NOAA Technical Memorandum NMFS

MAY 1985

OPERATIONAL PLAN FOR NMFS ALBACORE PROGRAM

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Center

NOAA Technical Memorandum NMFS

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Malcolm Baldrige, Secretary
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National Marine Fisheries Service
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Preliminary Albacore Operational Plan

The Southwest Fisheries Center/Southwest Region operational plan for albacore is designed to fulfill the goals of the National Marine Fisheries Services strategic plan for the North Pacific Albacore Fishery Program. The operational plan's structure is based on the final options field of the strategic plan (Parrish and Mackett 1984, Admin. Rept. LJ-84-9)

1. CITIZENS PARTICIPATION IN PLANNING AND OPERATIONS

Importance. The National Marine Fisheries Service's Albacore Program will be successful only if it helps to insure the continuance of a healthy U.S. albacore fishery. To accomplish this, the albacore resource must be maintained at productive levels, the U.S. fishermen must have access to the resource, and the albacore fleet must remain efficient in order to remain competitive. The National Marine Fisheries Service feels that the best way to achieve these objectives is to maintain constituent input to NMFS planning, to continue established communications between the fishermen and NMFS personnel, to develop cooperative fishery advisory services, and to expand cooperative field programs involving research vessels, chartered fishing boats, and industry sponsored vessels.

Present Situation. Currently there is considerable citizen input to NMFS albacore planning. The strategic plan was developed from criteria and goals established at a constituent workshop. Personnel from NMFS are heavily involved in the annual fishermen's meetings, and there is considerable effort in cooperative advisory services and at sea research projects including exploratory fishing, gear development, and tagging programs.

Future Needs. The long term needs necessary to insure citizen participation in the NMFS albacore program are primarily dependent upon the establishment of a policy through which this participation can be affected.

The principal short term needs include reporting back to the participants of the constituent workshop, informing the fishermen of the results of the strategic planning effort, and establishing a NMFS/Industry committee to plan a cooperative field program.

Operational Elements

A. Constituent workshops
   1. Presentation of NMFS strategic and operational plans at a second constituent workshop.
   2. Incorporation of input from the second workshop to the operational plan.
B. Inform fishermen and industry concerning the strategic and operational plans.
C. Develop a joint NMFS/Industry committee to plan cooperative field work.
   1. Field experiments.
   2. Exploratory fishing.
   3. Gear development.
   4. Environmental monitoring.
   5. Tagging programs.

Work in 1985

A. Report the results of the constituent workshop, strategic planning and the development of the operational plan to the fishermen at their annual meetings.
B. Establish a committee to coordinate NMFS/Industry cooperative programs.

2. FISHERY DATA AND STATISTICS

Importance. A fishery data and statistics system which addresses the need to gather, archive, and distribute fishery data, both domestic and international, is a necessary prerequisite for a successful north Pacific albacore program. Industry and NMFS products (reports, advisories, etc.) are required by several different user groups including NMFS, industry, boat owners, recreational users, and other scientific users. Activities under this section form a basis for many other elements of the plan.

Present Situation. The Southwest Region is currently collecting data and editing and disseminating landing, processing and marketing information principally through the mechanism of the "Fishery Market News Report." In addition, the SWFC is collecting, archiving and distributing data and scientific products in a diffuse system. Fishery data, both foreign and domestic, are collected, stored and disseminated from one data base to those requesting data. Scientific products are distributed by each laboratory or division to those requesting information and, in some cases, to prearranged distributions. Environmental data are stored in a separate data base and some of these data are available on request. Custom tailored scientific data products (i.e., transformed, mapped, etc.) are not generally available. A centralized contact for all information does not currently exist. Some potential user groups are unaware of information available or how to access it.

Future Needs. The long term needs of this section include definition of the interaction of the Center and the Region in the area of data/information gathering and dissemination. Also, a Center/Region policy on the availability of data and scientific products to various user groups needs to be stated. This may include limitations on costs contributed by the Center/Region, limitations on user groups, etc. Promotion of Center/Region data and products should be addressed. Additional long term needs include the need to maintain incoming data availability.

