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CANADIAN RESEARCH IN SUB-AREA 4

Résumé of results and program

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Early seasonal or short-term work (Craigie, Duff, Battle, Needler, Huntsman) discovered a good bit of the general background of life history and distribution of our groundfish species. R. A. McKenzie and Vladykov were employed in the 30's in full-time investigations of cod and haddock. Work was interrupted by the war from 1940 to 1945 and re-established on a more vigorous level, especially as regards the statistical study of the fishery and of the stocks but also including further life history studies and work on fishing methods.

The hydrographic program in Sub-area 4 has shown a similar development, with concentration first in the Bay of Fundy area supplemented by expeditions as far as the Strait of Belle Isle. In recent years hydrographic investigations have been increased in co-operation with Navy and for the past two years the program has included quarterly hydrographic sections covering the Sub-area fairly well.

The investigations to date have thus revealed fairly well the life histories and growth rates of the principal species and given us a good deal of background knowledge of their principal movements and of the divisions of the stocks. It is, for example, clear that the groundfish stocks of Sub-area 4 are distinct from those in Sub-area 5 (off New England) and Sub-area 3 (off Newfoundland) except for some movement from Sub-area 3 to the west coast of Newfoundland. The problems of the Sub-area are thus somewhat distinct from those of the two neighbouring Sub-areas as regards the fish stocks themselves as well as the fisheries.

The following is a very brief summary of the sort of knowledge we now have on the principal groundfish species:

Cod

This is the most important species in Sub-area 4, where it is more than twice as important as haddock. This is contrasted with an even greater importance of cod in Sub-area 3 and the preponderant importance of haddock in Sub-area 5.

From variations in growth rates, vertebral counts, worm infestations and tagging, we know something of the division

of cod populations within the Sub-area. Although the distinctions are not necessarily sharp, the Gulf stocks are different from those outside and there is some difference between inshore and offshore stocks in spite of some wandering over the whole area. There is a seasonal outward movement of cod from the Gulf in the winter which, however, does not greatly affect the fishery, as these wormy cod are deliberately avoided, so that the fisheries based on Gulf and Scotian Shelf stocks are separate to a considerable degree.

Growth rates are known in various parts of the Sub-area, and age composition of the catches has been determined in a general way. Information is not sufficient to give a good measure of total mortality and no data are available on which to divide this into fishing and natural mortalities. Such information as we have for southwestern Nova Scotia suggests a total mortality and a growth similar to that of haddock on George's Bank, with apparently lower mortality rates and slower growth elsewhere in the Sub-area.

Changes in abundance are being followed by the collection of information on catch and catch per effort in a number of sub-divisions of the Sub-area. Such information is not available over a long term but has been obtained intensively since 1946. There has been a drop in catch and catch per effort of cod since 1946 with some indication of a higher total mortality rate now than then. Natural factors may, however, enter into this change as there has been an upward trend in temperatures for the past ten years.

Although the growth rate and total mortality off western Nova Scotia is similar to that of haddock in Sub-area 5, the cod enter the fishery at a higher age and there is very little wastage through capture and discard of small cod.

### Haddock

Haddock, although less important than cod in the Sub-area as a whole, do nevertheless support important United States and Canadian fisheries. Being restricted largely to the Scotian Shelf, with relatively small quantities in the southern Gulf, haddock have little importance in the Gulf, but outside their importance approaches that of cod (half in quantity but more than half in value).

There are similar local differences in the haddock stocks, the degree of separation being similar to that in the case of cod. The growth rate is lower than that in Sub-area 5 and the age when haddock enter the fishery higher. Data on mortalities are poor, being inadequate in the first place and confused by heavy fluctuations in abundance of year-classes. Total mortalities are, however, apparently lower than those in Sub-area 5 (perhaps 33% as against 44%). Fishing mortalities

are not known, but the slower growth and lower total mortality makes the case for restriction poorer than in Sub-area 5.

