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Status of the fisheries and research
carried out in Subarea 4 in 1975

by

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Introduction

The following documents contain information on research carried out in Subarea 4 or data analyses relevant to Subarea 4 stocks: Research Documents 76/1/1, 76/VI/2, 3, 4, 5, 6, 11, 21, 22, 24, 25, 26, 29, 37, 40, 42, 44, 45, 46, 47, 48, 49, 52, 56, 57, 59, 60, 65, 73, 74, 77, 83, 85, 87, 90, 95, 97, 98 plus addendum, 118. Summary Documents 76/VI/9, 12, 14, 15, 16, 18, 20, 23, 31, 33, 38. The following documents contain general information which is of interest to those conducting research in Subarea 4: Research Documents 76/VI/8, 10, 19, 34, 38, 58, 63, 75, 96, 99, 100, 101, 105, 106, 115, 117. In addition, a variety of data and analyses relevant to the assessment of the status of Subarea 4 stocks are contained in the Working Paper series.

Status of the fisheries in 1975

Total preliminary nominal catches of finfish from Subarea 4 in 1975 were 818,000 tons, 2% below the 1974 total of 834,000 tons. Total catches of invertebrates increased to 49,000 tons, a 34% increase from the 1974 level of 36,000 tons. The harvest of seaweeds declined to 40,000 tons from 66,000 tons.

Cod catches declined by 27,000 tons from 172,000 tons in 1974 to 145,000 tons in 1975. The declines in catch occurred in almost equal quantities in the stocks in Div.4T-Subdiv.4Vn and in Subdiv. 4Vs-Div.4W. These declines are partly due to catch quota restrictions on Denmark, Portugal, and Spain. American plaice catches declined by 6,000 tons to 22,000 tons in 1975 from 28,000 tons in 1974, due to reduced Canadian catches mainly in Div. 4S and reduced USSR catches on

the Scotian Shelf. Reduced USSR catches were apparently due to catch quota restrictions. Reported catches of searobins on the Scotian Shelf again occur for 1975, although this species is not thought to occur in the area. The catch of 3,000 tons reported is substantially lower than that of 9,000 tons reported for 1974. Mackerel catches declined by 11,000 tons to 32,000 tons in 1975. The reduction in USSR catches was apparently due to catch quota restrictions, but lower Canadian catches were due to reduced availability of mackerel to inshore gear, particularly in Div. 4T. Alewife catches declined by 12,000 tons to 6,000 tons in 1975 due to unexplainable declines in both Canadian and USSR catches.

Silver hake catches in Div. 4VWX increased by 20,000 tons in 1975 to 116,000 tons due to an increase in the 1975 TAC by 20,000 tons over that of 1974. Catches of anglers increased by 6,000 tons to 18,000 tons in 1975 and catches of skates increased by 9,000 tons to 19,000 tons. Herring catches in Div. 4X increased by 12,000 tons to 147,000 tons, both Canadian and USSR catches increasing in this Division. Total Subarea 4 herring catches increased by 10,000 tons to 238,000 tons in 1975. Squid catches increased to 14,000 tons from 400 tons in 1974 due to initiation of a USSR fishery.

For all other species, changes in catch levels were relatively small (i.e., less than 5,000 tons). The influence of catch quota regulations make many of the changes in catch levels difficult to interpret with respect to status of the stocks.

Research carried out by member countries

Canada - Seasonal physical oceanographic surveys, including T-S and current measurements were carried out in the Gulf of St. Lawrence (Div 4RST) and T-S measurements were made along the Halifax section (Div 4W). Estuarine and coastal embayment studies were continued with physical oceanographic measurements being made in Georges Bay (Div 4T) and St. Margarets Bay (Div 4X), and suspended sediment studies carried out in the Northumberland Strait (Div 4T). Temperature and salinity data were collected on a variety of research cruises throughout Subarea 4.

