FIFTH MEETING

INTER-AMERICAN TROPICAL TUNA COMMISSION

San Diego, California

August 14, 1953

The fifth meeting of the Inter-American Tropical Tuna Commission was held at the U. S. Grant Hotel, San Diego, California, beginning at 10 a.m. Friday, August 14, 1953.

Present were: Sr. Lic. José L. Cardona-Cooper, Chairman, and Sr. Lic. Virgilio Aguiluz of the Costa Rican Section; Mr. Eugene D. Bennett, Mr. Lee F. Payne and Mr. Gordon W. Sloan of the United States Section; Mr. Domingo A. Díaz, Consul General for Panamá; Mr. John L. Farley, Director, U. S. Fish and Wildlife Service; several members of the advisory committee to the U. S. Section; representatives of the California Department of Fish and Game; Dr. M. B. Schaefer, Director of Investigations for the Commission, with Mr. G. V. Howard, Mr. Bell M. Shimada, Mr. Rolf Juhl, and Mr. Franklin G. Alverson of the staff; and others.

Mr. Cardona-Cooper welcomed all those in attendance. He expressed the greetings of both the Commission and the Costa Rican Government to Sr. Domingo A. Díaz, representing Panamá. Mr. Díaz replied, expressing his pleasure at being able to attend. Mr. Bennett welcomed Sr. Díaz on behalf of the U. S. Section.

The Commission proceeded to the several items on the agenda of the open meeting:

I - Approval for publication of Annual Report for the Year 1952

The Annual Report of the Commission for the year 1952 had been drafted and sent to all Commissioners for review and suggestions, and had been revised to include suggested changes. The revised draft was approved for publication without discussion.

II - Presentation and discussion of research during the past year

At the request of the Chairman, Dr. Schaefer, Mr. Howard and Mr. Shimada presented at some length the researches which have been conducted by the staff during the past year. A number of charts and graphs were exhibited to illustrate the results of these investigations.

The Commissioners and others present asked a number of questions respecting the material presented and the inferences drawn therefrom. These were duly discussed.

A recess for luncheon was taken from noon until 2 p.m., during this presentation and discussion.

III - Program of Investigations for fiscal year 1953-54

The Director of Investigations had drawn up a program of investigations for fiscal year 1953-54, based on a budget of $107,000. This had been transmitted to the Commissioners for consideration. The items of the recommended research program were:

1) Routine collection and analysis of current catch statistics, logbook data, and related information for measuring abundance and yield of tuna and bait-fish stocks.

2) Completion of tabulation and analysis of historical data for studying changes in abundance and yield of tuna stocks in the past; further development of theoretical basis for interpretation of these data with respect to the determination of level of maximum sustained catch.

3) Tabulation and analysis of historical data for studying changes in condition of bait-fish stocks.

4) Experimental transplantation of anchovetas from Panamá to the Gulf of Nicoya to determine possibility of rehabilitation by this means.

5) Continuation of studies of biology, ecology, and life histories of bait species, with major emphasis on the anchoveta, by means of

(a) Samples obtained by the fishing fleet,
(b) Field studies at Puntarenas,
(c) Such other field studies as may be undertaken within the limits of available funds.

6) Analysis and interpretation of oceanographic data from the Eastern Pacific, in cooperation with Scripps Institution of Oceanography; correlation with variations in biological productivity and in the productivity of the tuna fishery.

7) Investigation of important aspects of biology, ecology, and life histories of yellowfin and skipjack tuna as opportunity may arise for conducting such studies within the limits of available funds, taking advantage of opportunities for cooperative work with other agencies.

After discussion, it was moved, seconded and unanimously carried: That the program of investigations recommended by the Director for fiscal year 1953-54 be approved and adopted.

IV - Recommended program and budget for fiscal year 1954-55

Dr. Schaefer had transmitted to the Commissioners and others concerned, on May 28, a recommended research program, and budget estimates therefor, for fiscal year 1954-55. Revised estimates were submitted on July 28, 1953 in the light of the actual appropriation for the current fiscal year.

The program recommended included investigations along several lines, necessary to be conducted to fulfill the obligations of the Commission under the treaty. The details of the recommended program, and the budget estimates for it, amounting to $396,966, are attached to these minutes as Appendix A.

The program and budget were discussed at some length. It was brought out that the program recommended includes several lines of investigation, all of which are necessary to attaining the purposes of the Convention. At the same time, however, the President of the United States has recently instructed all departments of the government that their budgets for fiscal year 1954-55 must be held within stringent limits of economy. The Director was asked, therefore, if it is possible, in view of the current situation, to postpone any part of the work, or by any other means modify the budget recommendation in line with the economy directive.

The Director stated that: The program and budget presented is an estimate of the work that the Commission should do in order to accomplish its full responsibilities under the treaty. In view of the economy directive, however, it would probably be desirable to assign some degree of priority to different kinds of work. We can do effective research and yet defer some of the work to a future time, and can, perhaps, rely on cooperating agencies to continue to do a little work on some lines of study which we cannot afford to put money into.

