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Report of Regional Meeting of ICNAF Scientists
Woods Hole, Massachusetts, December 14-16, 1960

Dr. Graham acted as Chairman and J. L. Hart and J. B. Skerry as reporters. A list of participants is attached as Appendix I.

Sea Scallops

Merrill reported on the distribution and abundance of sea scallops in the area from Block Island to Cape Hatteras as determined by eight transects and supplementary drags made on recent surveys by the research vessel Delaware. This area, which lies south of the ICNAF Area, is a consistent producer with a 14-year average of about 3-3/4 million pounds. Scallops were found between 20-40 fathoms subject to bottom type and temperature. The positions of local concentrations is variable because of the transfer of larvae by along-shore currents in contrast to the closed circulation of Georges Bank.

Bourne reported on the Canadian scallop fishery and research. The Canadian fishery reached an all-time high in 1960, despite certain restrictions on fishing. The large landings were the consequence of a large year class of scallops on Georges Bank and fishing practices adapted to take advantage of it. Log books have been placed on all boats with reasonable success. On trips aboard commercial vessels large numbers (up to 30%) of clappers and dying shells were noted. Clappers persist for at least 100 days. A decrease in the fishery from present levels is forecast and a falling off in catch is already observed. Two Canadian boats that were equipped to use 4-inch rings for experimental work have continued to use this gear commercially. A study of scallop larvae is being undertaken at the St. Andrews Laboratory.

Posgay reported on the status of the U.S. scallop fishery and on research conducted by U.S. biologists. U.S. landings of sea scallop meats from Georges Bank from May 1959 through September 1960 have been largely assigned to the year class which was recruited to the fishery during 1959. This year class made up about 90 percent of the catch on the most heavily exploited ground. This ground, in the vicinity of 41°00'N., 67°30'W., yielded 13.4 million pounds of meats between April 1959 and September 1960, 42 percent of the total U.S. landings from Georges Bank during the same period.

Quantitative research vessel samples collected at one point within this area in May 1959 and May 1960 show that total abundance was reduced 85 percent during the year. During the same period landings per day spent on the grounds rose from about 2,200 pounds to about 3,600 pounds. It, therefore, appears that landings per day spent on the grounds cannot be used as a reliable index of abundance. Some of the increase in yield per unit of effort was caused by changes in fishing practices and the enlargement of crews which in effect increased the number of scallops which could be shucked per day but most of the increase was the result of growth. The average weight of meats realized from shucking 100 sea scallops rose from 3.4 pounds in July 1959 to 6.1 pounds in August 1960. This indicates the maximum potential benefit to be expected if the size at first capture were to be postponed one year. The natural mortality rate, measured by the clapper:live shell ratio was low; about 8 percent per year and the growth rate somewhat higher than the average for Georges Bank.

In a sedentary organism like the sea scallop, studies must be conducted in many scattered areas and over a period of time in order to obtain information pertinent to the fishing bank as a whole. Sufficient growth rate studies have now been made to provide a good

average picture for the entire bank. There are no great differences on the various important fishing grounds. Mortality rates are now available for some heavily fished areas and programs under way will provide information for other areas so that an average estimate will be available for the entire bank.

Cod

Martin opened discussions of the studies of the cod fishery in Division 4T.

Characteristics of the ICNAF cod fishery are changing in response to increased fishing pressure. Landings are increasing and abundance of large fish is decreasing. A comparison with the Northeast Atlantic indicates that further increases in fishing will produce still greater landings and still lower abundance of large fish.

The cod fishery of ICNAF Division 4T is changing rapidly. Increased otter trawling by Canadian and European fleets has doubled landings to about 100 thousand metric tons per year. Catch per unit of effort by Canadian draggers has been cut in half in 10 years and sizes of cod landed have decreased significantly (less than 2 percent of the fish caught are now over 70 cm. in length).

Jean reported on results of research vessel surveys since 1957. These show that natural factors such as recruitment, growth, and water temperature cause year-to-year variations but do not account for the downward trend in landings of cod per unit of effort in Division 4T in recent years. Smaller fish are being caught and a larger proportion of scrod are retained for landing. As a result, discards have remained at about the same level - 10 to 15 percent by numbers and 5 to 7 percent by weight - since the introduction of 4-1/2-inch mesh cod ends in 1957. No appreciable change in sizes of cod landed from Division 4T is anticipated for 1961.

Dickie reported on analysis of the Division 4T cod data for the period 1947 to 1958. Catch curves were prepared for the earlier and later parts of this study period. The data for the two different fisheries, otter trawl and hook and line, were analyzed separately. The analysis of the otter trawl data presented the classic picture of increased fishing pressure on the stocks. There has been a decrease in catch per unit of effort with an increased total catch, along with a decrease in the average size of fish landed and an apparent increase in total mortality.

