The Sub-Committee on Long-Range Research Plans submits the following report and recommendations to the Committee on Biology and Research.

1. PARTICIPANTS


All sessions were held at the San Bancho Annex of the Ministry of Agriculture and Forestry. The Sub-Committee expresses its appreciation to the Japanese National Section of the Commission for its kindness in making arrangements for the conduct of the meetings.

2. PURPOSE OF THE MEETING

The purposes of the meeting of the Sub-Committee are given in Section 2 of INPFC Document 340, entitled "Report of the Committee on Biology and Research for 1959 on Items Other than the Progress of Research on Problems Raised by the Protocol". The Terms of Reference are quoted below:

"Since research plans for the immediate future have already been adopted and set forth in "Report of the Sub-Committee on Research Plans for 1960" (Appendix I), we are considering here programs of much longer scope, perhaps several years. There is some divergence in national views as to the degree to which closer attainment of Protocol objectives can be achieved by continuation of research..."
programs at their present level. Nevertheless, all three nations agree that a thorough review of the problem is needed, in order to determine the types of programs which can yield precise information on specific Protocol objectives, such as:

"a. To determine the exact proportion of continental stocks of the three major species in commercial or research catches in finely divided areas of the high seas, both east and west of the Provisional Line.

"b. To weight these catches according to the abundance of the stocks in each area.

"Such precise determinations require further refinement of experimental and analytical techniques, and more detailed data than now available of catch and effort from both mothership fisheries and research vessels.

"It is suggested that the three national sections proceed as follows:

"1. Appoint a working party of two scientists from each country to work with the Secretariat on the problems of long-term planning of research.

"2. Ask the Secretariat to prepare a paper making a preliminary assessment of the status of the present program and of the problems involved in planning further research which would be effective in providing answers to questions raised by the Protocol and its associated problems. The Secretariat should have the cooperation of the working party by correspondence.

"3. Instruct the working party to meet with the Secretariat (perhaps in early summer in Tokyo, so as to give the Secretariat time to carry out its assignment) and discuss the status of the present program, the need for further research and the prospective value of various lines of research. Further questions might be raised and further work required as a result of this meeting.


"NOTE: The above refers to research on the problems raised by the Protocol, which is already an assigned duty of the Committee on Biology and Research. Should the Commission require broader research, the same mechanism could be used to develop plans."
In the conduct of its work the Sub-Committee first considered a preliminary assessment of the present status of scientific knowledge related to the questions raised by the Protocol and then considered what should be done to improve the usefulness and reliability of data already obtained.

3. THE INITIAL RESEARCH OBJECTIVES

The Protocol to the North Pacific Convention requires the Commission, in essence, to determine if salmon from Asia and salmon from North America are intermingling on the high seas. If intermingling exists the Commission is to conduct studies to determine a line or lines which will best divide salmon of Asian and North American origin and whether it can be shown beyond a reasonable doubt that this line or lines more equitably divide such salmon than the present provisional lines. The task of the scientists concerned with developing a research program for the Commission in connection with the Protocol questions thus could be divided into two major parts: First, to determine if salmon from Asia intermingled on the high seas with salmon from North America. This question has been very clearly answered in the affirmative. Second, if intermingling was found to exist, to plan a program of accumulation of scientific data and information which would allow the Commission, in a reasonable period of time and within realistic limits of effort, to attempt the determination of the line or lines specified in the Protocol. The Sub-Committee notes that it is not within its function to decide or even discuss the principles on which drawing of the lines should be based. The task of the scientists with respect to the Protocol questions ends when they have provided the Commission with the best possible quantitative description of the intermingling of salmon from the two continents in terms of areas, time, species and stocks concerned, and, if possible, of the biological and ecological conditions governing such intermingling.