In view of this, the Director specifically recommended: The work on catch statistics will require approximately $44,000. This is something we cannot curtail, since it is the fundamental basis of the entire research program. Respecting bait studies, the work we are doing in Costa Rica, and the work we are doing at our headquarters laboratory with samples returned by the fleet, must be continued; this will cost about $46,000. We must do a little work on tuna life history and biology, costing about $20,000. These three items add up to $110,000 which is approximately our basic budget this year, and represents the minimum budget required with only the United States and Costa Rica as parties to the Convention.

With the adherence of Panama to the Convention, if we are to do adequate work on the bait fish of the Gulf of Panama and the adjacent Colombian Coast, we will have to spend more than we are now spending on that phase of our program. Our estimates for fiscal 1954-55 were based on doing this work in Panama and adjacent areas. The entire item of $112,000 for bait studies should, therefore, be retained. Similarly, with the adherence of Panama to the treaty, we will have to extend somewhat our studies of the life history and biology of the tunas. I estimate that this will require an additional $47,000.

These basic items, which should definitely be undertaken, will come to a total of $225,000.

Under this program, as opposed to the full program recommended, we would be dispensing with tuna tagging, with research in oceanography, and with some studies in tuna life history and biology. We would depend on the State of California to conduct tuna tagging during fiscal year 1954-55, and await the future to determine whether we shall have to augment their efforts in later years. Deferring the large item of some $114,000 for oceanographical studies means we would have to confine our efforts in this direction to such cooperation with the research program of the Scripps Institution of Oceanography as may be feasible.

In subsequent discussion it was pointed out both by the Commissioners and by representatives of the tuna industry that the items which might be deferred were, nevertheless, an important and essential part of the Commission's research, and that it will very probably be necessary to obtain appropriations for such work at a future date.

It was then moved, seconded and unanimously approved that: The Commission adopt the proposal of the Director of Investigations for the curtailed program with a budget of $225,000 for fiscal year 1954-55, and that the Director accordingly be instructed to prepare such a budget and transmit it in the ordinary channels to the governments of the United States and Costa Rica; and that the budget also be submitted to Panamá when she becomes a member-government of the Convention.

In subsequent discussion it was made clear that the intention of the Commission is that the original recommended research program, with a budget of $396,966, be presented to the member governments and that it be indicated what parts of that program may be deferred in the interest of economic necessity to arrive at the curtailed program with a budget of $225,000.

V - Election of Chairman and Secretary

Mr. Lee F. Payne was nominated as Chairman of the Commission for the following year. This nomination was seconded and unanimously approved.

Sr. Lic. José L. Cardona-Cooper was nominated as Secretary for the ensuing year. This was seconded and unanimously approved.

There being no further business, the open meeting was adjourned. The Commission immediately went into executive session, attended only by the Commissioners, the Director of Investigations, Sr. Domingo A. Díaz, and Mr. John L. Farley. At this session the following actions were taken:

I. The following resolution was adopted unanimously, as a basis for determining the contributions of the member governments: "Whereas, the treaty provides for the division of the cost of the joint activities carried on by the Commission between the High Contracting Parties on the basis of the utilization of the tunas by each of them, respectively, and Whereas it is advisable to define the extent of utilization necessary to create the liability for contribution, and to fix a minimum contribution, Now, therefore, be it Resolved, that beginning with fiscal year 1954-55,

each High Contracting Party contribute to the expenses of the Commission in the proportion in which the tunas from the Eastern Tropical Pacific are utilized within their respective countries, regardless of the source of the fish, with a minimum annual payment of $500."

II. On the basis of current statistics of utilization of tunas from the Eastern Tropical Pacific by Costa Rica and the United States, it was determined that for fiscal year 1954-55 the contribution of the United States should be 99.7% and the contribution of Costa Rica should be 0.3%, or $500, whichever is the greater.

The Commission unanimously passed a resolution expressing appreciation to the members and organizations of the tuna industry for their hospitality to the Commission.

The meeting was adjourned at 5:00 p.m.

9/18/53

APPENDIX A

RECOMMENDED RESEARCH PROGRAM OF THE INTER-AMERICAN TROPICAL TUNA COMMISSION FOR FISCAL 1954-55

The Convention between the United States and Costa Rica establishing the Commission clearly defines its functions and duties. Pursuant to these treaty provisions, there has been recommended to the member governments, at the annual meetings of 1951 and 1952, a program of investigations including the several lines of research believed to be required to accomplish the mission set forth under the treaty, namely, to collect and interpret the factual information needed for maintaining the populations of tunas and bait fishes at levels which will permit maximum sustained yields. The recommended program of research which has been described in detail previously, need not be recapitulated here in detail. It includes the initial lines of investigation which need to be pursued during the next few years, subject to modifications as the facts may determine.

