

THIRD ANNUAL MEETING

Identification of Major Groundfish Stocks  
in Sub-area 4 of the Northwest Atlantic Convention Area

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Conservation of the groundfish fishery of the northwest Atlantic ocean is the primary purpose of the International Commission for the Northwest Atlantic Fisheries. Intelligent management of this large fishery will be based firstly on knowledge of the definition of the various groundfish stocks, their distribution and movements, and secondly on an understanding of the factors which determine the size of the catch which may be taken from these stocks. It is of particular interest to determine whether or not regulation of fishing may be expected to increase the long-term yield of any particular groundfish stock.

The development of a mesh regulation for haddock fishing in Sub-area 5 has been based on definition of the haddock stock and an assessment of the effect of fishing on its yield to the fishery. Similar information must be collected for the major cod, haddock, redfish and halibut stocks throughout the Convention area.

It is the purpose of this report to review, in summary form, the status of our knowledge of the principal groundfish stocks in Sub-area 4 as a basis for considering conservation requirements. Current investigations of the population dynamics of the various groundfish stocks will provide the basis for determining optimum fishing conditions and the relation of present fishing practices to an objective of "best use" of our groundfish resources. Such basic information as natural and fishing mortalities is not well understood but definition of groundfish stocks in Sub-area 4 has been studied for some 25 years and the results of investigations of the more important species (cod, haddock, redfish and halibut) may be described.

Cod

Cod is the most important groundfish species in Sub-area 4 with landings normally exceeding 200 million pounds (100,000 metric tons). The greatest part of the catch is landed in Canada and more than half of these landings are taken by inshore, small-boat fishermen. The cod is a cold-water species and its relative importance increases from south to north in Sub-area 4. Only about a quarter of the groundfish landings are cod at the mouth of the Bay of Fundy but cod make up more than 90% of the groundfish landed along the Gaspé coast and the north shore of the Gulf of St. Lawrence.

The deep-water Fundian Channel between Georges and Browns Banks and the still deeper Laurentian Channel between

St. Pierre Bank and Banquereau are barriers to the movement of cod. Except for occasional movements of individual cod across these channels we may consider that the cod populations along the Nova Scotian coast, in the western Gulf of St. Lawrence and on the Nova Scotian offshore banks are resident in Sub-area 4. The evidence is based on about 2,500 returns from some 22,000 cod tagged in Sub-area 4 and on vertebral counts on about 28,000 cod sampled throughout this "Maritime" fishing area. More recent observations on growth, year-class strength and infection with parasites support the results of pre-war tagging and vertebral-count investigations.

Within Sub-area 4 we find a great many cod populations which may be divided into a number of major stocks:

(1) Western Nova Scotia - Resident populations show restricted movement and do not mix with eastern or offshore cod. The number of vertebrae is low; about 10% are infected with cod-worms; growth rate is very rapid; total mortality is high with very few cod living more than seven years; and spawning is in April and May.

(2) Central Nova Scotia - Resident populations show very restricted movement. The majority are spring spawners with a vertebral count which is higher than that of western Nova Scotia but lower than that to the east and offshore. A population of fall-spawning cod with a low vertebral count is also found in the Halifax area.

(3) Eastern Nova Scotia - Populations show a movement offshore in winter and inshore in summer. Vertebral number is high and about 20% are infected with cod-worms. Growth rate is slower than that of western Nova Scotia cod and mortality is lower. Cod are not fully recruited to the fishery until they are about five years old and they are of little importance to the fishery beyond an age of 11 years.

(4) Western Cape Breton - The cod population along the western Cape Breton coast moves out of the Gulf of St. Lawrence in the autumn, winters just north of the offshore banks and returns around Cape North to the Cheticamp area again in the spring. Spawning has been observed in June and July.

(5) Offshore Nova Scotia - Both resident and migratory populations of cod are found on Nova Scotian offshore banks. Some appear to be resident on the banks all year round, others move in along the eastern Nova Scotian shore in summer months and still others move into Cape Breton and the Gulf of St. Lawrence as far as Gaspé for the summer. The cod on eastern banks show a greater tendency to migrate Gulfwards than those on the western banks. Western banks' fish spawn in early spring and eastern banks' fish in late spring. Vertebral number is high and cod-worm incidence low in offshore cod. Growth is slower than that of western Nova Scotia but faster than that of Gulf cod. Most fish are contributed to the fishery from five to 12 years of age. Offshore catches increase during winter months with concentration of fish in deeper water and offshore movement of cod from inshore waters and the Gulf.