In contrast to cod, haddock have been increasing in abundance in recent years, the Canadian catch having a peak in 1951. The high abundance of haddock in the 30's, low in the early 40's and increasing abundance now may be associated with hydrographic changes. The upward trend of temperatures over the past ten years may be favourable to this more southern species than cod. The fluctuation in the abundance of broods appears to be greater than it is to the south.

Some observations have been made recently on wastage at sea. Relatively small quantities of small haddock are discarded in the winter months but quantities may be very high at other seasons.

The United States Fish and Wildlife Service has very extensive data on the United States haddock fishery in Sub-area 4, including catch and catch per effort data and measurements and scale samples of commercial catches. This material has not been fully digested, the United States investigators concentrating their attention mainly on Sub-area 5.

### Halibut

Our information on halibut stocks is sketchy. Growth rates are known at Anticosti and Clark's Harbour areas, being faster in the latter. Tagging at Anticosti, LaHave Bank and Brown's Bank showed little movement, LaHave stocks being distinct from those on Brown's. The peak catch in 1950 (11,000,000 lb.) resulted apparently from a diversion of fishing effort to halibut because of relatively good price, associated with declining abundance of cod and accumulated stocks of halibut as a result of little halibut fishing during the war years. Data on age composition, etc., are too sketchy to indicate mortality rates but the halibut are older than those on the Pacific.

### Redfish

There is hardly any Canadian redfish catch in Sub-area 4 and this species has not been investigated by us. The United States redfish catch in Sub-area 4 is considerably greater than the total haddock catch in the Sub-area and the potentialities of the fishery remain great for Canada as well as the United States. The United States Fish and Wildlife Service have catch data on redfish catches and populations in the Sub-area and a major redfish investigation in progress.

### The general Sub-area problem

Moving from Sub-area 5 to Sub-area 4 we move from a relatively simple to a more complex management problem. Hydrography, topography and fish stocks are more complicated in 4; haddock are still important, but cod already over-shadow them. Our scanty evidence indicates that fishing is somewhat less intense in 4 than in 5 and the fish generally slower-growing, making the immediate value of restrictions more doubtful. On the other hand, the fishery is probably more intense in 4 than in 3 where the catch per effort is greater and the cod and plaice are older.

Information on the fishery and on the populations of the major species is now being obtained more rapidly than in the past but there are some very serious gaps. Some of these, especially catch per effort data on the major species, and age sampling for haddock and redfish, might be filled by digestion of extensive United States data.

A great deal more effort is needed to obtain the information necessary to develop intelligent management if and when necessary. We need more information on such matters as fishing mortalities, the ages at which cod mature, with consequent effect on migration pattern, and other subjects which are essential to an understanding of the population dynamics. In general it may be said that our effort to follow catches, catch per effort and sizes and ages of the principal species are relatively good but that we need to expand our effort into other directions if the information we are now collecting is to have its full value.

### Program

Without attempting to outline a detailed program, the following points are made:

1. It is necessary to continue and improve the collection of statistics of catches and fishing effort and sampling of commercial catches for size and age. This now occupies a large proportion of the time of available field staff.
2. There is need for a greater effort in analysis of data already collected both here and in the United States. Work remains to be done here on data on tagging, vertebral counts, age compositions of stocks, etc. It is highly desirable to have the extensive United States haddock data analyzed.
3. We should follow the Canadian redfish fishery in Sub-area 4 when it develops, through collection of statistics and sampling of the stocks. There is, however, no immediate opportunity in view and the major work on this species must

be by the United States until the Canadian fishery develops.

4. It is planned to develop tagging with improved methods as a means of studying fishing mortality. Preliminary experiments are planned during the present year and the future volume of this work will depend on the effectiveness of the technique which is developed.

5. Additional information is needed in Sub-area 4 on the selectivity of the meshes of trawls and on the wastage of fish at sea. This problem is of more importance to the haddock than to the cod fishery but the conditions in Sub-area 4 differ so greatly from those in Sub-area 5 that information must be obtained in the former as a basis for possible regulations to reduce destruction of small haddock there.

To meet the needs of ICNAF in Sub-area 4 it will be necessary for the groundfish investigations there to be expanded with emphasis on cod rather than on haddock as in Sub-area 5.