The research program recommended by the Commission at the last two annual meetings has not been initiated because of failure to appropriate the required funds. Instead, a start has been made on those lines of study which have been deemed most critical and which could be initiated with available funds.

It is believed that the failure to receive adequate financial support for the Commission's program is a result of the urgent defense problems of the United States rather than any belief that the program itself is intrinsically unworthy of the support requested. I, therefore, believe that the Commission should again recommend to the member governments the full program of investigations and the budget necessary for this purpose.

It will be most convenient to consider the research program under the same headings as previously employed (see appendices to the minutes of the annual meetings for 1951 and 1952), indicating for each the present status of the research, expected activities during fiscal 1953-54, and recommendations for fiscal 1954-55.

I. Collection, compilation, and analysis of catch statistics, logbook records, and other data regarding the bait fisheries and tuna fisheries, in order to study success of fishing, changes in abundance and yield, and shifts in areas of baiting and fishing.

The basic task of the Commission's staff is to determine the effects of fishing on the tuna and bait-fish populations. Our studies depend on measurements of the changes in size of the fish populations in response to changes in the amount of fishing, which are inferred from measurements of abundance, fishing intensity and catch furnished by the records of the commercial fishermen. The collection and interpretation of these records is without doubt the indispensable foundation for our investigations. Their proper interpretation requires much additional information about the biology and ecology of the fish species concerned, of course, but without these records the remaining investigations would bear little fruit.

Present status

In order to obtain information currently on the areas of fishing, amount of fishing, and catches of both tunas and bait fishes by the vessels of the fishing fleet, the staff has in full operation a system of collection of such data by means of logbooks which are being kept by a large majority of both clippers and seiners. Statistics of vessel movements and landings for the entire fleet are obtained through canneries, vessel owners associations, and government agencies in the United States and Costa Rica.

The current logbook information is compiled and charted as it is obtained so that there may be available on a current basis objective measurements of the changes which are occurring in the fishery. This is desirable for two purposes: (1) To become cognizant of changes which may indicate the desirability of modifying the activities of the fishermen to increase the sustainable yield. (2) To have the measurements of abundance and catch in such form that they may be readily correlated with the results of biological and ecological studies and so lead to understanding of the natural laws which govern the abundance of the fish stocks and the catch which may be obtained from them.

The interpretation of current information on the fishery, in terms of the dynamics of the fish populations, can only be accomplished by comparison with similar information over a series of years covering different levels of fishing intensity. Fortunately a considerable body of data has been collected covering the period of rapid growth of the fishery from 1932 to date. The available data are:

(1) Statistics of tuna landings by species by boats for the California fleet from 1931 to date

(2) Similar data for vessels landing in Costa Rica from 1944 to date

(3) Data on time spent at sea for each boat for the major share of the fleet from 1932 to date.

(4) Information on size, fish capacity, and other characteristics of the vessels involved, and

(5) Logbook records for a sizable sample of the fleet since 1940 and for some vessels since 1930, showing activities by days on each trip. These logs which the masters have kept for their own use are quite good in most instances for tuna fishing, but are less complete for bait fishing activities.

Compilation and analysis of these data is a considerable task, upon which we have made only a good start. It is urgent that this job be completed as soon as may be possible.

Expected activities during fiscal 1953-54

The collection, compilation, and analysis of current information will be carried forward routinely.

It is expected that with no increase in available funds, it will be possible during the next fiscal year to complete analysis of historical data respecting the catch per-day's-absence from port, and to have well toward completion the larger task of reducing the information from microfilm copies of old vessel logs to useful statistics and the analysis of these.

Requirements during fiscal 1954-55

The routine collection and analysis of current information must be continued as the continuing record of the fishery basic to all our other research.

It is urgently necessary that the analysis of all the historical data be completed as soon as possible. Until this task has been completed, we can make no very reliable interpretations of the current data, and so cannot estimate the present status of the fish stocks. It is becoming apparent that such estimates are likely to be urgently needed in the near future. The current data for the yellowfin tuna fishery indicate decreased total catches accompanied by decreased yields per unit of fishing effort. This is a danger signal indicating that there is a very good possibility that some or all of the components of the population of this species may now have been fished to a level below that at which the maximum sustained catch may be obtained. On the other hand, this may be a transient phenomenon caused only by a short-time change in the quantity of fish available to the fishermen, as a result of environmental variations. Until we have been able to determine the frequency and magnitude of such variations, from the historical data, no firm statement can be made.

II. Investigations of those aspects of the biology and life history of the tunas necessary to the proper interpretation of the statistical data of the fishery, and required for understanding the reactions of the tuna stocks to changes in fishing intensity and to environmental changes.