These data have, however, inadequately represented the total stock, particularly in the earlier years when most of the catch was made by hook and line, which gear catches larger average sizes of fish. A preliminary analysis has been made of hook and line data. These data must be taken into account to assess effectively the full influence of the fishery on this stock of cod.

May reported on the results of tagging studies on the cod population which is line-fished in winter at Isle au Morts (Division 3PN). This fishery depends on fish which immigrate to the area from the Gulf of St. Lawrence (Division 4R) in autumn and return to the Gulf in May. The small stock remaining in the area during late spring and over the summer contains many spring migrants from Burgeo Bank (Division 3PN).

Haddock

Hodder reported on the status of the haddock fishery in Subarea 3. Since 1955, when the peak landing of haddock was 104 thousand tons, the decline in annual landings has been very rapid to 35 thousand tons in 1959 with Spain and Canada together taking approximately 90 percent of the total.

Research vessel surveys for the period 1951-1960 indicate that the haddock fishery has depended on the progression of dominant year classes through the fishery. The very abundant 1949 year class was largely responsible for the high level of the landings

during 1955 to 1957 - 90 percent by number in 1955, 78 percent in 1956, and 52 percent in 1957. In 1958 the dominant year class present in the landings was that of 1952 (47%), but the 1949 brood still contributed a very significant quantity (26% by number). By 1960, however, the landings were dominated by the 1955 year class. In view of the scarcity of large fish of year classes previous to 1955 and the evidence of no significant survival of year classes since that of 1955, it would appear that at the present level of fishing the annual landings must inevitably continue to decline and remain at a very low level unless strong year classes appear in the very near future. Discards dropped in 1958 with the use of 4-inch mesh cod ends but increased again in 1960 with the appearance in catches of the 1955 year class.

McCracken reported research on haddock in Subarea 4. Examination of Subarea 4 haddock landings and recent haddock survey results showed relatively stable landings now taken largely by otter trawlers. Decreased size composition of landings reflected acceptance of smaller size by industry; decrease in numbers of large fish; and recruitment of relatively large year classes. Average size at age for haddock has decreased between 1948-1959 and evidence suggests a decrease in growth rate. Research vessel haddock catches show poor recruitment of 1958 and 1959 year classes and suggest decreased landings in the immediate future.

Dickie reported on mortality studies of Division 4V and Division 4W haddock. Data for this fishery from 1947 to 1958 show that despite the progressively slower growth rate, catch per unit effort has increased. This is associated with the acceptance of smaller haddock by the market and recruitment of the strong 1952 year class in 1956 and 1957; effects which have led to a general increase in total landings, despite an apparent small drop in fishing effort. Mortality estimates have been compared with effort levels, and while the results suggest some effects of fishing, the correlation between them is very low. Some further studies directed at partial explanation of this variability are contemplated.

Skerry reported on young-of-the-year haddock surveys in the Gulf of Maine and Georges Bank for the years 1958, 1959, and 1960. These surveys based on 30-minute tows indicate that young haddock inhabit nearly the same areas from year to year but in varying numbers. No significant environmental changes were noted. The number of young-of-the-year taken per tow in the area were 18.8 in 1958, 16.5 in 1959, and 3.9 in 1960. It is expected that fair to good scrod catches will be landed in 1961, but the landings of scrod in 1962 will be poor.

Jensen reported on the Subarea 5 haddock fishery. Around 1950 the fishery changed from one for large haddock to scrod. The fishery reached an all-time general low in 1959. Recently, the situation has improved with increasing scrod landings as a result of the large 1958 year class. This year class is expected to maintain the fishery for at least another year.

Effects of Environment

Brunel reported on vertical distribution of cod in relation to food organisms. Six trawl hauls of 1-hour duration were made at the same locality, in a rather constant hydrographic and benthic environment, over a 24-hour period, twice a month from May 19 to August 29, 1960. There was no clear-cut difference between day and night in cod food, i.e. in the proportion of pelagic and benthic prey and in the frequency and abundance of these preys. But, at least twice as many codfish were caught at night as in the day on July 25 and after, and small (31-50 cm) cod were less abundant at night than medium-size (51-70 cm) cod in July, suggesting vertical migrations of the diurnal type. Correlations between cod catch and proportion of benthic prey to pelagic prey in the stomachs in June suggest another type of "feeding vertical migrations" of limited extent in depth, unrelated to day and night, when cod feed heavily on euphausiids in the absence of herring. A similar correlation on August 29 must be attributed to herring, which is also the only pelagic prey in the stomachs at other dates where correlations are only partial or absent. Herring would also attract cod to pelagic feeding, but the pattern is much less clear than for

euphausiids. Small cod appear to feed more exclusively on bottom prey than medium-size cod.

