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ANNUAL MEETING - JUNE 1969

Informal Meeting of ICNAF Advisers on Cooperative Research in Subarea 5  
and Adjacent Waters  
Boothbay Harbour, Maine, 9-12 December 1968





Serial No. 2142  
(B.f.3)

P.O. Box 638  
Dartmouth, N.S., Canada

21 January 1969

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1. In accordance with decisions of the 1968 meetings of Panel 5 and Scientific Advisers to Panel 5, Dr H.W.Graham (USA) convened an informal *ad hoc* meeting of ICNAF scientists interested in the cooperative research program being carried out in Subarea 5 and adjacent waters.
2. The meeting was held at the laboratory of the US Bureau of Commercial Fisheries, Boothbay Harbour, Maine from 9-12 December 1968 under the chairmanship of Dr H.W.Graham (USA). Mr L.R.Day (ICNAF) acted as rapporteur. The agenda consisted of seven items for discussion and is attached as Appendix I. A list of meeting participants is Appendix II.
3. Mr B. Skud, Director of the Boothbay Harbour Laboratory, welcomed the participants. The Chairman drew attention to the cooperative research projects in plankton, groundfish and herring and the need for detailed discussion and review of these projects. He pointed out that travel limitations prevented the attendance of Canadian herring scientists. It was agreed that discussion of Item 1 "Review and coordination of herring research..." would be left for consideration by Canadian and US herring scientists later in the month at the St. Andrews Biological Station. Pertinent recommendations from the subsequent herring meeting held at Fisheries Research Board, St. Andrews, 19 December 1968 are attached as Appendix III.

Groundfish Surveys on Nova Scotia and Georges Bank

4. Dr Grosslein (BCF, Woods Hole) reported on the groundfish surveys carried out by BCF, Woods Hole. Otter trawl surveys of the Shelf (15-200 fm) from Hudson Canyon to western Nova Scotia, have been conducted at least once a year since 1963, with the principal objective of obtaining quantitative indices of fish abundance to help assess effects of exploitation and determine environmental factors controlling fish distribution. The survey area was extended south to Cape Hatteras in 1967 (total survey area now approximately 75,000 square miles) and is now covered twice a year, spring and fall.

The distribution of stations is accomplished by means of a stratified random sampling design which seems ideally suited for this type of survey. An important characteristic of the design is that valid estimates of sampling error are possible.

Surveys to date have provided new information on distribution of fish in relation to temperature, generated predictive indices of year-class strength particularly for haddock, given independent (of commercial statistics) estimates of stock size changes which at first look for Georges Bank haddock appears to reflect recent major changes in exploitation, and in general provided quantitative data on relative structure of the entire groundfish community. Dr Grosslein concluded with the hope that joint effort could be developed in obtaining indices of abundance by the use of acoustic gear.

5. Dr Halliday (FRB, St. Andrews) reported that plans were being made to set up a survey program in ICNAF Div.4VW in 1969, similar to the US groundfish survey program.
6. Dr Scott (FRB, St. Andrews) reported on work on underexploited species in Subarea 4. There is a growing interest in fishes which are of potential economic importance but which are not exploited at present. In the Canadian fisheries, three obvious examples are silver hake, argentines and sand lance. The first two are being fished by the USSR and can no longer be regarded as unexploited - silver hake in particular may have been overfished.

The sand lance (*Ammodytes dubius*) is virtually untouched and recent exploratory fishing trials by the Nova Scotian Fisheries Department have revealed large concentrations of the fish in the Browns Bank area. They also occur over the rest of the Nova Scotia banks in shallow water. The stock appears to consist of a number of separate populations in which there are differences in mean lengths-at-age and otolith size and pattern among other things. They are winter spawners (November-January) and appear to remain on the banks throughout the year. They form a major constituent in the diet of the larger cod on the banks.

7. Subsequent discussion of the various contributions disclosed that some participants were interested in more and detailed discussion of the techniques and requirements for joint research projects. To satisfy the need, three Working Groups were set up as follows: (1) a Groundfish Survey Working Group; (2) a Plankton Working Group and (3) a Benthos Working Group. These groups met concurrently on 10 December. Short reports by the Working Groups are included as Sections 23, 24 and 25.