In the short term, gathering and storing data must be continued. Coordination of the Center/Region needs and roles should be accomplished. Data and product availability as stated above should be maintained.

Operational Elements

A. Definition of long range goals for data and information dissemination system.
   1. Identify current potential users.
   2. Define user needs.
   3. Identify level of Region/Center involvement.

   Work in 1985

   1. Identify areas of common data needs of the Center and Region.
   2. Coordinate common Center/Region data use.
   3. Assign responsibility for collection.

B. Design and implementation information system

Work in 1985

1. Maintain current data and collection activities

Southwest Region.

Landings data.

Cannery receipts.

Ex-vessel value.

Production data.

Southwest Fisheries Center.

U.S. landings data.

U.S. logbook/interview program.

Size composition of U.S. catch.

Foreign Fishery data.

Research Data

3A. INTERNATIONAL COOPERATION FOR SCIENCE AND TECHNOLOGY.

Importance. International cooperation for science and technology serves two functions. First it addresses the need to maintain a scientific dialogue with scientists of the other major fishing countries. This allows the U.S. to access scientific information and data on a more complete and timely basis than is possible otherwise. It provides the U.S. with the opportunity to involve scientists from foreign countries in research areas on topics that they are in a better position to address because of data or expertise. Secondly, this section addresses a need for some segments of the U.S. industry (particularly boat owners) to monitor fisheries technology developments in the fishing fleets of foreign countries.

Present Situation. The collection of data from foreign sources useful for albacore fishery monitoring, stock assessment and management analysis is the joint reponsibility of the SWR and SWFC. In particular, statistics on albacore market conditions, trade activity and other aspects of economics are primarily from the SWR, whereas foreign fishery statistics and biological and oceanographic data from

foreign fishery agencies are assembled by the SWFC. NMFS access to Japanese fishery data for north Pacific albacore is facilitated by the informal research partnership established in 1975 between Japan and the U.S. and later expanded to include Canada. Taiwan and South Korea have also been welcome participants, although their role in the fishery is minor. In view of recent international trends toward restricted access to tuna fishery data, the NMFS arrangement with the Japanese on north Pacific albacore is both auspicious and of critical importance. While continued access to Japanese north Pacific albacore data seems assured for the near future, it is less certain in the long run. With continued indications that the albacore harvest is close to its maximum sustainable level and with increasing overlap of fishing grounds and the resulting direct competition for albacore, the political climate surrounding the fishery could change. Rising tensions would likely alter the entire process of communication between albacore scientists of the participating countries, and result in greater restrictions on data exchange.

Future Needs. The long term needs of this activity include providing for a stable forum for regular exchanges of both scientific data and information. Additionally, regular exchanges of scientific personnel to work on topics of need are needed. The long term need associated with fishery technology is to arrange a regular monitoring of the foreign fisheries and their associated literature.

The best course for NMFS to follow in the short term is to maintain a good working relationship with the Japanese, Canadians and others and to adhere to terms of the informal agreement. This requires reciprocal data exchange. To fulfill its side of the agreement, NMFS should continue to collect data in the U.S. fishery, assemble these in a timely fashion, and distribute them to the foreign partners.

Foreign fishery data should be used only for purposes intended and agreed upon, and not in any way which would improve the competitive position of U.S. albacore vessels or unnecessarily put foreign fishermen in a bad light. In regard to the latter point, great care must be exercised in using any Japanese drift gill net statistics (salmon, squid, albacore, pomfret, etc.).

Good relations should be fostered by continuing the practice of exchanging scientists between the SWFC and Japanese research laboratories. In addition, specific projects should be identified which could be pursued jointly by U.S. and

Japanese scientists. In many cases such collaboration would accelerate our acquisition of new information on the Japanese fisheries and lead to improved understanding of existing data bases.

Operational Elements.

A. Exchange of scientific data and information.
   1. Albacore workshop series.
   2. Personal contacts with foreign scientists.
   3. Exchange of guest scientists.