At the beginning of the Commission's investigations, remarkably little was known about salmon in offshore waters of the North Pacific, or of the factors governing their behavior. It was necessary, therefore, to develop a whole series of techniques of investigation, in the hope that some, at least, of these techniques would be useful. Accordingly, the Commission's first research program, which began to operate in 1955 and is continuing in 1960, was described in terms of methods or techniques of investigation. That is, it consisted of such activities as offshore fishing by research vessels, the collection of samples, studies of racial characteristics to test if continent of origin could be determined, tagging to indicate migration, etc. A program of this type is essential in the early stages of any new field of scientific research. As information is accumulated and the nature and scope of the problem become apparent, it is possible and essential for the objectives of research to be defined in more precise and limited terms.
Investigations undertaken by the Commission to date have resulted in a most remarkable and valuable accumulation of information on the offshore life of salmon in the North Pacific, which is, however, much too extensive to describe here.

4. RESTATEMENT OF THE OBJECTIVES OF RESEARCH ON PROTOCOL QUESTIONS

As stated in Part Three of this report, it is essential, in the initial stages of an unprecedented, ocean-wide fisheries investigation of this sort, to explore every conceivable and feasible source of knowledge. As research progresses, certain lines of investigation will be discarded, others will be improved and emphasized, and new lines of investigation will be opened. At the same time, as is specifically true in our case, the general outlines of the problem become much clearer, the limits of available techniques become apparent, and the complexity of the problem can be assessed.

Before proceeding to assess the present status of knowledge bearing on questions raised by the Protocol, it is essential to describe the research objectives in terms of what past experience has shown to be possible and attainable. The question of whether or not this is enough information to allow the Commission to make the determination required by the Protocol is a separate one.

Accordingly, in the sections of this report which follow, the Sub-Committee has used as a guide the following criteria with respect to research objectives:

a. The three most abundant species, i.e., sockeye, chum and pink salmon, are of primary concern.

b. We are seeking information on the abundance, origin, distribution and intermingling of salmon on the high seas in a quantitative sense.

c. The period of each year with which we are concerned is the late spring and summer.

d. We are seeking knowledge of average conditions with respect to the distribution and intermingling of salmon by conducting research for a number of years and knowledge of the factors causing year-to-year fluctuations.

e. We are considering separately the mature and immature forms of these species of salmon, since their distribution and movements in offshore waters are different.
f. We have become aware of the essential dynamic nature and variability of abundance, distribution and intermingling of salmon on the high seas. We must expect that it will be very difficult to forecast many of the factors which will control abundance, distribution and intermingling in the future.

5. **PRELIMINARY ASSESSMENT OF THE PRESENT STATUS OF ACHIEVEMENT IN RESEARCH**

In order to develop a long-range plan of research it is necessary to make some assessment of results already achieved. As a basis for a preliminary assessment of the present status of achievement in research on the questions raised by the Protocol, the Sub-Committee received from the Secretariat a document entitled "A Preliminary Assessment of the Status of the INPFC Research Program on Questions Raised by the Protocol" (INPFC Doc. 356) (appended). The Sub-Committee commended the Secretariat on the preparation of a very useful paper. The Sub-Committee recommends that this document receive the distribution usually accorded INPFC documents on the understanding that it is a preliminary statement of the views of the Secretariat and not necessarily of the agreed views of the scientists of the three national sections.

The Sub-Committee noted the generally pessimistic views expressed in this document (356) regarding the significance of the results of the Commission's research program and the prospects of obtaining sufficiently precise quantitative information on salmon distribution on the high seas. The Sub-Committee noted that this pessimism has reference only to the very narrow terms of reference quoted in Section Two of this report (Doc. 370).

The Sub-Committee carefully reviewed Part Three of Document 356 - "Evaluation of the present research program". The following agreements and recommendations were made with respect to each topic discussed in the above section of the Secretariat's report:

A. **Catch statistics**

The Sub-Committee noted that a group of scientists from the three countries has recently begun work in Japan on a joint report on the subject "Distribution of salmon on the high seas of the North Pacific Ocean, including the Bering Sea, without reference to area of origin or intermingling". The Sub-Committee considers that detailed catch and effort data and biological data both from research vessels and commercial fishing vessels are of great value for quantitative studies of salmon distribution. The Sub-Committee requests that the group working jointly on distribution of salmon be prepared to report its progress to the Sub-Committee prior to the next annual meeting.
B. Research vessel operations

