), 30 (USSR), 36 (FRG). Results of specific research studies are contained in Research Documents 9, 10, 14, 15, 17, 30, 32, 33, 36, 38, 39, 43, 56, 57, 58, 63, 71, 73, 90, 91, 92, 98, 103, 104, 110.

1. Status of fisheries

Total nominal catches decreased by 23% to 874,000 mt from 1,139,000 mt in 1973.

Nominal catches declined for Canada (599,000 to 528,000 mt), Denmark (7,500 to 4,600 mt), France (M) (26,000 to 20,000 mt), Japan (5,000 to 1,700 mt), Poland (1,800 to 900 mt), Spain (40,000 to 34,000 mt), USSR (423,000 to 251,000 mt), USA (13,800 to 12,700 mt). Small increases were reported by FRG (1,600 to 2,100 mt), Norway (700 to 1,200 mt), Portugal (17,400 to 17,800 mt), and the UK (0 to 500 mt).

Species showing the most substantial declines in catch were silver hake (299,000 to 96,000 mt) and redfish (170,000 to 96,000 mt), but significant decreases (ie > 5,000 mt) also occurred in catches of cod, witch, and squids. These decreases were partly compensated by increases in catches of American plaice, sea robins, mackerel, alewife, and argentines.

2. Research carried out

(a) Canada. Hydrographic and plankton studies were continued in the Gulf of St Lawrence and on the Scotian Shelf. Stock assessment and research vessel inventory studies of groundfish and pelagic fish populations, and statistics and sampling collection from commercial fisheries were continued. Experimental development of acoustic counting techniques was also continued. A comparative fishing experiment between the research vessels A. T. Cameron and E. E. Prince was conducted. Egg and larval surveys conducted for eight years in Div. 4T were concluded in 1974. A study of protozoan parasites in the swim bladder of gadoids was undertaken on the Scotian Shelf. Herring larval surveys were conducted in the Banquereau area (Div. 4 VW) and in the Bay of Fundy (Div. 4X). Approximately 35,000 herring were tagged in the Bay of Fundy, 11,000 mackerel in Div. 4TVWX, and 48 bluefin tuna. Trials were carried out on selectivity and masking effects for Digby scallop dredges in the Iceland scallop fishery.

(b) France (SP). Four cruises of the RV Cryos were conducted in part in Sub-area 4. Hydrographic and plankton surveys were conducted in Div. 4R in November. Meristic studies of herring and yellowtail were conducted in Div. 4V and a herring larval survey was conducted in Div. 4X. Biological data were collected in Div. 4R and Div. 4V for cod, herring, redfish and yellowtail.

(c) FRG. Hydrographic and juvenile herring surveys were conducted in Div. 4X in March and April. Selectivity studies were conducted in the Gulf of St Lawrence in April and May.

(d) Japan. Exploratory fishing for Illex was conducted on the Scotian Shelf, and commercial samples of redfish collected.

(e) Spain. Commercial samples of cod from Div. 4V and Div. 4W were collected.

(f) USSR. Investigations of the long-term fluctuations in the heating background of shelf waters were continued. USSR conducted autumn trawling surveys collecting biological data dealing with silver hake stock assessment and the biological data have been collected by fishing and research vessels.

(g) UK. Continuous plankton recorder surveys were continued, 533 miles being sampled in 1974.

(h) USA. Combined groundfish, plankton and hydrographic surveys were conducted in Div. 4X in spring and in autumn. Studies of spawning and fecundity of important fish species were continued.

### 3. Research results reported

Most countries fishing Subarea 4 in 1974 conducted sampling studies of their commercial catches. These, and other data particularly from research vessel surveys, were utilised to reassess the status of major stocks in the Subarea and recommend regulatory actions to the Commission. The results of these assessments are summarised in the report of the Assessments Subcommittee (Summ.Doc. 75/18) and in the report of Scientific Advisers to Panel 4. Other new information on fish stocks and their environment is summarised below.

#### (a) Hydrographic and plankton studies.

Effects of St Lawrence River discharge has been traced by correlation analysis with sea temperatures to propagate from the Gulf of St Lawrence, onto the Scotian Shelf and through the Gulf of Maine at known coastal current drift speeds.

Studies of the occurrence of petroleum and naturally-occurring hydrocarbons in sea water between Bermuda and Halifax showed that petroleum hydrocarbon concentrations are low, limited to the upper 10 m, and there is no evidence of effect on phytoplankton growth.

Water temperatures in the St Georges Bay area (Div. 4R) were slightly higher in 1974 than in 1973.

The heating background of shelf waters has been investigated using as indices the depth of the 5°C isotherm in the Emerald Bank area and the minimum temperature of the cold intermediate layer in the Halifax section. These indicate 1962 and 1963 were relatively warm, followed by a cooling period through 1966, and a subsequent warming period continuing into 1974.