#### Review of Sample Data and Exchange for Div.4X and Subarea 5 Commercial Groundfish Landings

8. Mr Stern (BCF, Woods Hole) reviewed US large and scrod haddock landings and landings per day from 1962-1967 from Georges and Browns Banks. US commercial landings during 1968 have shown the effect of drastically reduced recruitment since the 1963 year-class. Georges Bank landings through the third quarter were 45.5 million pounds, off 20.7 million from 1967. Scrod landings were off 24 million pounds whereas large haddock were up 3.2 million. Browns Bank (SA 42) landings were similar to 1967 with 4.9 million lbs being landed. Bay of Fundy (SA 41) landings amounted to 3.8 million pounds.

Scrod landings per day indexes for Georges Bank have shown a downward trend since 1966 when the 1963 year-class passed into the large haddock category. Annual landings per day for large haddock on Georges Bank have not decreased over the last several years.

Estimates of numbers of fish at age on Georges Bank (from US commercial samples) have clearly shown the dominance of the 1963 year-class. Data from the Canadian otolith exchange program were presented for the years 1962-1965. Canadian age samples from SA 41 and 42 agree well with US samples of numbers at age. Critical analysis of this data will wait until the samples from 1966 and 1967 have been processed.

9. Dr Kohler (FRB, St. Andrews) expressed interest in the exchange of length and age data under the Canadian-US cooperative 4X and 5 haddock program, also in the spawning time and fecundity of 4X haddock and the size and age of cod taken as a by-catch in the fishery for haddock. It was agreed these items would be discussed by the Groundfish Survey Working Group.

#### Review and Coordination of Plankton Research

10. Mr Posgay (BCF, Woods Hole) reviewed the plankton sampling program conducted by the Woods Hole Laboratory. Conventional bridled plankton nets have been compared with Bongo nets and Bongo nets with the Gulf III sampler. All of the experiments show that the Bongo nets catch more per unit volume filtered than either of the other types.

A series of experiments have been conducted with Bongo nets to measure the effects of mouth area, speed of tow, length of tow, and mesh size on the catch of fish eggs and larvae. None of these have any significant effect except the interaction of speed and mesh size. Some of the smaller larvae and those eggs which are just a bit larger than the mesh size are apparently extruded through the meshes at 6 knots but not at 3 knots. He also reported that in the spring of 1969 a US-USSR cooperative grid vs random sampling egg and larvae survey program was to be set up to provide a comparison of the two sampling designs.

11. Dr Kohler (FRB, St. Andrews) then reviewed Canadian work carried out in the southern Gulf of St. Lawrence (Div.4T) on the distribution of fish eggs and larvae. Reduction of size and age composition of commercial catches of groundfish in the southern Gulf of St. Lawrence led to investigation into factors affecting recruitment to the stocks. For this reason, bottom surveys with small-meshed otter trawls have been carried out since 1958. These surveys capture fish of one year of age and older. Investigation of the earlier life history of these species required towing for them with a variety of plankton nets. Concentrated work on

dependent on particle density. Rosenthal and Hempel (Federal Republic of Germany) found that herring larvae feeding on copepod nauplii could not feed when nauplii were reduced below a critical level; that, in the first month of life, the herring larvae catch only 10% of the nauplii that they sight, whereas in the second month of life they catch 90%. Their work pointed to a critical feeding period during the early post yolk-sac stage.

Lasker (USA) worked out an energy budget for the California sardine population and estimated that during years of peak abundance, the sardine energy requirement amounted to one-fifth of the total primary production of the occupied California Current. The demise of this species, caused by several poor years of recruitment and perhaps overfishing of the spawning stock, must have released large quantities of food-energy, some of which is presently being utilized by the anchovy.