The statistical data and other data on the operations and results of the fishing fleets are essential to understanding the population dynamics of the tunas and the effects of the fishery on the stocks. Such data are not sufficient by themselves, however. The adequate understanding and interpretation of them depends on knowledge of the biology and behavior of the fishes concerned. Certain aspects of the life histories and habits of the tunas must be understood before the statistical data can result in accurate quantitative estimates of the condition of the stocks.

First, of course, we must know what stocks we are dealing with. To obtain any precision in the interpretation of the statistical data we must consider them by categories corresponding to natural units of the tuna population. This requires the determination of the geographical ranges and extent of intermingling of the population units with which we have to deal, if, indeed, the Eastern Pacific population of each of the tuna species is not a single, rather homogenous unit.

In order to understand how a tuna population is influenced by an intensive fishery upon it, we need to have a good quantitative knowledge of how the population is renewed naturally by birth, growth, death, and

migration. Both our understanding of the catch statistics and the designing of any recommendations for the rational exploitation of the tuna populations requires extensive knowledge of these vital statistics.

The migrations of the tunas and their behavior at different ages (for example with respect to spawning and feeding) are important factors in judging the effects of the commercial fisheries upon the stocks, as well as in judging the effects of environmental variations.

These kinds of investigations are costly because they require work at sea. Work at sea requires ocean going ships, the operation of which costs a good deal of money. A limited amount of work can be done from the beach, based on study of the commercial catch, but most of the important problems require research at sea from specially equipped vessels. It is not proposed that the Commission acquire a vessel. It is quite possible, and much more economical, to make charter arrangements for the use of existing vessels of other oceanic research agencies or for use of commercial vessels. The specialized equipment required and the operating costs of the vessels, however, is still an item of major expense.

Present status

The Commission has been financially unable to undertake any studies along this line except for one investigation, undertaken cooperatively with the California State Fisheries Laboratory and the Scripps Institution of Oceanography, of the occurrence and distribution of tunas in sub-surface waters off Central America and northern South America. This investigation, from the vessel N. B. Scofield of the State of California, has shown that there exist in sub-surface waters large, old tunas, presumably unavailable to the fishery, which spawn in this region. Distribution of the fish was not uniform. They were found most abundant in waters well offshore, outside Galapagos Islands. The demonstration of the presence of the fish advances our knowledge, but also gives rise to important questions, such as: at what age and size the fish descend to the sub-surface waters? How much do their progeny contribute to the fishable stock? How does their distribution vary seasonally?

Additional information pertaining to the biology and life history of tunas is being gathered by the California State Fisheries Laboratory by means of size-frequency analyses of the landings at San Pedro, which are expected to contribute to determination of age and growth and perhaps to other aspects of the life history.

The Commission has also collected material for a scientist of the Scripps Institution of Oceanography who is investigating the possibility of using paper chromatography for racial analysis of the tuna stocks, material for another scientist at Santa Barbara College studying races of tunas by blood typing, and a series of plankton samples (taken during the cruise of the Scofield mentioned above), which may contribute to knowledge of distribution of spawning of the tunas.

Expected activities during fiscal 1953-54

It is not anticipated that the Commission will be able to undertake

any new investigations along these lines during the coming year. Our efforts will consist in attempting to complete the studies of materials already collected (or rather to encourage the cooperating workers to complete them). Should opportunities arise for further cooperative investigations within the scope of our financial resources, they will, of course, be used to advantage.

Requirements during fiscal 1954-55

The following investigations need to be provided for during the fiscal year:

1) Systematic quantitative sampling of commercial landings at the principal ports of landings, to supplement the material now being collected by the State of California and to encompass additional subjects including: spawning areas and seasons (from study of gonad development), size and age at maturity, anatomical differentiation of separate populations, and estimates of total mortality rates.

2) Studies at sea from commercial fishing vessels. Observations and materials collected by this means will provide information respecting feeding habits, times and places of occurrence of juveniles as clues to spawning areas and seasons, variations in distribution and availability to the fishery related to features of the environment. From commercial vessels may also be conducted, by means of tagged fish, important studies of migrations and rates of fishing mortality.

3) Special studies from research vessels. Many of our biological problems require the use of specialized equipment at sea. The most urgent, however, are:

(a) Geographical variations in productivity of different sea regions and their relationship to tuna distribution.

(b) Further studies of the vertical migration and distribution of tunas in sub-surface waters

(c) Preliminary studies of horizontal and vertical distribution of spawning by occurrence of eggs and larvae in plankton hauls.

To conduct these studies during 1954-55, we shall require:
(1) Necessary personnel and materials for studies of commercial landings at San Diego, San Pedro, and Puntarenas (or elsewhere in Latin America).
(2) Personnel and equipment for studies at sea aboard commercial vessels.
(3) Provision for chartering a research fishing vessel for two months, plus purchase of special equipment needed for the studies listed.