B. Gathering industrial fishery data.
   1. Definition of industry's needs for fisheries and scientific information.
   2. Identification of current channels of acquiring information.
   3. Development of a policy concerning the acquisition and use of industrial information.

Work in 1985

1. Participation in North Pacific Albacore Workshop.

3B. FISHERY MANAGEMENT

Importance. High sea fishing for north Pacific albacore is conducted by several nations, primarily Japan, U.S., Canada, South Korea, and Taiwan. These fishing fleets are expanding the areas in which they operate, using a variety of gear types. As the level of harvest by all nations approaches the estimated MSY, the need for close monitoring of the various fisheries to assess the cumulative impact of fishing on the stock becomes more critical. The albacore fishing nations would be in a better position to act when the stock shows signs of overfishing if they had established a common data base and criteria for identifying overfishing beforehand rather than trying to react to a resource crisis without prior consultation.

Present Situation. Formal arrangements for exchange of albacore fishery data among nations do not exist. Fishing data reported by U.S. fishermen are provided on a voluntary basis. Informal exchanges of data among researchers have been effective between Japan and the U.S. Cooperation between U.S. albacore

fishermen and scientists also has been good. Those individuals directly involved in these informal exchanges generally do not believe that formalizing their arrangements is urgent or even desirable at this time.

Future Needs. Should management of the north Pacific albacore fisheries become necessary in the future, it could not be undertaken by any single nation or even two nations. A multilateral compact will be needed to address albacore management issues.

Operational Elements

A. Establish an international framework for the collection and dissemination of fisheries and scientific information.
B. Establish a new international framework for management of international and domestic north Pacific albacore fisheries.

Work in 1985

1. Report on Japanese interest in international information exchange and management.
2. Develop draft criteria for when stock needs protection.
3. Evaluate formal versus informal data exchange.
4. Determine whether unilateral regulation of the U.S. albacore fishery would conserve the resource.

3C. DEVELOPMENT AND INTEGRATION OF INFORMATION FOR RESEARCH AND MANAGEMENT

PART 1. STOCK STRUCTURE STOCK ASSESSMENT

Importance. This section of development and integration of information for research and management addresses the need to provide managers with sound, accurate descriptions of the condition of the population of north Pacific albacore and the various stocks within it. If the United States is to realize its goal of increasing its catches of north Pacific albacore to 35,000 mt by 1995 and not overharvest any one segment of the population, accurate assessments of each of the stocks being fished is essential. Further, because the fishery is multinational

and the delineation of the stocks being fished is not clearly understood, the assessments made can change as the various segments of the fishery change their fishing patterns and catch levels.

Present Situtation. Currently the Southwest Fisheries Center realizes the critical importance of defining the stock structure of the north Pacific albacore and assessing the condition of the stock(s). Considerable effort is being devoted to studies which should eventually lead to a usable definition of the stocks being exploited. Effort is being devoted to assessment of the population. The annual albacore workshop is designed to address the international aspects of this. Stock assessment is presently based on the analysis of domestic and foreign catch statistics, logbooks and biological sampling of the U.S. fishery. Work has recently begun to assess the size/age structure of the portion of the albacore fishery in the traditional area of the U.S. fishery using exploratory fishing with alternative fishing gear.

Future Needs. The long term needs of this activity include defining the approximate boundaries of each stock. Simulation modeling (see 3C Part 5) should be used to assess the accuracy and precision needed, in stock definition, to allow adequate stock assessments. Preliminary estimates of population dynamics rates are available; however, our knowledge of mortality rates and recruitment is very limited.

In the short term, analyses need to be carried out to estimate the accuracy and precision needed in stock structure definition. These can be used to design future field studies. Current field work, tagging, and age structure estimation should be continued to maintain continuity and provide information needed for assessments. Periodic assessments and fishery monitoring should be continued.

Operational Elements

A. Definition of Pacific albacore stocks.
   1. Analysis of genetic stock structure.
      a. Mitochondrial DNA
      b. Chromosomal kyrotyping.
      c. Electrophoresis.
   2. Field studies to define fishery stocks.
      a. Tagging studies to describe geographical distribution.
      b. Population biology
         1. Geographical variation in growth rates.
         2. Geographical variation in birthday distribution.
         3. Geographical variation in parasites.
      c. Modeling to evaluate the implications of variations in stock structure.