(6) Southern Gulf of St. Lawrence - Populations in the Prince Edward Island area restrict their movements to the southern Gulf of St. Lawrence. Tag returns outside the Gulf are few, vertebral count is low and infection with cod-worms high. Growth is slow and cod contribute to the fishery for several years (ages four to fourteen). Spawning

is somewhat later in the Gulf (July-August) than on Nova Scotia grounds.

(7) Gaspé - Cod are abundant in the Gaspé area of the Gulf. Vertebral counts are higher than those of the southern Gulf and similar to those of Cape Breton and Nova Scotia offshore banks. Worm incidence is high with over 50% of the cod infected with the cod-worm. Growth rate is slow and fish as old as 15 years are common in the catches; the average age of cod in Gaspé landings is about eight years. Spawning occurs in late summer (August-September).

(8) Eastern Gulf of St. Lawrence - Cod populations on the Newfoundland side of the Gulf are quite distinct from those taken west of the Laurentian Channel. Tagging shows a migration out of the Gulf in winter and a return movement to the Gulf in spring. Vertebral counts are lower than those observed at Cape Breton. Large, old, slow-growing cod are taken from this eastern Gulf area.

(9) Northern Gulf of St. Lawrence - Slow-growing cod are found in the northern Gulf. They do not mix with those taken west of the Laurentian Channel.

To sum up, we find a great many populations of cod in Sub-area 4. In general, each major stock of cod remains distinct. Those off central and western Nova Scotia move relatively little. Those in the Gaspé and Prince Edward Island areas move greater distances but remain year-round in the Gulf. Cape Breton cod show a seasonal movement offshore in the autumn and Gulfwards in the spring. Resident offshore cod populations are augmented by migrating cod during late autumn and winter months. These migrating cod move inshore and into the Gulf along the Laurentian Channel during summer months. The populations along the Newfoundland shore and Quebec north shore of the Gulf of St. Lawrence are distinct from those taken west of the Laurentian Channel.

#### Haddock

Haddock landings from Sub-area 4 are smaller than those from Sub-area 5 but the relative abundance of haddock varies widely; landings reached a peak of 130 million pounds (60,000 metric tons) in 1930 and fell below 40 million pounds (18,000 metric tons) in 1942. Canada and United States fishermen share the catch about equally. Haddock are normally found in warmer water than cod and at more southerly latitudes. They are abundant all along the Nova Scotian coast in both inshore and offshore waters but landings from the Prince Edward Island, New Brunswick, Quebec and Newfoundland areas of the Gulf of St. Lawrence are very small.

Haddock are more restricted to bottom than cod and for this reason Sub-area 4 haddock are even more sharply separated from those in Sub-areas 3 and 5 than noted above for cod. Sub-area 5 haddock have a low vertebral count, a high growth rate and a high mortality rate, with few living beyond an age of seven years. Sub-area 3 haddock also have a low vertebral count but growth rate is low and older fish are caught. Relative strength of year-classes varies widely in haddock and it is of interest to note that the dominant year-classes differ in these three sub-areas. In recent years the landings have shown the following outstanding year-classes: 1942 in Sub-area 3, 1943 in Sub-area 4 and 1948 in Sub-area 5. The evidence based on some 25,000

vertebral counts, 14,000 tagged haddock and an intensive postwar program of sampling for sizes and ages of the commercial catch demonstrates clearly that Sub-area 4 haddock are distinct from the haddock of adjacent sub-areas except for some mixing with Sub-area 5 haddock in the Bay of Fundy area.

Investigations of the haddock in Sub-area 4 have shown a number of major haddock stocks:

(1) Northern Bay of Fundy - Haddock appear during summer months in this region. Their growth is rapid and tagging has demonstrated that they are related to the New England stock.

(2) Southern Bay of Fundy - The population off western Nova Scotia moves into the Bay of Fundy during summer months and away from the Bay in winter. Growth is slower than that of northern Bay of Fundy haddock. During the past few years the 1939, 1943 and 1945 year-classes have contributed a major part of the landings.

(3) Browns Bank - The slowest-growing haddock of Sub-area 4 are resident on Browns Bank. This population differs sharply from that of Georges Bank to the west and LaHave Bank to the east.

(4) Southwestern Nova Scotia - The haddock of this area are faster growing than those of Browns but slower growing than haddock taken from offshore and eastern Nova Scotia grounds. Tagging results show an eastward drift of large haddock from the area but most tag returns were taken from the area of tagging indicating a resident stock. The 1943 year-class dominated landings from 1947 through 1951. Western Nova Scotia haddock are heavier at any given length than those taken to the east.

(5) Eastern Nova Scotia - A population of fast-growing young haddock in this area shows seasonal offshore movement. Vertebral count is higher than that of western Nova Scotia. The 1943 year-class in particular and lately the 1947 brood have dominated landings during recent years.