Marak reported on the drift of cod eggs and larvae from the spawning area on the northern edge of Georges Bank. These studies based on surveys made in 1953, 1954, and 1956 show that spawning areas can be deduced from plankton surveys and that there is some indication of a relation between drift pattern and strength of year class.

Jensen reviewed research results on Subarea 5 cod with emphasis on the division of the stock into four recognizable divisions.

A subcommittee to make suggestions to North American representatives at the forthcoming meeting on environmental studies submitted the report attached as Appendix II.

Yves Jean of the St. Andrews Laboratory, A. May of the St.John's Laboratory and A. Jensen of the Woods Hole Laboratory met to standardize methods of preparing charts presenting data on cod biology in their respective areas.

Cooperative Haddock Program

Biologists of the St. Andrews Laboratory and the Woods Hole Laboratory reviewed the cooperative program for Subarea 4 haddock. It was noted that the exchange of interview data and otoliths is continuing satisfactorily and that the U.S. will presently have a report on changes in the Division 4X haddock populations resulting from the use of these data. Since the Canadian fishery in this division is changing from a line trawl fishery to an otter trawl fishery, Canada will sample the otter trawl landings as well as the line trawl landings.

Assessment Working Group

Beverton gave a report outlining the progress made during two days of special meetings preceding the general session.

For the meeting to be held in Lowestoft in March 1961, it was decided to take as first priority the preparation of a final report covering essentially the scope of the Progress Report submitted to the Bergen meeting, i.e. assessment of effort of various mesh sizes at current effort levels. Fresh data are now available for several fisheries and plans were made to use corresponding assessments to be revised in readings for consideration at the Lowestoft meeting. Arrangements were also made for the preparation of tables and data for inclusion in the final report.

Attention was given to the remaining tasks set to the Working Group, in particular, that of assessing the effect of mesh increase at fishing intensities other than those operative at the present time. A method was presented for making such assessments from length composition data which has the advantage that the assessment of mesh size can be made in the same way for any postulated level of effort. It is hoped to use an electronic computer for the rather lengthy calculations involved. If the results are available in time for the March meeting they will be incorporated in the final report; otherwise, they will be made the subject of a separate statement to the Research and Statistics Committee in June.

Evening Lecture

Dr. Paul Galtsoff gave an evening lecture on "The Concept of Prosperity in Marine Ecology," an abstract of which is attached as Appendix III.

Small Haddock Problem

Edwards reported on small haddock taken by the specialized silver hake, industrial, and animal food fisheries which have grown by more than twentyfold since 1950. The

three fisheries have taken some 9 million pounds or 17 million haddock in three years. This represents a potential loss of some 34 million pounds of haddock available for food fisheries. Experimental fishing indicates that part of the haddock captured could be avoided. The effects of possible minimum size regulation and seasonal closure of nursery grounds is being studied.

Resource Management

Brackett reported on enforcement. Exemption provisions are realistic but the special small gear vessels provide enforcement problems because, among other things, it is difficult to establish the source of fish as within the area of Federal jurisdiction. Minimum size limits at 15 inches associated with exemption provisions should be considered. This would be partly self-enforcing. Preliminary approaches to arranging complementary state regulations are promising.

McCracken aired Canadian problems in enforcement. There is no evidence from fish size of mesh regulation infractions. The application of chafing gear can impair the effects of mesh regulation and in some areas it is not properly used.

Martin pointed out that scientists should be well informed on the variability of mesh sizes and types of twine in cod ends, use of chafing gear, and discards at sea. This is essential background for mesh assessment studies. It was agreed that scientists must advise Commissioners on regulation problems, but they should not be involved in actual enforcement problems.

Beverton discussed European experience with gears down to half-inch and the various dilemmas involved. The Northeast Atlantic Fisheries Convention will go beyond mesh size and fish size to include recognizing nursery areas and other additional controls. Size limits serve two purposes: (1) as an adjunct to mesh size, and (2) to disentangle mixed fisheries. The minimum size should be set at the 50-percent point. Fisherman reaction must be considered and anticipated if possible. To meet the need we must know current catches and practices. Study must be given to how the fisherman can accommodate to conform to new regulations. Flappers as chafers do not affect selectivity. He wondered whether chafers are really necessary. There is an international enforcement officer who reviews enforcement procedures upon invitation.

APPENDIX I

List of Participants

CANADA

St. Andrews

Dr.J.L.Hart
Dr.W.R.Martin
Dr.F.D.McCracken
Dr. Neil Bourne
Dr.L.M.Lauzier
Dr. Yves Jean
Dr.L.M.Dickie

St.John's

Dr. W. Templeman
Mr.V.M.Hodder
Mr.A.W.May

Station de Biologie Marine, Grande-Riviere, Quebec

Mr. P. Brunel

UNITED STATES

USFWS, Washington, D.C.