There was considerable interest in transfer efficiencies between trophic levels. Gulland (FAO) said that ultimate productivity estimates for fisheries for many areas were being made partially on the basis of energy transfer coefficients. He said that transfers seem to be made more efficiently in the higher latitudes of discontinuous production than for the continuous productivity areas of the tropics. There was some contention about whether or not efficiency of energy transfer would be expected to be maximized in a natural production system. There was evidence from Reeve (USA), Bill Odum (USA) and also from H.T. Odum (1956) that production and efficiency in thermo-dynamic systems are inversely related. It was felt that natural systems tend toward maximum production which would indicate that low efficiencies would be expected. Tyler's personal inclination was that species under competitive existence are interested in taking as much of a food resource away from a competitor as possible, and so they would evolve to maximize food intake. It has been shown that digestion efficiency decreases with increase in ingestion rate.

It seems clear that the most significant contributions in food-web ecology are going to come from (and are already coming from) groups of ecologists working on small geographic localities, for only in this way can a composite picture of a natural production system be developed. However, there is a great need for lab work on bioenergetics of key species, namely those that are widely distributed, abundant, and which form a part in major energy transfer pathways that can be exploited by man.

One of the fudge-factor areas in food web ecology appears to be in the estimates made of energy dissipated as heat through respiration. Lasker (USA) estimated that 90% of the energy intake in the Pacific sardine was lost in respiration. He had no measurements of fish activity in the field but guessed that the fish spent half of the time in an active feeding state and half of the time cruising and applied his laboratory respiration data accordingly. Birkett (UK) estimated that 65% of the plaice's energy income goes to respiration. He assumed that his fish were living at three times the resting metabolic rate - an estimate presumably based on Winberg's work. It is interesting that workers dealing with the energetics of invertebrates have ignored activity level altogether in their energy budget estimates.

It is well known among fish physiologists that maximum change in activity level can bring about a 5- to 10-fold increase in respiration rate, depending on the species.

#### Consideration of Benthic Studies

15. Dr Wigley (BCF, Woods Hole) said that the major objectives of his benthic research are (1) composition of the benthos, (2) quantitative geographic distribution of major taxa of benthic invertebrates and (3) geographic distributions of species of benthic invertebrates.

The fauna is composed mainly of four major taxa: crustaceans, mollusks, echinoderms and polychaete worms. The diet of groundfish is composed largely of the same taxonomic groups that are abundant in the benthos standing crop.

Very little is known about production rates of offshore temperate benthos communities. Published reports indicate that production may be of the order between 0.7 and 3.0 times the standing crop. In Div. 52, the standing crop of benthic animals is approximately 2,100 pounds per acre (wet weight). Following the scheme outlined by Dr J. Petersen (1918), a very large part of the production is made up of organisms which are not useful as food for groundfish. The calculated values

fish eggs and larvae in the southern Gulf started in 1965 and has been carried on up to this date. Data on distribution of fish eggs and larvae, on stages of development of the eggs, on drift of surface water, on numbers of deformed eggs and on temperature changes in the southern Gulf have been gathered since 1965.

Relative importance of the various factors affecting the survival of fish eggs and larvae in the southern Gulf has yet to be assigned. However, it is apparent that time of disappearance of ice cover, water temperatures, relative surface drift from year to year, effect of damage or deformity to young eggs, relative number of eggs spawned, and availability of food for larval fish are all important factors. Continued studies will emphasize detailed work on depth distribution, larval food studies and mortality rates. Abundance of eggs and larvae is being related to sizes of year-classes of commercial fish and of fish caught in research vessel survey operations. In addition, related fecundity studies are being carried out in the southern Gulf of St. Lawrence.

12. The Chairman, in response to a preliminary indication from the Canadian data that egg and larval surveys may be of doubtful value for forecasting and predicting purposes because egg and larval catches seem to bear little relation to each other for some species, said that the US egg and larval studies were not for forecasting purposes but to learn more about the processes of recruitment. Year-class strengths were determined at 6 mos (young-of-the-year) in the US groundfish surveys. He emphasized that there was a major need for more manpower or a major breakthrough in handling the great bulk of plankton material sampled.

13. Mr Marak (BCF, Woods Hole) reported on US work on haddock spawning in the Georges Bank area. In 1968, peak haddock egg production occurred on Georges Bank in mid-April. This curve was established by two sampling methods. Examinations of gonads of haddock collected by the commercial fishing fleet and of haddock eggs caught in plankton tows taken by the R/V *Albatross IV* were made from February to June. The gonad studies were conducted by Robert Livingstone and the plankton studies by Marak. The average temperature during the peak of production was 3.6°C. When these data are compared to work done by Clark in 1940 and 1941, it was found quite similar.