Support should also be given, as needed, to the scientists at Scripps Institution in the study of separation of races by paper chromatography and other chemical techniques if these techniques prove applicable to the tunas.

III. Tuna-tagging and recovery to determine migrations, growth, degree of independence of stocks, and rate of fishing mortality.

This item is properly a part of the studies of tuna life history and biology discussed immediately above. It is considered separately, however, because of the outstanding importance of this research method to very important aspects of the life history and population dynamics of fishes.

The employment of tagged tunas is the only direct and conclusive means of studying migrations and independence or homogeneity of stocks. Liberation and subsequent recovery by the fishery of tagged tunas offers a direct means of estimating population numbers and the rate of exploitation of the population by the fishery. In determining the level of population which will provide maximum sustained yields, an important factor entering into the equations of population change is the rate of catching by the fishery, which can, at the present state of development of fishery science, be evaluated only by tagging experiments.

Successful tagging and recovery of tunas is a difficult technique, because these large, powerful fish are extremely delicate. Required is a tag, and technique of tagging, which will not result in death of the fish, abnormal behavior, or loss of the tag, and yet be visible to the fisherman recapturing the fish. Such a tag needs to be employed in large numbers throughout the range of the tunas.

Present status

The Commission has been unable to do any work on this phase of the investigations. The research group of the California State Fisheries Laboratory has, fortunately, been able to develop an external tag of considerable promise and has liberated some 2000 tagged specimens from commercial vessels. A few recoveries have been made of tagged yellowfin, none at all from skipjack (which are the more delicate). It is believed that further developmental work is required on tagging techniques before the tag can be employed routinely to obtain quantitative data on migrations and rate of exploitation, although the agency mentioned is now using it in a routine fashion.

Expected activities during fiscal 1953-54

We will be able to do nothing on this project.

Requirements during fiscal 1954-55

Work needed to be done by the Commission during 1954-55 will depend to a large degree on the results of current work of the California State research group. Should their results be more favorable than we now anticipate, so that the technique now employed may be used routinely for quantitative results, the Commission should plan to engage cooperatively with the California State researchers in liberating a sufficient number of tagged fish to yield reliable results as to migrations and rates of exploitation. On the other hand, if further development of methodology proves to be needed, the Commission should complete any necessary development

of techniques before embarking on a large scale tagging project. Costs will be much the same in either case, since in tagging from commercial vessels the major cost is salaries and subsistence of personnel, and nearly the same amount of personnel will be required for development work as for routine tagging. In the cost, we have estimated on the basis of routine tagging.

IV. Investigations of the life histories and biology of bait fishes, and studies of effects of fishing on the bait stocks.

Since the major share of the tuna catch is made by means of live bait, and will probably continue to be so made for many years at least, the use of the bait resources in a manner which will give sustained high production is essential to maintaining the tuna fisheries at maximum yield.

For each of the important bait species we require to know the same sort of things as we need in the case of the tunas: changes in abundance and yield in response to changes in fishing intensity and to environmental variations; degree of independence of stocks of different baiting areas; the salient facts of the life history and ecology of each species.

In the special case of the Gulf of Nicoya (Costa Rica) we have a problem of rehabilitation of a bait population once important, but now completely gone.

Present status

The Commission's principal current studies of bait fishes fall into three categories: (1) Compilation and analysis of data on catch and abundance from logbook records. (2) Studies of certain aspects of life history from samples collected by the fishing fleet. (3) Studies of the bait fishes of the Gulf of Nicoya and the ecological regime of that body of water.

From current logbook records we are obtaining routinely information on amount of bait taken by the fleet by species, season, and locality, and the amount of fishing effort required to obtain it. From these data, over a series of years, it should be possible not only to measure the amount of bait of each species captured at each locality, but also to arrive at measurements of changes in abundance, and to determine whether such changes are related to intensity of fishing or to ecological factors.

Good historical data on fishing for bait is not readily available. There are no statistics of total quantities taken. Old logbooks, available for a sample of the fleet, contain entries regarding baiting, but how adequate these data may be for assessing changes in abundance remains to be determined. As noted previously, we have been unable to do more than copy the old logbook data on microfilm for future study when means are provided to do so.

Collection, at different seasons and from many baiting areas, of "commercial" sizes of bait species, has been possible through the cooperation of a number of the vessel captains who freeze and return to our headquarters laboratory samples of their bait catches. From the samples we can infer important facts regarding age and growth, spawning seasons, and independence of stocks as shown by anatomical characteristics. Such

samples may also be usable for studying racial differences by paper chromatograms, a technique which is being investigated by cooperating scientists of Scripps Institution. Studies based on the samples obtained in this manner have, so far, been concentrated on the anchoveta, Cetengraulis mysticetus, which constitutes over 60% of all the bait used. A study of racial differentiation of stocks based on meristic characters has been completed. Studies of age and growth, and of spawning seasons are being carried forward. Other species are preserved for future study, with the exception of the sardine, Sardinops caerulea, specimens of which are turned over to the cooperative sardine investigations.