Studies of the Yarmouth upwelling were continued (Div 4X). Surveys for temperature, salinity, phytoplankton, and chlorophyll were made with a towed porpoising body (BATFISH), and airborne remote sensing flights were undertaken to detect surface chlorophyll. Quantitative analysis of zooplankton samples from survey cruises in the Bay of Fundy (Div 4X) is being made to investigate persistence, distribution and movement of selected local stocks of plankton.

A survey was conducted to study the presence of Bunker C oil on Chedabucto Bay beaches and in intertidal invertebrates and attached algae (Div 4W). Measurements were made of levels of insecticides and heavy metals in liver and muscles of cod from Div 4T, 4VN, 4W, and 4X as part of a continuing programme under the auspices of the ICES Working Group on Pollution Baseline and Monitoring Studies.

Annual groundfish research vessel surveys were completed on the Scotian Shelf (Div 4VWX) in July - August, in the southern Gulf of St. Lawrence (Div 4T) in August - September, and in the northern Gulf of St. Lawrence (Div 4S) in July. Surveys of groundfish populations and larval herring distribution were carried out in February in Div 4WX. The annual groundfish egg and larval survey in Div 4T was completed in July - August and herring larval surveys were made in the Bay of Fundy and Gulf of Maine (Div 4X and 5Y) in April and November. Field trials were conducted to develop a survey design for hydroacoustic counting methods for a large scale groundfish inventory.

Monitoring and biological sampling of commercial landings and study of sampling methods and data treatment continued, and a sampling programme by The Quebec Department of Fisheries for cod, redfish and flatfish was initiated in Div 4RS.

Investigations of the geographic distribution, incidence and intensity of infection of helminth parasites and of Eimeria gadi, a potentially serious disease of the gas bladder of haddock were initiated.

Studies of herring fecundity were continued. Studies of the relationships between the structure of hydrographic systems in the Bay of Fundy and the siting of herring spawning grounds, absolute size, and distribution of herring stocks have been initiated. Weir catches of juvenile fish in the Bay of Fundy are being studied as indicators of movement of fish groups and of the origin of the Bay of Fundy sardines.

Biological data on swordfish stocks off the Scotian Shelf (Div 4VWX) were collected during experimental longline operations with chartered vessels.

An apparatus was built to measure target strengths of live fish at different aspects, in relation to development of an echo-counting system. An obstacle avoidance system has been designed for the bottom-referencing under-water towed instrument vehicle (BRUTIV). Planning and trials were made on high-headline trawls and on double-codend trawls for separation of redfish and shrimp.

FRG - Juvenile herring surveys were conducted in March and hydrographic and larval herring surveys were conducted in October - November which covered part of Div 4X as well as Subarea 5.

UK - The continuous plankton sampler programme sampled 332 miles in Subarea 4 in 1975.

GDR - A herring survey in March covered part of Div 4X.

Japan - Experimental fishing for Illex squid by jigging was conducted during June to October on the Scotian Shelf in depths of 150-200 m. Commercial sampling of butterfish was conducted in Div 4X.

Spain - A scouting cruise for Illex squid made 32 tows in Div 4VWX, and commercial catches of cod in Div 4VN were sampled in January.

USSR - A trawl survey was conducted in Emerald Basin (Div 4WX) in autumn.

USA - Hydrographic, plankton, and bottom trawl surveys were conducted in Div 4X in spring and autumn as part of large scale surveys which also cover Subarea 5 and Statistical Area 6.

France - Hydrographic data and biological data on cod, herring, redfish and American plaice were collected on two research vessel cruises in Div 4RTVW in the January to April period. Cod tagging was conducted in Div 4R. Surveys were conducted for squids in Div 4WX in spring and autumn.

Research Results reported

All of the major stocks in Subarea 4 have been assessed from the viewpoint of advising on appropriate catch levels in 1977. The results of this research are reported in both the Assessments Subcommittee Report and the Report of Scientific Advisors to Panel 4 and thus are not repeated here. Other research results are summarized below.