Document J56 describes the purposes of research vessel operations and some of the associated problems. Essentially, the research vessels have two functions: First, to determine the distribution of salmon in offshore waters and, second, to obtain samples for racial studies. After a thorough discussion of the questions involved in operations of research vessels for the purposes given above, the Sub-Committee agreed to the following recommendations:

i. If and when joint research vessel operations are again undertaken for the purpose of studying salmon distribution, the necessary coverage will first be determined jointly and then individual vessel assignments will be made on the basis of the required coverage.

ii. The Sub-Committee defers any recommendation for further research vessel operations to study salmon distribution until it has available a better assessment than the results already obtained.

iii. It is expected that the question referred to above can be considered more adequately in October, 1960, when the quantitative distribution data compiled by the existing working party can be reviewed. At that time consideration should be given to the indices which best represent the abundance of salmon in offshore areas, the size of the area and the period of time that the indices of abundance should represent, the errors of the estimated index of abundance and ability to measure these errors.

C. Racial studies

The Sub-Committee reviewed and discussed the portions of Document J56 which deal with the topic of racial studies (identification of stocks). Discussion centered on evaluation of methods used insofar as the reliability of the results obtained is concerned. It is believed that the methods could be made more precise and useful.

The Sub-Committee agreed that one man from each national section should be designated as soon as possible, in correspondence with the Secretariat, to assess methods of analysis used in all racial studies. These persons are to commence their work by correspondence and be prepared to consider their assignment jointly at the next meeting. Dr. Kasahara was designated from the Secretariat to work with this group.

The Sub-Committee is reluctant to recommend further large-scale sampling for racial studies after 1960 until analyses of the existing data have been completed, methods have been evaluated and the necessity
and extent of further sampling have been evaluated.

a. **Morphological and meristic studies**

The Sub-Committee considered that morphological and meristic studies have not yet given precise information on quantitative abundance of stocks of various stages in various areas. However, for sockeye valuable general information has been obtained.

b. **Scale studies**

No particular exception was taken to the views expressed in Document 355 with respect to scale studies, although some details were left for consideration at a later date. Summary reports of scale analyses in progress were given and the general conclusion was reached that the scale work is at an early stage and that analysis of material now available must be pressed forward. Until analysis of scale information was more fully developed, no decision could be reached on how much emphasis should be placed on racial identification by means of scale studies. It was agreed, however, that there were good prospects for obtaining valuable information from scale studies on certain stocks.

c. **Parasitological studies**

The Sub-Committee found itself largely in agreement with the views contained in Document 355 with respect to parasitological studies of sockeye salmon. Consideration was given to the suggestion that parasitological information might be used in quantitative determination of the distribution of Bristol Bay sockeye salmon. It was pointed out that there is some evidence that sockeye populations from the various streams tributary to Bristol Bay may not be homogeneously distributed in offshore waters. Agreement was reached to examine the questions of sampling involved in deriving quantitative information on Bristol Bay sockeye distribution from parasitological data. Evaluation of the sampling problem will be worked out between representatives of Canada and the United States.

d. **Serological studies**

The Sub-Committee reviewed the comments contained in Document 356 with respect to problems of determining origin of salmon by employing serological techniques. Attention was given to the discrepancy in conclusions with respect to quantitative distribution of sockeye derived from serological techniques in comparison with those derived from other techniques. General agreement was expressed with the views contained in Document 356 and it was noted that attempts to explain the differing results would be continued.
e. Study of movements by tagging

The Sub-Committee reviewed the comments on the tagging program contained in Document 553 and expressed general agreement with its conclusions. The Sub-Committee felt that the tagging of salmon in offshore waters should be further expanded and continued and that areas of coverage should be planned cooperatively. Details of expansion planned for 1961 should be developed when the Sub-Committee meets immediately prior to the 1960 Annual Meeting.

f. Oceanography

The Sub-Committee reviewed the comments on the Commission's oceanographic investigations, and information from other sources, as given in Document 556. Descriptions of work in progress were given by Sub-Committee members. Agreement was expressed with the conclusion contained in Document 556 with respect to oceanographic investigations, namely that work of the joint reporting group on oceanography be expedited and that early consideration be given to assessment of the interrelationships between oceanographic conditions and salmon distribution and movements.