   Work in 1985
   1. Evaluate the potential of methods for describing genetic stocks of albacore.
   2. Continuation of tagging.
   3. Analysis of tag returns for development of modeling based on the presently available tagging data.
   4. Modeling approaches.

B. Development of age/size composition time series for the catch by gear type and model area.
   1. U.S. catch.
   2. Japanese catch.

   Work in 1985
   1. Fill in missing sizes in age-growth work
   2. Continuation of sampling of the U.S. catch for length frequencies and logs.
   3. Development of age/size composition time series for the U.S. catch by model area using new growth data and the MacCall algorithm.

4. Development of age/size composition time series for the Japanese catch by gear type by model area.

C. Determination of population age structure.

1. Gillnetting and longline experiments and/or exploratory fishing in U.S. fishery areas.
2. Analysis of length frequencies of Japanese gillnet and longline data.
3. Determine methods for aging older albacore.
4. Determine age composition of albacore on the spawning grounds.
5. Calculate mortality rates of adult albacore based on 4.

Work in 1985

1. Gillnetting and longline exploratory fishing to evaluate size and age structure of the California model area. Use of a chartered fishing vessel is proposed. (Appendix II)
2. Development of pilot study to determine methods for aging older albacore.

D. Determination of stock size.

1. Develop cohort analyses of albacore based on one and two stock hypotheses.
2. Develop indices of recruitment based on one and two stock hypotheses.
3. Use modeling approaches to assess stock size (See Modeling Section).

Work in 1985

1. See Appendix I

PART 2. EXPAND INTERNAL NMFS COOPERATION ON FULL SPECTRUM OF SCIENTIFIC UNDERTAKINGS

Importance. Components of the National Marine Fisheries Service which impact the albacore program are scattered among many organizational units. Therefore, close cooperation and communication are necessary to insure efficient utilization of resources and non-duplication of effort.

Present Situation. The presently established albacore committee is responsible for the coordination of albacore activities within the Southwest Fishery Center and the Southwest Region. It also provided scientific expertise and staff support for the development of the NMFS Albacore Strategic Plan. A number of the elements of the strategic plan are the reponsibility of NMFS orgainzational units other than the SWFC and SWR; the mechanism through which the strategic and operational plans are to be coordinated with the other NMFS organizational units is not yet established.

Future Needs. There are both short and long term reguirements for the development of a policy which defines the overall responsibility for the implemention and coordination of the NMFS Albacore Strategic Plan.

Operational Elements

A. Conduct cooperative planning between NMFS organizational units participating in the Albacore Program.
B. Maintain Center/Region communications.

Work in 1985

1. Develop joint Center/Region operational plan for long term research and management of the North Pacific Albacore resource.

PART 3. EXPAND STUDIES OF RELATIONSHIPS AMONG THE FISH AND THE ENVIRONMENT

Importance. Albacore range over a large expanse of the north Pacific during their life cycle. Their abundance, distribution, migration rates, availability and vulnerability to capture are regulated by behavioral and physiological responses to environmental factors. Understanding the relationships between the fish and their environment is considered a prime prerequisite for maintaining and enhancing the U.S. fishery as the exploitation rate of the combined foreign and domestic fleets increases.

Present Situation. Currently the SWFC has a large share of its research effort directed toward developing environmental data bases, conducting experiments to determine behavioral and physiological responses of albacore to environmental factors and analyzing the relationships between albacore catch rates and environmental conditions.

Future Needs. Long term needs include the development of multidisciplinary environmental monitoring systems for the north Pacific ocean/atmosphere system, determination of how individual albacore react to environmental conditions and development of methods to integrate this information to the population level. All of this is necessary if NMFS is going to help the U.S. fishery to expand. In addition, when the combined international fishery approaches MSY, this same information will be necessary to design a management regime which will allow the fishery to remain at a highly productive state.