(6) Cape Breton - The haddock of the southern Gulf of St. Lawrence are large, fast-growing fish which move out of the Gulf in the late autumn to return again in late spring. They winter on Nova Scotian offshore banks. These haddock move into the Gulf close to shore around Cape Breton with the oldest haddock moving first. These migratory haddock grow quickly (although more slowly than those of Sub-area 5) and they have the highest vertebral counts in the whole area.

(7) Offshore Nova Scotia - Resident populations of haddock with rapid growth and high vertebral counts are found offshore. During winter months these fish are joined by haddock from inshore Nova Scotia and the southern Gulf of St. Lawrence; the vertebral count appears to be somewhat higher at this season. The 1943, 1944, 1946 and 1947 year-classes have all contributed significantly to the landings from offshore banks during recent years.

There are, then, many populations of haddock in Sub-area 4. The haddock populations off western Nova Scotia differ from those found offshore and around eastern Nova Scotia by migrating less extensively, by growing more slowly, by weighing more for a given length, by showing differences

in the relative importance of year-classes and by having a lower vertebral count. The haddock populations of eastern Nova Scotia migrate seasonally, apparently to avoid the particularly low water temperatures which appear in this area during winter months.

### Redfish

Redfish landings from Sub-area 4 were small prior to 1945 but annual catches as high as 170 million pounds (77,000 metric tons) have been taken during recent years by United States trawlers. The Canadian catch is negligible.

The redfish of Sub-area 4 differ from those of adjacent sub-areas in growth, meristic counts and parasitization. The absence of the external parasite Sphyrion lumpi is a striking characteristic of Sub-area 4 redfish.

Within Sub-area 4 there are many isolated deep-water populations differing one from the other. Heavily exploited populations of small redfish are found off western Nova Scotia, central Nova Scotia and Cape Breton. Populations of large redfish have been found in deep water along the outer edge of Nova Scotian offshore banks and along the Laurentian Channel as far as Gaspé. Redfish appear to concentrate in tongues of deep water between the banks.

There are many gaps in our knowledge of redfish populations in Sub-area 4; their size and extent, their diurnal and seasonal movements and their life history. The validity of age reading is not well established and population dynamics are therefore not understood. Further investigations of these problems are required before it will be possible to describe Sub-area 4 redfish stocks in greater detail.

### Halibut

Annual halibut landings from Sub-area 4 average about four million pounds (2,000 metric tons) and most of the catch is taken in deep water off Nova Scotia. Catches are made close to shore off southwestern Nova Scotia and Anticosti but more are taken along the outer edge of offshore banks. Most of the Sub-area 4 halibut catch is landed in Canada. The halibut populations of Sub-area 4 do not cross the Fundian and Laurentian Channels; they are distinct from the halibut of other sub-areas.

Within Sub-area 4 investigations have shown a number of halibut populations, none of which move very extensively. There are seasonal movements, apparently related to changes in bottom temperature; halibut move inshore coincident with the warming of bottom waters.

The halibut found off south-western Nova Scotia differ from those of the northern Gulf of St. Lawrence in colouration, size and age composition and in growth. They have white or cherry-tinged, rather than grey, bellies; they are smaller and younger fish; and they grow more rapidly. Tagging has shown that even within this area the Roseway-LaHave halibut do not intermingle with those found to the west. German Bank halibut move east to the Cape Sable Island area in late summer and return west to deep water in winter where they spawn. There is a drift of some halibut to eastern grounds but no movement to the west.

The halibut of the Anticosti region of the Gulf of St. Lawrence are old, slow-growing greys. Tagging has shown very limited movement along the Laurentian Channel with none re-captured west of this Channel.

#### Summary

(1) All four of the important groundfish species of Sub-area 4 (cod, haddock, redfish and halibut) are, for management purposes, distinct from the stocks of adjacent sub-areas.

(2) Within each species we find a number of discrete stocks in Sub-area 4.

(3) Groundfish are taken both outside and inside the three-mile territorial limit and in each species we find that some populations are fished both offshore and inshore as they migrate from one area to another. Halibut move inshore at Cape Sable Island; cod and haddock move inshore at Cape Breton in spring and autumn months; and redfish may be taken close to shore off Digby Neck, Cape Breton and Gaspe.

(4) Bottom-living haddock and halibut stocks are more sharply divided by deep water channels than the more pelagic cod and redfish.

(5) The warmer-water species, haddock and halibut, are sensitive to very cold water; they move into shoal water during summer months and leave again before winter; they show more clearly defined migrations than the cold-water cod.

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