Studies in the Gulf of Nicoya were commenced in February 1952. Since then the regional laboratory at Puntarenas has accomplished the following: (1) Established that there are no longer any anchovetas in the Gulf of Nicoya, although ecological conditions appear to be suitable for their living there. (2) Determined that the disappearance of the anchoveta population in 1947 followed heavy exploitation by the fishery and coincided with extensive, severe occurrence of "red water," probably due to Gymnodinium, which is toxic to fishes. (3) Determined that a number of other species of anchovies, as well as thread herring and other clupeoid fishes, are present in considerable numbers. (4) Collected series of those species which are presently or potentially important as tuna bait, for life history studies, and made observations on their distribution and behavior. (5) Obtained a regular series of observations of temperature and salinity distributions and quantitative zooplankton samples toward elucidating the annual cycle of physical and biological changes.

There is no reason to believe that anchovetas will not live and propagate in the Gulf of Nicoya at the present time, since other closely related anchovies are present in numbers and are propagating themselves. Since, however, there are now no anchovetas in the Gulf, and since racial studies of anchovetas from various baiting grounds indicate they are not very migratory, natural reseeding is not to be expected very soon. An experiment in reseeding by transplantation is required.

In addition to the above studies, we have also completed development, in the Scripps aquarium, of an apparently suitable tag for use on anchovetas for studying migrations and for assessing rates of exploitation of the stocks. This tag is now undergoing field trials.

Expected activities during fiscal 1953-54

The processing and analysis of logbook data respecting the catches of bait species will be carried forward routinely.

Studies of life history of anchovetas based on samples from the commercial fleet will be continued. In particular, a manuscript on races from meristic characters will be completed, and studies of age and growth from size frequencies, and of maturation and spawning from gonad studies, should be well along toward completion, if not completed. Specimens of other species will be collected and preserved for later study.

Respecting the Gulf of Nicoya, it is planned that the scientist who has been in charge there will return to headquarters and complete manuscripts

on the material collected through September 1953. Routine hydrographic and planktological observations will be continued from the laboratory on a reduced schedule to obtain further information on the ecological regime, and collections of material for elucidating the biology of the thread herring, the only bait species of present importance now inhabiting the Gulf, will be made. During the fall of 1953 we also plan to transplant a sizable quantity of anchovetas from Panamá or Fonseca to the Gulf of Nicoya, and keep track of their subsequent behavior to determine whether this baiting area may be rehabilitated by this means.

Requirements during fiscal 1954-55

During this fiscal year we should plan to:

1) Continue routine collection and analysis of current logbook records for continuing measures of abundance and yield of bait fishes on the several baiting grounds.

2) Complete analysis of historical data of the bait fisheries from old logbook records, in conjunction with the similar analyses of the tuna fishing (under item I).

3) Conduct tagging experiments at each of the important baiting areas for anchovetas on a sufficient scale to verify the results of meristic studies respecting racial divisions, to measure local migrations, and to estimate rates of exploitation.

4) Conduct field studies at suitable locations, particularly between Panamá and South America, to obtain required materials for studies of those aspects of the biology and life history not available from "commercial" samples, with particular reference to the anchoveta. It is anticipated that Panamá will adhere to the Convention prior to this fiscal year making necessary field investigations in the Gulf of Panamá and on the Colombian coast adjacent to Panamá. Plans should be made for establishing a temporary laboratory at each of these places for conducting the required studies, and for providing for a suitable small boat for field work at each place, by purchase or charter, together with necessary supplies and equipment for the research.

5) Continue studies of bait species by means of samples returned by the fleet, including other species than anchovetas.

V. Investigation of the oceanic circulation and other aspects of physical, chemical, and biological oceanography, and studies of the relationships of these to the tuna populations.

The aggregation, behavior, and abundance of the tunas is influenced importantly by the physical, chemical, and biological processes of the ocean. These are creatures of the high seas whose relations to the land are only incidental. The only important influence of the land is as it forms a boundary of the sea and so affects the system of ocean currents which is the frame of reference to which the tunas are oriented. The

features of the ocean current system and their variations must be understood, and our information on the occurrence and behavior of the tunas related thereto, if we are to obtain a clear understanding of their ways of life and of what things determine their abundance and availability to the fishery. We must obtain not only a general description of the average conditions of the tropical Eastern Pacific, but must obtain also measurements of the seasonal and annual variations from the average to relate to the variations in the occurrence and behavior of the tunas.

The tropical Eastern Pacific is one of the least well known parts of the Pacific Ocean. It is necessary, therefore, first to obtain a good general description of the circulation of this region and some idea of the forces that drive it. On the basis of this, plus whatever information may be available on the variations, and their causes, to relate to the pertinent information concerning the tuna populations.