Mr. R. Silliman

Office of Statistical Services, Gloucester

Mr.L.H.Couture

Resource Management

Mr. L. Brackett

Office of Naval Research

Mr.M.C.McLean

Woods Hole Oceanographic Institution

Mr. D. Bumpus
Mr. M. Howe

Woods Hole Biological Laboratory

Dr.H.W.Graham, Chairman
Dr.R.L.Edwards
Dr.P.S.Galtsoff
Dr.J.A.McCann
Mr.J.B.Skerry
Mr.J.A.Posgay
Mr.A.S.Merrill
Mr.R.C.Hennemuth
Mr.G.F.Kelly
Mr.A.C.Jensen
Mr.R.R.Marak
Mr.W.H.Callahan
Mr.H.W.Jensen
Mr.L.R.Porter, Jr.
Mr.P.H.Chase, Jr.
Mr. R. Livingstone, Jr.
Mr.R.N.Hersey
Mr.S.R.Nickerson
Mr.C.L.Wheeler
Mr.J.R.Donovan
Mr.R.L.Fritz
Mr.J.P.McDermott

ICNAF Headquarters

Dr.E.M.Poulsen
Mr.F.R.Thomas

UNITED KINGDOM

Fisheries Laboratory, Lowestoft

Mr.R.J.H.Beverton

APPENDIX II

Meeting of ad hoc Committee

Environmental Studies

Attended by Lauzier (Chairman), Beverton, Brunel, Bumpus, Edwards, Graham, Hart, Martin, McLean, Poulsen and Templeman.

Lauzier, and then Graham, reviewed guidelines and directives to the Committee. The results of the Moscow meeting were reported by Lauzier.

McLean and Graham reported on the new National Oceanographic Data Center. Considerable discussion ensued about the purposes of the environmental studies committee. The consensus was that Graham and Lauzier carry two general ideas to the March meeting in Aberdeen, as follows: 1. That priority be given to the symposium, planned around a program decided on by the full committee. Careful planning of the symposium along specific lines is urged. To further the purposes of this discussion, the committee members will obtain from their respective groups a list of suggested appropriate topics on which reports may be given at the symposium. It was suggested that convenors for the symposium might well be appointed at the March meeting. It was further recommended that the committee consider inviting participants from outside the ICNAF area should such action be considered desirable. 2. That active long-term planning of work be postponed until after the symposium.

It was also the consensus that this symposium should not be planned to take place before 1963.

The two delegates were further requested to obtain inventories of available pertinent hydrographic and biological data for the March meeting.

A considerable body of opinion was expressed about the primacy of environmental problems. There is a need for adequate, consistent long-term hydrographic information to serve two purposes: 1. As a basis for short and long term prediction of hydrographic trends and, 2. as a basis for the evaluation of year-to-year changes in hydrographic conditions as significant causal factors in the well-being of fish populations.

APPENDIX III

The Concept of Prosperity in Marine Ecology

by Paul S. Galtsoff

ABSTRACT

The concept of prosperity, developed primarily by French marine ecologists, implies the flourishing condition and vigor of marine communities. High productivity of principal fisheries resources is found in these communities of predominantly one or few species. Prosperity means not only numerical abundance, but also great fertility, high rate of growth, low natural mortality and general healthy condition of a population. Only a few marine species form prosperous associations. The following outstanding examples may be listed: periodic blooms of diatom Aulacodiscus; Red tide caused by Gymodinium; clam banks of the North Sea; underwater fields of eel grass, Pyllophora, Cystosira and floating kelp; scallop grounds of Georges Bank and of the western coast of Europe; oyster and pearl oyster banks; populations of limpets and other gastropods; marine birds' rookeries; and aggregations of fur seals on Pribilof and other islands of the Pacific.

Conditions determining prosperity of aquatic forms may be evaluated for those few species the physiology of which has been sufficiently studied. The evaluation is based on general principles formulated by Mitcherlich in his elaboration of the Liebig's law of the minimum.

In the majority of marine bottom communities several positive and negative factors control prosperity. The positive factors are the character of the bottom, temperature, water quality, water movements, and food. The negative factors are: sedimentation, competition, enemies, disease and parasitism, and pollution. The efficiency of each factor is evaluated from 1, for marginal condition, to 10 representing an optimum. The absence of a negative factor is given a value of 10 and its highest effect in reducing the population is designated as 1. By taking separately a sum total of + and - factors and multiplying the two sums the effect of principal ecological conditions on a population is represented as a score with the lowest value of 25 and the highest of 2500. The application of this method to oyster grounds of New England gives satisfactory results.