A plankton survey in September 1974 in Div. 4X caught herring larvae only off southwestern Nova Scotia. Mean larval length increased with latitude. A herring larval survey in Div. 4VW in October - November found no large concentrations of larvae.

An eight year series of data from egg and larval surveys on the Magdalen Shallows (Div. 4T) were used in an examination of stock-recruitment relationships of cod, herring, and mackerel. For cod, the quadratic effects of temperature and spawning stock biomass were key factors in determining egg abundance levels. The number of larvae was found to increase linearly with egg abundance and temperature. A dome shaped density-dependent relationship existed between the numbers of larvae and the estimated abundance of age 2 cod. For mackerel, a distinctly dome-shaped quadratic relationship was found between parent stock biomass and the logarithm of the modal catch of eggs, while the relationships between numbers of eggs and numbers of larvae, and number of larvae and numbers of age 1 juveniles were intrinsically linear. The catches of both spring and fall spawned herring larvae varied in response to sea temperature and spawning stock biomass. Year class size was intrinsically linearly related to larval abundance and pelagic stock biomass (herring and mackerel).

(b) Cod.

Stock structure - tagging experiments in Div. 4R, Subdiv. 3Pn and 4Vn, confirm previously described seasonal migrations into and out of the Gulf of St Lawrence on both sides of the Laurentian Channel with relatively little mixing across the Channel. Tagging experiments on both inshore and offshore stocks in Div. 4X confirm that there is relatively little mixing but indicates some mixing of Browns and Georges Bank cod.

Ageing - age reading comparisons between Canada and Spain for Subdiv. 4Vs cod gave only 60% agreement.

Spawning time - between 16 April and 5 May, 81% of Browns Bank (Div. 4X) cod were past spawning, none actually being found in spawning condition, the remainder being ripening fish.

Growth - growth rate of Div. 4VN - 4T cod is correlated with stock biomass and temperature.

(c) Haddock.

A study of the occurrence of the protozoan parasite Eimeria gadi in the swim bladder of Div. 4WX haddock showed the highest incidence in the Emerald Bank area, incidence decreasing to the southwest. Overall average incidence was 32.3%. Incidence was negligible in fish smaller than 35 cm. Between April 16 and May 5, 15% of Browns Bank (Div. 4X) haddock were spawning and 41% were past spawning.

(d) Redfish.

A study of the distribution of redfish in Div. 4R showed largest catches were made between 4° and 5°C.

(e) Silver hake.

Age, growth and maturity - According to length-frequency analysis performed by Canada, the growth of silver hake and the age composition of the commercial catch have been described by analysis of length-frequency data. One year old fish are approximately 13 cm long in March, reach 26 cm by December, and 31 cm by the following December. The commercial catch is composed predominantly of age 2 fish.

All age 1 fish are immature and all age 2 males are mature. On average, 75% of age 2 females are mature. However, the USSR ageing technique using otoliths indicate that the catch is composed primarily of age 3 and 4 fish and that maturity occurs at age 3.

Year class strength - There are indications that temperature may have an important influence on year class success.

(f) Herring.

Stock structure - Meristic studies have not, as yet, provided a clear understanding of stock relationships but suggest close relationships of autumn spawning herring in Subdiv. 4VN and 4Vs but not for spring spawning groups in these areas. There may be three distinct complexes of spring spawners in the west Newfoundland, Bird Rock - Cape Breton, and Sable Island areas.

Larval surveys in Div. 4VW in October-November did not locate concentrations of larvae in sufficient quantities to support the hypothesis that a large autumn spawning stock is resident in this area.

Tagging experiments indicate that a substantial proportion of herring found in the Bay of Fundy (Div. 4X) during summer over-winter in Subdiv. 4W(a). Another, smaller, portion over-winters in the western part of Subarea 5.

Juvenile surveys - Catches of juvenile herring from the 1974 March surveys in Division 4X differed between vessels. The stratified number per tow for US Albatross IV were 70%, 6% and 22% for ages 2, 3 and 4 respectively. The stratified number per tow for FRG Walter Herwig were 1.2%, 52% and 47% for ages 2, 3 and 4 respectively.

Growth and mortality - Equations describing the growth of herring in Div. 4V, Div. 4W, and Div. 4X have been calculated and growth parameters used to obtain an estimate of natural mortality.

(g) Bluefin Tuna.

Six tagged tuna were recovered, five from near the tagging location, the sixth 535 miles from the release site after three years at large.

(h) Sampling.

An analysis of sampling efficiency indicated continuing deficiencies. In particular, cod in Div. 4TVn and Div. 4X, and pollock, American plaice, and yellowtail stocks in Div. 4VWX were not sampled to the level of minimum ICNAF requirements in 1973.

A test for bias in herring sampling at a Canadian port was negative, but the small size range of fish involved makes the experiment inconclusive.

Tests of various sampling and weighting procedures in determining numbers removed in the Cape Breton (Div. 4Vn) herring fishery made possible a number of recommendations for avoiding bias and minimising variance of the estimates.