Short term needs include the development of environmental indices and the determination statistical relationships between albacore catch and environmental factors. In addition, work is necessary to define the environmental state of the preferred albacore habitat.

Operational Elements

A. Field experiments to define the habitat, aggregation and migration of albacore.

1. Experiments on factors occurring at time and space scales affecting individual fish.
   a. Determination of the oxygen tolerance of albacore.
   b. Acoustic tagging to determine small scale movements of albacore in response to gradients of temperature, oxygen, depth and water clarity (ocean color).
   c. Determination of metabolic rates of albacore at different energetic states.
2. Experiments and analyses on environmental factors occurring at time and space scales affecting fishing operations.
   a. Development of data base for factors which affect daily CPUE of longline, gillnet, jig and baitboat fisheries.
   b. Development of functional relationships between smaller scale environmental factors and the availability and vulnerability of albacore to capture.

Work in 1985

1. Field studies using the JORDAN or a chartered fishing vessel are proposed to carry out acoustic tagging and to determine the O_2 tolerance of albacore.
2. Analysis of environment factors affecting catch and CPUE of jig boats in the U.S. fishery.

B. Analysis of albacore/environment relationships occurring at time and space scale of interest to industry and management.

1. Large scale analyses of habitat/environmental conditions in relation to physiological factors.
2. Development of time series indicies of large scale environmental processes affecting the timing, routes and rates of albacore migration.

3. Development of time series indices of large scale environmental processes affecting year class size of albacore.
4. Development of descriptive and predictive models of interactions among the environment, fishing effort and catch of albacore (also see related work in the modeling section).

Work in 1985

1. Comparison of geographical fields of oxygen concentration and oxygen tolerance from experimental program.
2. Development of time series of environmental data for modeling purposes.
3. Initiation of time/space modeling of albacore catches and environmental processes in the northeastern Pacific.

PART 4. CONDUCT SOCIO-ECONOMIC ANALYSIS OF STRUCTURE, FUNCTIONING AND PERFORMANCE OF U.S. ALBACORE INDUSTRY

Importance. This research addresses the need to provide a comprehensive description of the structure, operation and performance of the harvesting, processing and retail trade sectors that comprise the U.S. albacore fishery. This includes determining how these sectors respond individually and collectively to changes in their operating environments. Research in this area is directed toward providing evaluations of policy alternatives designed to assure economic stability in the U.S. albacore fishery.

Present Situation. Currently, the SWFC is conducting studies that focus on the economic performance of vessels, both individually and as a fleet, that participate in the north Pacific albacore fishery: specifically, their dependence on albacore versus alternative species and how their performance is affected by changes in their operating parameters.

Future Needs. Develop analytical framework that predicts, with a stated degree of confidence, the magnitude and time/area distribution of U.S. fishing effort for north Pacific albacore for given biological, economic and policy conditions.

Establish the economic linkages between the albacore harvesting, processing and retail sectors and integrate these sectors into a comprehensive albacore economics component. Incorporate the economics component into the albacore fishery simulation model.

Operational Elements

A. Develop model of within season decision-making behavior of U.S. fishermen for whom the north Pacific albacore fishery is an operating alternative.

1. Analysis of within season fishing/non-fishing activities and their associated costs and earnings for fishing vessels participating in the north Pacific albacore fishery.
2. Given discrete choices in terms of fishing for albacore, fishing for alternative species, or not fishing, develop a stochastic model that predicts how U.S. fishing vessels allocate their time among these activities in response to changes in conditions affecting their fishing operations.

Work in 1985

1. Obtain and analyze economic and catch effort data on individual albacore vessels's fishing trip and between trip activities.
2. Assemble and review background information and material related to multi-species/multi-purpose vessel discrete choice modeling.
3. Formulate model of time/area/species decision-making behavior of U.S. vessels participating in the north Pacific albacore fishry.

B. Analysis of albacore demand at the retail market level: canned white meat tuna and alternative product forms. Initiate Work in 1986.

C. Analysis of domestic processing and distribution of albacore tuna. Initiate work in 1987.

D. Integration of albacore harvesting, processing and retail analyses into a comprehensive albacore socio-economic component. Initiate work in 1987.