Present status

With appropriations so far made available, the large outlay for research of this nature has been quite beyond the capabilities of the Commission. Fortunately, the Scripps Institution of Oceanography undertook, under the sponsorship of the Navy, between May and September 1952, an extensive cruise, to obtain observations for elucidating the general features of the physical and chemical oceanography of the region from San Diego to Callao. Some important biological data were also collected. The Director of the Tuna Commission participated in the planning of the cruise, and he and one other staff member participated in the field work. It is expected that, when analyzed, the data obtained on this cruise will provide a very good idea of the general features of the oceanic circulation and its effects on biological productivity. This will provide a firm basis of planning more detailed studies to elucidate the fine details of the circulation and the seasonal and annual variations, and to investigate how these are related to the abundance, distribution, and behavior of the tunas.

A second opportunity to obtain information on the ecology of the tunas, as related to the broad features of the circulation, arose during the winter of 1952-53, when a two months expedition was undertaken aboard the research vessel N. B. Scofield, of the State of California, the scientific staff being contributed by the State Fisheries Laboratory, the Scripps Institution, and the Tuna Commission. The expedition, as noted above, was designed to study the sub-surface distribution of the tunas, but as part of that task a considerable amount of oceanographic data was collected in the region off Central America and northern South America. Fortunately, this winter and spring has seen the occurrence of the anomalous oceanographic situation off northern South America called "El Niño," which is characterized by important changes in the oceanographic regime, the distribution of the fish fauna, the climatic conditions, etc. The observations obtained by the Scofield cruise should assist in elucidating this important phenomenon, and so advance our understanding of the biological effects of important variations in the current systems, in addition to providing data to relate to the occurrence of sub-surface tunas.

Expected activities during fiscal 1953-54

It is not expected that the Commission will be able to engage in any new research in this direction during 1953-54. We shall, indeed, be pleased if, with prospective facilities, we can assist significantly in the analysis of the data already collected. This analysis must precede intelligent planning of future observations. It is optimistically expected that the cooperating agencies, with some help from us, will be able to complete the analysis of the existing data during this period.

Requirements during fiscal 1954-55

It is anticipated that existing data collected by the expeditions noted above will be pretty well analyzed by the beginning of this fiscal year. On the basis of these results we expect to have sufficient information to efficiently plan additional observations for the purpose of elucidating the details of the circulation and its variations, which are important to the tuna fisheries.

It cannot be anticipated that the facilities of Scripps Institution will be available without charge for this purpose. By a fortunate circumstance, our interests coincided with those of the Scripps Institution in carrying out its broad mission of oceanic explorations, since the general description of the circulation is a necessary first step in our investigations. The Commission must plan to provide from its own resources for the additional studies which will be needed to provide a sufficiently detailed knowledge of the oceanography of our region for judging its effects on the tuna fisheries.

Observations of ocean currents, of distribution of physical and chemical properties, of standing crops and rates of production of organisms at various stages in the food chain, and other such observations which go to make up "physical, chemical, and biological oceanography" are expensive. They require a good deal of specialized equipment at sea and ashore. They require the employment of a seagoing research ship.

It is estimated that during fiscal year 1954-55 we should plan for two months operations at sea, using a chartered research vessel or commercial vessel fitted out with research equipment. We will need to expend considerable funds for the capital outlay needed for equipment for use aboard this vessel and for equipment ashore for processing and analyzing the materials collected.

It is also planned to obtain information on seasonal variations of temperature and salinity, at least, by providing simple instruments to selected vessels of the tuna fleet whose masters may be relied upon to make accurate and reliable observations.

The circulation of the region of the sea in which we are interested is primarily driven by the force of the winds. Our ultimate objective is to be able, on the one hand, to understand the effects of the oceanic circulation on the tuna populations and, on the other hand, to be able to

relate the oceanic circulation to the wind pattern in sufficient detail to predict the ocean currents and distribution of properties from meteorological observations. These latter, being taken routinely for other purposes, are of negligible cost compared with the observations at sea needed to measure the current, etc., directly. By fiscal 1954-55 our knowledge of the oceanography should be sufficient that a start may be made on relating the oceanographic results to the existing data of meteorology.

ESTIMATED BUDGET FOR RECOMMENDED RESEARCH PROGRAM

FISCAL 1954-55

In presenting the estimated requirements for the recommended research program, it is convenient for budgeting and fiscal control to make the estimates by the natural categories of expenditures employed in our accounting system, which categories do not correspond exactly to the items of the recommended program. The same procedure has been followed in previous years. These budget groupings, or "projects" are based primarily on the kind of activity, but also to some extent related to geographical location. These accounting "projects" are as follows:

Project A - General expenses of headquarters laboratory, including Director's salary and expenses, and laboratory and office expenses jointly chargeable to all activities.