Hydrography and plankton - Physical and chemical studies related to the productivity of the Gulf of St. Lawrence during the past 5 years have shown that temperature ranges from -2 to 20° C, the lowest values occurring both at the surface in winter and in the intermediate "cold layer". The importance of the cold layer to the productivity of the Gulf lies in the fact that it effectively separates the photic zone from the nutrient-rich deep water during those months when insolation is not the limiting factor on phytoplankton growth. Salinity ranges from 25 to 35 ‰, the low values having their origin in the freshwater input, the high values in incoming waters from the North Atlantic Ocean. Specific gravity correlates very strongly with temperature, in contrast to the Scotian Shelf where variations are much more dependent on salinity. Oxygen ranges from 2 to 10 ml/l, decreasing to a minimum at intermediate depths. Studies of particulate organic matter show that there is an export of one million tonnes of organic matter from the Gulf annually to the Atlantic Ocean through Cabot Strait.

A study of long-term variations in heat content of Scotian Shelf waters in the period 1962-72 shows that waters were cooling between 1962 and 1964 with a subsequent fairly regular increase in temperature to 1972.

Maps of the distribution of hydrographic stations from 1950 on file with

the Marine Environmental Data Service, Ottawa, are now available.

Twenty-one oceanographic sections across Northeast Channel were taken in 1975 and indicate that Slope Water was regularly present from March through December, frequently inside the sill, confirming previous observations of sporadic flow into the Gulf of Maine.

The volumes of zooplankton in samples collected in 1973 were higher off southwestern Nova Scotia (Div 4X) than on Georges Bank and the Gulf of Maine in spring, but lower than on Georges Bank and similar to the Gulf of Maine in autumn.

Summaries of abundance, length-frequency, and distribution of larval fishes collected on eight cruises by USA vessels during ICNAF larval herring surveys from September 1971 to February 1975 are now available and portions of these data refer to Div 4X.

A description of the abundance, composition, and distribution of zooplankton on Browns Bank in comparison to Georges Bank and the Gulf of Maine in September-October 1974 is now available. The data suggests that predacious Salpidae may compete with plankton eating fishes for Copepoda.

A study of plankton volumes in the area of the Laurentian Channel in November-December 1972 showed that plankton volumes were largest in the Cape Breton region and smallest off southwestern Newfoundland, with Banquerean intermediate.

Cod - A study of the age at maturity of Browns Bank cod in 1972 indicated that 50% maturity occurred at 3.5 years, almost a year older than in Georges Bank cod.

The year-class sizes at age 1 of cod in Div 4V_gW was found to be negatively correlated with the catch rate of silver hake. It is hypothesised that silver hake and the fishery on it are important determining factors of cod recruitment through predation and by-catch of small cod.

Tagging experiments conducted in Div 4R and Div 3P in the winters of 1975 and 1976 confirm the movement of cod south as far as Burgeo Bank in winter and a return movement back into the Gulf of St. Lawrence (Div 4R) in spring.

It is suggested that the southern migration is associated with feeding and the northern one with spawning.

Pollock - The biology of pollock has been reviewed particularly in relation to stock separation and it is concluded that there are strong interrelationships between pollock in Subareas 4 and 5. Separate stocks of pollock cannot be identified with present knowledge. New data on growth give von Bertalanffy growth parameters of $L_{\infty} = 102$ cm $K = 0.22$ and $t_0 = 0.38$.

Silver Hake - A negative correlation between the length of one year old silver hake in commercial catches in September and the size of the year-class to which they belong suggests that the growth characteristics may be useful in prediction of year-class strength.

Argentines- Further study of ageing techniques from otoliths describes the pattern of ring formation and new data on growth imply that there are no differences in growth pattern of argentines on Browns and Emerald Banks.

Redfish - A study of catch, catch rate and fishing effort trends for redfish in the Gulf of St. Lawrence suggests that the MSY is in the order of 50,000 mt, but that catches and effort since 1968 have been above the equilibrium level and catches below this level can be expected in the immediate future.