E. Introduction of albacore socio-economic component into "North Pacific Albacore Fishery Policy Analysis System". Initiate work in 1988.

PART 5. DEVELOP FISH/FISHERY/ENVIRONMENT MODELS FOR MANAGEMENT.

Importance. Modeling and the attendant preparation of fishery and environmental information is intended to be a prime factor in the development and evaluation of potential policies for determining if the north Pacific albacore fishery would benefit from management. Modeling will be useful for investigating questions concerning the degree of exploitation of the resource and the degree of competition among various gear types. These are important questions in dealing with problems of allocation of the resource. The model will also be merged with an economic model of the US fishery (3C. part 4.) to allow investigation of the efficiency of proposed management schemes in promoting the development and preservation of the economic viability of the fishery and the biological viability of the resource.

Present Situation. A modeling effort concerned with albacore in the north Pacific has been underway for some time now in the SWFC. The focus of effort is to produce a simulation model that deals with recruitment, growth, migration, natural death, and harvest of albacore in a region covering most of the Pacific Ocean north of the equator. The model should predict albacore catch by space, time, and gear type in response to input data on recruitment, effort, and relevant environmental parameters. A working version of such a model has been implemented on computer facilities at the SWFC. The present version presumes constant environmental conditions, that is, parameters such as recruitment, migration, and catchability do not vary from year to year (though there may be patterns of seasonal variation within each year).

A workshop has been held to consider the problem of incorporating environmental driving functions so that the model will be responsive to variation in environmental conditions. As results from 3C. Part 3. become available, appropriate environmental driving variables will be added to the model. The report of the workshop lists the features of the model that should be considered for environmental driving inputs and outlines which researchers are engaged in relevant investigations.

In progress now is the extensive process of organizing input data for the model. This involves extracting catch, effort, and size sample data from data bases dealing with the principal fisheries which harvest albacore in the north Pacific, organizing the data for input into the model, and analyzing the data to obtain estimates of other necessary input parameters. We have just finished extracting U.S. catch/effort data and organizing U.S. size sampling data into a form which allows facile juxtaposition of size distribution plots. This is being done to look at spatial and temporal variation in size distribution with a view to determining appropriate ways to use substitute size distributions for strata with no sample data. We have recently received revised data from Japan. Some of the data need to be punched, and some of the data tapes have not arrived yet. The tapes include catch and effort data and sampling data to get size distributions in catch. When all is ready, we can proceed as with the U.S. data.

Another area of work concerns the estimation of model input parameters. The purpose here is to estimate a historical series of recruitment rates and to estimate gear specific and size specific catchability coefficients. It is planned to do this using various schemes for cohort analysis including length structured and age structured cohort analysis. One of the contemplated methods is under development at present. Effort to investigate robustness of some of the procedures is underway using an individual fish model that is under developement.

Future Needs. Long term requirements for the development of the model are essentially of three types. First, we must maintain sources of data for determining the catch, effort, location and size/age composition of the various gear types and nations. Second, we must determine how the environment affects recruitment, growth, migration, natural mortality and the exploitation of albacore in the north Pacific. Where these affects are found to be significant, we must develop functional relationships between the life history processes and the causal, or associated, environmental factors. Third, we must evaluate the effect of stock size on recruitment and improve our estimates of recruitment, migration, and natural mortality.

Short term needs for model development are primarily those associated with the development of historical catches by size/age for the various gear types and nations. This includes development of new methodology for analyzing age/size

composition of catches, updating data sources to include the revised Japanese information and the assembly of age/size specific catches by gear type by model area.

Operational Elements (See Appendix I)

A. Incorporation of environmental driving functions.
   1. Second workshop on environmental input to the model.
   2. Reformulate model with environmental driving functions.

   Work in 1985
   1. Dependent upon results of albacore-environment research.

B. Assembly of fishery data for input to model.
   1. Revise data base.
   2. Keep data base updated with latest fishery statistics.

   Work in 1985
   1. Revise data base by eliminating substituted length frequency samples.
   2. Incorporate the recently received updates of Japanese catch/effort and size sampling data.