Project B - Research on biology, life history, ecology and utlization of bait species; expenses of Puntarenas laboratory

Project C - Study of current and past operations of the fishing fleet from catch statistics, logbook data, and other sources; measurement of changes in abundance and yield of the tuna stocks; expenses of office at San Pedro

Project D - Research on biology, life history, ecology and population dynamics of tunas (including tagging program)

Project E - Analysis and evaluation of data on the physical, chemical, and biological oceanography of our region of study

Project F - Vessel equipment and operation; observations at sea

In Table 1 attached hereto are presented the estimated funds required for the recommended program, classified by accounting projects and U. S. Government budget object classifications.

In order that the expenditures according to items of the research program may be more easily perceived, I have also classified the estimates in Table 2 according to the item of the research program to which they pertain, plus an item for administration and headquarters expenses.

In Table 3, the estimates have also been classified according to items of the research program, with the amounts for administrative and headquarters expenses apportioned to the five research items. This has been done in accordance with request of Mr. Herrington of the U. S. State Department.

TABLE I. - ESTIMATES BY ACCOUNTING "PROJECTS" AND U. S. GOVERNMENT BUDGET OBJECTS

FISCAL 1954-55

PROJECTS

Budget Objects	A	B	C	D	E	F	TOTALS
01- Personal services	38,128	36,610	22,500	35,270	14,630	------	$ 147,138.
02-Travel expenses	3,000	9,330	1,040	5,400	1,080	------	19,850.
03-Transportation of things	250	800	50	150	------	------	1,250.
04-Communications	2,200	200	100	------	------	------	2,500.
05-Rents and utilities	8,800	3,500	840	------	------	------	13,140.
06-Printing, binding & reproduction	6,000	100	900	200	------	------	7,200.
07-Other contractual services	4,885	3,900	1,000	2,000	9,000	78,000	98,785.
08-Supplies and materials	2,200	5,200	610	500	1,800	1,000	11,310.
09-Equipment	4,900	39,860	1,000	5,330	1,600	56,485	109,175.
15-Employer's contribution to Social Security	1,632						1,632.
TOTALS:	71,995	99,500	28,040	48,850	28,110	135,485	$ 411,980.
					Less salary lapses		15,014.
							$ 396,966.

TABLE 3 - ESTIMATES BY ITEMS OF THE RESEARCH PROGRAM, WITH HEADQUARTERS AND ADMINISTRATIVE EXPENSES APPORTIONED TO OTHER ITEMS

FISCAL 1954-55

Budget Objects	ITEM OF RESEARCH PROGRAM: Catch Statistics	Tuna life History & biology	Tuna Tagging	Bait Studies	Ecology & Oceanography	TOTALS
01-Personal services	31,656	16,916	29,656	42,705	26,205	$ 147,138.
02-Travel expenses	1,640	1,440	4,490	9,930	2,350	19,850.
03-Transportation of things	50	125	75	850	150	1,250.
04-Communications	340	540	440	640	540	2,500.
05-Rents & utilities	3,280	1,640	1,640	4,940	1,640	13,140.
06-Printing, binding & reproduction	2,100	1,250	1,325	1,300	1,225	7,200
07-Other contractual services	1,977	46,977	2,977	4,877	41,977	98,785.
08-Supplies and materials	970	1,260	460	5,760	2,860	11,310.
09-Equipment	1,750	27,761	1,650	40,960	37,054	109,175.
15-Employer's contribution to Social Security	377	184	323	464	282	1,632.
TOTALS:	44,140	98,093	43,036	112,426	114,285	$ 411,980.
					Less salary lapses	15,014.
						$ 396,966.

TABLE 2 - ESTIMATES BY ITEMS OF THE RESEARCH PROGRAM

FISCAL 1954-55

ITEM OF RESEARCH PROGRAM

Budget Objects	Catch Statistics	Tuna life history & biology	Tuna Tagging	Bait Studies	Ecology & Oceanography	Headquarters & Administrative	TOTALS
01-Personal services	27,236	12,496	25,236	38,286	21,786	22,098	$ 147,138.
02-Travel expenses	1,440	1,240	4,290	9,730	2,150	1,000	19,850.
03-Transportation of things	50	75	75	800	150	100	1,250.
04-Communications	100	300	200	400	300	1,200	2,500.
05-Rents & utilities	2,840	1,200	1,200	4,500	1,200	2,200	13,140.
06 Printing, binding & reproduction	900	50	125	100	25	6,000	7,200.
07-Other contractual services	1,200	46,200	2,200	4,100	41,200	3,885	98,785.
08-Supplies and materials	810	1,100	300	5,600	2,700	800	11,310.
09-Equipment	1,550	27,561	1,450	40,760	36,854	1,000	109,175.
15-Employer's contribution to Social Security	329	136	275	416	236	240	1,632.
TOTALS:	36,455	90,358	35,351	104,692	106,601	38,523	$ 411,980.
						Less salary lapses	15,014.
							$ 396.966.