#### Review of Food Chain Symposium Results and Possible New Research

14. Dr Tyler (FRB, St. Andrews), who participated in the Marine Food Chain Symposium held at Aarhus, Denmark from 23-26 July 1968, reviewed the contributions to the Symposium. He said they presented information in three categories - determination of the pathways of energy flow, determination of the magnitudes of energy flow along various pathways and the fate of energy after entering a trophic level. Several speakers had pointed out that production at the higher trophic levels in the sea is often dependent on organic materials coming off the land. Zatsepin (USSR) reported in his written brief that biomass of benthic fauna in the Barents Sea decreased with distance from the land. Much of the organic addition is apparently detritus and soluble large molecular compounds. Finenko (USSR) showed that detritus particles formed an interface for the precipitation of the large molecule polypeptides and polysaccharides and that these particles were subsequently important sites of bacterial development. McIntyre, Munro and Steele (UK) showed that sea water filtrates could support a thriving meiofauna population in columns of sand. Bacteria were abundant in the columns but not protozoa. Presumably compounds in the filtrate supported the large bacteria population which in turn supported the meiofauna. Zatsepin (USSR) and also Nelson Marshall (USA) showed that filter feeders were the dominant in-fauna producers in inshore waters. Zatsepin went on to point out that swallowers were the dominant producers of the in-fauna in offshore regions of the Barents Sea.

Birkett (UK) has worked out rates of transfer between the bivalve *Macra* and its chief predators, plaice and starfish. Ralph, Edwards and Steele (UK) have described rates of transfer of energy between the bivalve *Tellina* and the plaice. (He thought that their paper was particularly interesting. They found that the rate of siphon regeneration of the *Tellina* population could supply a maintenance ration for the plaice stock in a beach area in Loch Ewe. But the plaice ceased to feed on *Tellina* when the bivalve density dropped to a low point. Then the *Tellina* which had not reproduced for three years while their siphons were under heavy predation, began gonad development )

In the plankton department, Mullin and Brooks (USA) reported an energy budget for two California copepods. Parsons and LeBrasseur (Canada) showed size selection of food particles with copepods and also reported that rates of feeding of copepods were

of groundfish foods for the 5Z area correspond closely with groundfish production in 1960, a period of moderate catch and stable groundfish standing crop.

16. Dr Tyler (FRB, St. Andrews) reported on his studies of the division of food resources in a community of marine, demersal fish in Passamaquoddy Bay, New Brunswick. The community was made up of four groups of fish: those present throughout the year, those present in summer only, those present in winter only, and those that were rare and appeared to be present only occasionally. Three species, *Raja radiata* (thorny skate), *Raja erinacea* (little skate), and *Urophycis tenuis*, could each be divided by body size into two feeding groups or stanzas. Eleven other species did not show feeding heterogeneities by body size for the size ranges sampled. These species were all heterogeneous with respect to one another and so each constituted one feeding stanza. The seventeen feeding stanzas partitioned the food environment among themselves by species of prey largely according to where the prey species lived with respect to the substrate-surface, and also according to body size of the prey species and body covering of the prey species. The partitioning became more severe when prey species decreased in abundance. There is evidence that young American plaice (*Hippoglossoides platessoides*) and long-horn sculpin (*Myoxocephalus octodecempinosus*), as well as most of the fish that occur on the Passamaquoddy station in summer only, are chiefly dependent on super-abundance of *Meganyctiphanes norvegica* for their food energy.

#### Consideration of Temperature Trends and their Possible Effects

17. Mr Welch (BCF, Boothbay Harbour) reported that surface sea water temperatures at Boothbay Harbour for 1968 are running warmer than those for 1967. The mean for the first 11 months is 0.8°C higher than for the comparable period of 1967.

Long-range predictions of Dr Hurd Willett of Massachusetts Institute of Technology, based on two solar cycles of 80-90 years and 20 years, indicate that warming should now take place with a peak in the mid- to late '70's (not as high as in the mid-50's) then a decline to a point lower than 1967 by the mid- to late '80's.