C. Estimation of input parameters using two approaches.
   1. Investigate best way to use length sample data to assemble aggregate catch-at-length data.
   2. Assemble aggregate catch-at-length data.
   3. Length structured analysis.
   4. Investigate robustness of MacCall's ageing procedure.
   5. Translate catch-at-length to catch-at-age.
   6. Classical cohort analysis.

   Work in 1985
   1. Investigate best way to use length sample data to assemble aggregate catch-at-length data.
   2. Assemble aggregate catch-at-length data.
   3. Length structured analysis.

4. Investigate robustness of MacCall ageing procedure.

D. Use of the Albacore Model.
   1. Maintain list of management questions that the model can be adapted to answer.
   2. Adapt model to investigate questions of gear competition.
   3. Amalgamate albacore model with economic model of albacore fishery.

PART 6. CONDUCT STUDIES TO GAIN AN UNDERSTANDING OF GEAR COMPETITION

Importance. Gear competition can be defined as the degree to which catch by one unit of fishing gear diminishes the potential catch of another unit of gear. Competition can exist within a gear type exploiting a given portion of the life cycle or among several gear types possibly exploiting different portions of the life cycle.

It is a qualitative generality that the greater the exploitation rate, the greater the competition among units of fishing gear. Given a suitable model of an exploited fishery and the fisheries exploiting it, gear competition can be quantitatively evaluated in various ways. The Albacore Model (3C. Part 5.) is one method. Using it we will be able to evaluate, under various conditions, the marginal effect of one gear type on another. We will also be able to evaluate questions such as: the benefit we would expect a gear type to realize if a second gear type were not deployed at all, or if the effort of the second gear type were increased by some factor.

Tagging data can also be useful in evaluating the potential for competition between gear operating in different areas due to exchange of fish between the areas. What is required is intensive tagging in each area followed by close observation of the fishery statistics as well as the tag returns in each fishery.

Present Situation. Earlier studies using general production models suggest that albacore catches in the north Pacific are approaching the MSY level. This suggests

that competition between the three traditional gear types, ie., longlining, bait boats, and trolling, is potentially already a significant factor. Yield-per-recruit studies have shown that the fisheries on the younger age groups are impacting fisheries based on older age groups. The U.S. fishery which has the youngest age composition of the north Pacific albacore fisheries, therefore, undoubtedly impacts the Japanese fisheries. The recent expansion of the Japanese albacore fisheries has largely occurred on younger albacore. The Japanese fisheries, therefore, impact the U.S. fishery; however, yield-per-recruit models, which do not take reproduction into account, are inadequate to test the full effects of one fishery or gear type on another.

Future Needs. The long term requirements necessary to evaluate the effects of gear competition include several types of information. Monitoring of the U.S. fishery for catch effort and age/size composition must be continued and we must continue to receive similiar information on the various foreign fisheries. This information allows a partial evaluation of the effects of the gear types which catch younger albacore, ie., trolling, on those which catch older albacore,ie., longlining. However, knowledge of the underlying stock-recruitment relationship is necessary before the effects can be fully evaluated and little evaluation of the effects of the Japanese longline fishery on the U.S. troll fishery can be made without this information.

In the short term, we need to develop time series of the catch by age/size of the various north Pacific albacore fisheries and to use the albacore model to test potential effects of gear competition under different assumed recruitment relation ships.

Operational Elements

A. Adapt albacore model to address questions of gear competition.
B. Formulate plans for intensive tagging to deal with specific gear competition issues.

Work in 1985

1. See Section 3C. Part 5D and Appendix I.

4. FISHERY ADVISORIES AND EXTENSION

Importance. Fishery advisories and extension services play important roles in the research program on North Pacific albacore. They are conducted as part of a system where fishery and environmental data required for research studies are obtained from fishermen and other segments of the industry in return for fishery advisory information which fishermen and others in the industry use to optimize planning and operating to promote a viable U.S. albacore fishing industry. A fishery advisory and extension program is essential for the U.S. to realize its goal to increase its catch of North Pacific albacore and for NMFS to obtain the data bases essential to provide management advice to assure optimum productivity of the resources.