Herring - An historical review of literature on herring distribution on the Scotian Shelf was combined with new data from the Soviet scouting and fishing fleet for the 1963-72 period. A complex distributional pattern which varies by fish size, season and hydrographic conditions was discerned. Review of tagging results from Bay of Fundy tagging experiments confirm previous results that there are strong interrelationships between Bay of Fundy and Chedabucto Bay herring (Div 4Wa) and between herring on both sides of the Bay of Fundy. Significant intermixing with Subarea 5 stocks is also indicated and urgently requires further study. A stochastic model was used to study the effects of temperature perturbations, and predation and competition from mackerel on the recruitment process for Gulf of St. Lawrence herring. It was determined that temperature and abundance

of age group 0 mackerel affected the growth rate of herring, but that neither the total herring biomass or total pelagic biomass had a measurable affect on growth rate. The growth rate of herring, coupled with adult stock size and environmental effects mediated through temperature, were the prime determinants of the abundance of larvae < 10 mm.

Mackerel - Mackerel tagging experiments conducted in 1974 in Subarea 4 were reported on, and reports on 1973 experiments updated. Results confirm that a substantial movement into Subarea 5 and Statistical Area 6 occurs during winter, with a return movement into both Subareas 3 and 4 in the summer. Mackerel found in the Gulf of St. Lawrence in summer are shown to participate in this migration as do those found along the Nova Scotia coast. A study of length-weight parameters, maturation rate, and nematode infection, in mackerel in Subareas 4 and 5 and Statistical Area 6 found no differences among areas and hence did not provide a basis for stock separation.

Illex squid - An exploratory survey for squid in June caught moderate quantities on Banquereau Bank (Div 4V_S) in depths of 76 to 84 fms. These Illex had a range in mantle length of 10 cm to 20.5 cm with a modal length in most samples of 15.5 cm. A trawl survey in Div 4VWX in May caught Illex only to the south of La Have Bank (Div 4X) and these were smaller (mean length 14.3 cm for males and 14.6 cm for females) than specimens caught on Georges Bank (Div 5Z) at the same period. Most Illex were immature. In a survey in November - December, with a small number of stations in Div 4X, a large proportion of the Illex caught were juveniles with mean length of 10 cm. Squid of larger size were also present. A study of Illex growth indicated that, in the period May to December, males grow 1.4 cm per month and females 1.7 cm per month. Two groups with different reproductive cycles are hypothesized to explain observed size changes.

Loligo squid - Only a few large specimens of Loligo were caught off southwestern Nova Scotia in a May trawl survey. Only two specimens were caught

in this area in a November - December survey. A growth study of Loligo was conducted on material largely caught in Subarea 5 and Statistical Area 6.

Sea scallops - Assessments of the Bay of Fundy (Div 4X) and southern Gulf of St. Lawrence (Div 4T) scallop fisheries indicate that low and declining landings result from fishing effort more than twice that needed to provide close to optimal yields.

Iceland scallops - surveys of stocks in Jacques Cartier Strait (Div 4S) indicate that recent recruitment was poor and growth was slow.

Bluefin tuna - Tag and recapture, and size frequency data, indicate that fisheries for giant bluefin tuna in the west Atlantic, north of Cape Cod, exploit a common population of mature fish. Catch trends, mean sizes and ages are similar in the northeast and northwest Atlantic. Ageing data indicate that 19-24 year old fish dominated the 1975 Canadian catch with very few fish younger than 14 years. Few recruits have entered the fishery since the early 1950's. The population of giant fish is expected to continue to decline to about 10% of current stock levels in the next 4-10 years even with management practices giving protection to juvenile fish and limiting catch.

Other matters - Underwater noises produced by an offshore oil drilling operation in the Bay of Fundy (Div 4X) were measured and ranges at which herring can probably detect the noises estimated: at the moderate ambient sea-noise level of -40 db, the noisiest operation may be detected at 74 km.