Green crabs (*Carcinus maenas*) which became abundant as far northeast as Nova Scotia in the mid-50's, have declined in abundance, coincident with the decline in temperature. They are now rare in Canada and eastern Maine, only locally common in central Maine, and still abundant in southwestern Maine and northern Massachusetts. Capelin (*Mallotus villosus*), a cold water species, was abundant in the Passamaquoddy Bay area in the 1966-68 period.

18. Mr Colton (BCF, Woods Hole) reported that temperature trends in offshore waters at the surface and subsurface paralleled trends observed at coastal stations. 1968 offshore data indicate an end to the current cooling period and an association of this change with slope water and coastal water distribution along the Continental Slope. Changes in the distribution patterns of various groundfish species appear to be regulated in part by temperature conditions.

19. Mr Chase (Woods Hole Oceanographic Institution) reviewed temperature data for air at Boston, Mass. and New Haven, Connecticut, in winter for surface water at Boothbay Harbour for the months of August and February and for the year and for surface water in all months at Portland, Boston, Nantucket Lightships and at Woods Hole. These data are published in ICNAF Redbook 1967, Part IV, p.37-41. They show that sea temperature trends, in the main, follow air temperature trends and that New England temperatures have had similar trends to those shown for other areas in the North Atlantic.

20. Dr Graham (BCF, Boothbay Harbour) reported on the circulation in inshore waters along the coast of the Gulf of Maine. Upwelling was the most prominent feature. As described by Lauzier (1967) for the Canadian Atlantic shelf, water was carried parallel to or offshore from the coast at the surface with a compensatory movement inshore along the bottom. Exceptions to upwelling occurred when 1) surface water moved inshore along a dynamic gradient within the eastern sector of the coast, 2) winds, dynamic topography at the surface and bottom topography directed surface drift shoreward within the central and western portions of the coast, and 3) bottom water at times moved parallel with the coast.

21. Dr McCracken (FRB, St. Andrews) reported on the Canadian oceanographic-plankton project in the Bay of Fundy and eastern Gulf of Maine which was being carried out by Dr L. Lauzier and Dr B. Barrett (FRB, St. Andrews). He stated the purpose of the project was (1) to study seasonal variations of non-tidal drift at surface and





APPENDIX I

MEETING OF ICNAF ADVISERS

Boothbay Harbor, Maine

9-12 December 1968

ITEMS FOR DISCUSSION

1. Review and coordination of herring research including problems in age and growth.
2. Groundfish surveys on Nova Scotian and Georges Bank.
3. Review of sample data and exchange for 4X and 5 commercial groundfish landings.
4. Review of Food Chain Symposium results and how they may add direction to new research.
5. Review and coordination of plankton research. Consideration of possibilities for forecasting recruitment. Food habits of juvenile fish.
6. Further consideration of the food web. Studies of benthic organisms.
7. Temperature trends in the area of concern, and other hydrographic matters.



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Boothbay Harbour, Maine, 9-12 December 1968

Participants

CANADA

Dr R.G.Halliday, Fisheries Research Board of Canada, St. Andrews, N.B.  
Dr A.C.Kohler, Fisheries Research Board of Canada, St. Andrews, N.B.  
Dr F.D.McCracken, Fisheries Research Board of Canada, St. Andrews, N.B.  
Mr A.T.Pinhorn, Fisheries Research Board of Canada, St. John's, Newfoundland  
Mr T.K.Pitt, Fisheries Research Board of Canada, St. John's, Newfoundland  
Dr J.S.Scott, Fisheries Research Board of Canada, St. Andrews, N.B.  
Dr G.F.M.Smith, Fisheries Research Board of Canada, Ottawa, Ontario  
Dr A. Tyler, Fisheries Research Board of Canada, St. Andrews, N.B.