8. INCREASING THE PRECISION OF QUANTITATIVE KNOWLEDGE OF SALMON DISTRIBUTION IN THE AREA OF INTERMINGLING

Throughout its sessions the Sub-Committee kept in mind and made frequent reference to the objectives of future research. Reference was made to the objectives suggested in the second report of the Committee on Biology and Research at the 1959 Annual Meeting (Document 340), namely:

1. To determine the exact proportion of continental stocks of the three major species in commercial or research catches in finely divided areas of the high seas, both east and west of the provisional line.

2. To weight these catches according to the abundance of the stocks in each area.

Without considering whether attainment of these goals is essential in order to allow the Commission to reach the determination envisaged in the Protocol, the Sub-Committee members agreed that it is impossible to obtain such precise knowledge from data already in hand. Further, it appeared that the highly dynamic nature of salmon distribution, its variability due to changing ecological factors and changes in abundance of the various stocks found in the area of intermingling from year to year and our limited means of direct observation would necessitate large increases in the level of research effort, which, at least at the present time, could not be undertaken with assurance that information
of the standard described above could be attained. On the other hand, the Sub-Committee agreed that broader objectives which would be valuable to the Commission in the solution of the Protocol problem could be attained.

7. SUBJECTS FOR FURTHER CONSIDERATION IN THE FUTURE WITH RESPECT TO PROTOCOL RESEARCH

The Sub-Committee considered the significance of variations in the vertical distribution of salmon on the high seas, as indicated by preliminary research undertaken by Canada in 1959 and continuing in 1960. The Sub-Committee recognized the value of knowledge of the vertical distribution of salmon and its variations in time and space to the interpretation of data already collected. The Sub-Committee agreed to examine this question further at its next meeting, with the benefit of any additional information which may be available, and with the hope that some further work on this question might be undertaken in the Western and Central North Pacific in 1961. Attention was also drawn to the possibility that there may be a relationship between racial origin and vertical distribution of salmon.

Members of the Sub-Committee briefly discussed the question of ocean mortality of salmon and its possible relevance to the scientific questions related to the Protocol. It was agreed that the subject should be studied further at the Sub-Committee's next meeting and that the scientists of the three sections should come prepared with written suggestions for effective methods of study of mortality rates of salmon in the ocean.

A number of other topics already mentioned in various portions of this report will also require further discussion and assessment at the next meeting of the Sub-Committee.

8. GENERAL RECOMMENDATIONS

In addition to the specific recommendations incorporated in the assessment of research progress referred to in Section Five of this report, the Sub-Committee wishes to again endorse and emphasize its belief that analysis of all presently-available information related to the Protocol questions should be accelerated. The Sub-Committee notes that at the Sixth Annual Meeting the Committee on Biology and Research instructed its Editorial Sub-Committee with the assistance of the Secretariat to arrange as expeditiously as possible for joint reporting of appropriate phases of the research program and to develop plans for the eventual joint reporting of the results of the research program as a whole. The Long-Range Research Planning Sub-Committee believes that such joint reports will be of the utmost value in providing an assessment of the present status of knowledge on questions of salmon distribution and intermingling.
5. MISCELLANEOUS

The Sub-Committee noted that the bibliography attached to Document 35S contained many items of interest to those concerned with the subject of salmon distribution of the high seas. The Secretariat was requested to consult with the U.S. Bureau of Commercial Fisheries representatives in Seattle, who have prepared a comprehensive bibliography of scientific publications on salmon, in order to work out methods and procedure for ensuring that useful bibliographic information is made available to those concerned with the Commission's investigations.

The Secretariat agreed to provide lists of samples used in various racial studies.

10. DISPOSITION OF THIS REPORT

The Sub-Committee determined that its report should be sent to the members of the Committee on Biology and Research for approval by correspondence as soon as possible, with the understanding that, following approval of the report by the Committee on Biology and Research, copies will be sent to members of the Commission for their approval.

11. NEXT MEETING

The Sub-Committee recommends that it meet again in the period prior to the next annual meeting of the Commission and that arrangements for the time and place of the meeting be worked out by the Secretariat, taking due account of other scheduled meetings.