USA

Mr J. Chase, Woods Hole Oceanographic Institution, Woods Hole, Mass.  
Mr J.B.Colton, Bureau of Commercial Fisheries, Woods Hole, Mass.  
Dr H.W.Graham, Bureau of Commercial Fisheries, Woods Hole, Mass. (Chairman)  
Dr J. Graham, Bureau of Commercial Fisheries, Boothbay Harbour, Maine  
Dr M. Grosslein, Bureau of Commercial Fisheries, Woods Hole, Mass.  
Mr R. Hennemuth, Bureau of Commercial Fisheries, Woods Hole, Mass.  
Mr R. Marak, Bureau of Commercial Fisheries, Woods Hole, Mass.  
Mr J.A.Posgay, Bureau of Commercial Fisheries, Woods Hole, Mass.  
Dr G.J.Ridgway, Bureau of Commercial Fisheries, Boothbay Harbour, Maine  
Mr H. Stern, Bureau of Commercial Fisheries, Woods Hole, Mass.  
Mr A. Stickney, Bureau of Commercial Fisheries, Boothbay Harbour, Maine  
Mr B.E.Skud, Bureau of Commercial Fisheries, Boothbay Harbour, Maine  
Mr J. Watson, Bureau of Commercial Fisheries, Boothbay Harbour, Maine  
Mr W. Welch, Bureau of Commercial Fisheries, Boothbay Harbour, Maine  
Mr R.L.Wigley, Bureau of Commercial Fisheries, Woods Hole, Mass.

ICNAF

L.R.Day



Recommendations from a Meeting of Canadian and US Herring Scientists  
Fisheries Research Board, St. Andrews, 19 December 1968

1. Participants

BCF, Boothbay Harbour

Dr Graham  
Mr Anthony  
Mr Watson  
Mr and Mrs Chenoweth  
Mr Wentworth

FRB, St. Andrews

Dr McCracken (Chairman)  
Dr Anderson  
Dr Lauzier  
Dr Barrett  
Mr Messieh  
Mr Tibbo

2. Recommendations

a) re ICNAF publication of herring sampling data (Redbook 1968, Pt.I, p.86)

1. that herring length and age/length key data back to 1961 be published in a special issue of the ICNAF Sampling Yearbook;
2. that the herring lengths be published by month for all ICNAF divisions except Div.5Y for which the length data should be presented separately for a northern subdivision (from the border between Maine and New Brunswick to the border between Maine and New Hampshire) and for a southern subdivision (from the border between Maine and New Hampshire to Cape Cod);
3. that herring lengths be published in cm to the cm below, i.e. 4 cm group = 40-49 mm, subject to review by the ICNAF Assessments Subcommittee;
4. that the herring sampling data not be reported by type of gear or by vessel size at present;
5. that the herring age/length keys be published by quarters for Div.4X, 5Y and 5Z only on a trial basis with frequent review.

b) re ICNAF herring otolith and scale exchange (Redbook 1968, Pt.I, p.84)

1. that age recording be by year-class to avoid the complicating and often confusing definition of age;
2. that 1 January be established as the birth date for age recording and that age records be from 0 to 7 inclusive with ages greater than 7 to be grouped;
3. that photos be matte-type finish to enable marking on the print the position of each annulus or if glossy prints the position of each annulus can be marked on a strip of white tape;
4. that 100 photos of both scales and otoliths be prepared and distributed initially by Canada (St. Andrews) to herring experts in each of USA, Canada, USSR, Poland, West Germany and Romania;
5. that the ICNAF Secretariat will be responsible for circulating and collecting the exchange material;
6. that the exchange data sheets include the total length of the herring and their date of capture;
7. that the project coordinator (Mr Tibbo, FRB, St. Andrews) report results as a simple tabulation without attempting any detailed analysis;
8. that a workshop be held to examine and discuss techniques and results.

(over)



c) re Canadian-US cooperative programming for recruitment studies

1. that the timing of US and Canadian cruises be adjusted to provide overlap for comparative purposes;
2. that releases of seabed drifters be cooperative effort (USA to extend program to coastal waters of New England states);
3. that oceanographic and herring larval data and, if possible, other plankton information be exchanged;
4. that comparative tows be made to evaluate results and that feasibility of using a standard gear be explored;
5. that cruise announcements be exchanged among FRB, St. Andrews; BCF, Boothbay Harbour and BCF, Woods Hole as early as possible and that exchange of cruise personnel be encouraged.