Present Situation. Currently the SWFC fishery advisory operations consist of a seasonal forecast of where and when albacore are expected to be available for harvesting by U.S. fishermen and biweekly narrative bulletins containing current fishing activities. A summary of fishery data from the previous year's fishing is also provided near the start of a new fishing season. In addition, reports of cooperative research conducted with the albacore fishing industry through the American Fishermen's Research Foundation (AFRF) are distributed to interested fishermen. Numerous presentations dealing with recent research findings and general information about albacore are given each year to commercial and recreational fishermen and the interested public.

The albacore fishing industry is providing considerable information and assistance in response to the fishery advisory information supplied by the SWFC. Fishermen keep voluntary logbooks, conduct tagging experiments, recover and report tagged albacore. They also collect specimens for research, and collect oceanographic and marine weather data. In addition AFRF provides vessel time for research studies and support for tagging, biological and fishery-oceanography studies.

Future Needs. A number of future needs for fishery advisory information have been identified by constituents and are contained in the report of the constituent workshop for long-range planning, NOAA-TM-NMFS-SWFC-37. These involve improved or expanded environmental information for use in locating potentially

productive fishing areas, improved weather and ocean conditions information for vessel safety, and improved and expanded information on albacore availability, abundance, distribution and size composition. The albacore task force identified data needs including additional fishery, oceanographic, economic etc. data for use in research and eventually policy analyses that fishermen could provide in exchange for improved advisory information. Also fishery managers and policy makers will require some of the expanded fishery advisory information requested by fishermen.

Operational Elements

A. Definition of policy

1. Investigate feasibility, costs and benefits of various forecasting and advisory systems scenarios.
2. Interact with constituents to accomplish (1)
3. Continue present effort until decision is made.

5. ALBACORE FISHERY DEVELOPMENT

Importance. Albacore fishery development includes activities leading to the development, testing and delivery of high quality product to the consuming public. New fishing areas, gear development, product development, product quality, marketing and financial assistance to processors, fishermen, and marketers are all critical to the realization of a 35,000 mt annual U.S. fishery. Ideally, development of the fishery, aimed at increasing production, proceeds concurrently with development of markets adequate to utilize the increased production. Therefore a coordinated SWR/SWFC/industry program represents the most efficient course of action.

Present situation. The recent closure of west coast canneries coupled with increasing catches have necessitated concentration of NMFS efforts on the development of new products and markets for albacore. Financial assistance to vessels experiencing temporary economic difficulty has also been made available through the Fisheries Loan Fund.

Future Needs. For the most part, long term needs are difficult to pinpoint. World economic conditions and policy can drastically shift, and the success or failure of on-going projects often dictate future needs. Some areas of albacore market development that do lend themselves to long term planning include potential for future export market development (not feasible at this time), capitalization of the fishery, both shore based and vessels, and the eventual transfer of market development responsibility from government to industry.

In the short term, ongoing efforts to develop, test, and domestically market new fresh and frozen product forms will continue. The Saltonstall-Kennedy Grant Program, augmented by direct assistance from National Marine Fisheries trade and development specialists, is currently the major tool being utilized in a cooperative government/industry albacore development program.

Operational Elements

A. Fishery Development
   1. Investigate potential for increasing U.S. share of total catch
   2. Investigate potential for increasing efficiency
   3. Conduct gear research program on fishing strategies

   Work in 1985
   1. Continue SWR/SWC coordination and cooperation
   2. Complete assessment of alternative fishing gear research.
   3. Consider the award of S-K grant funds for exploratory fishing in the Southwestern Pacific.

B. Product Development
   1. Actively assist in the development of new products.
   2. Encourage the improvement of on-board preservation methods
   3. Improve quality of albacore products to the consumer.

Work in 1985

1. Complete assessment and disseminate results of FY-84 S-K grants that tested on-board processing methods to improve quality control and grants that develop new product forms.
2. Conduct FY-85 S-K solicitation for albacore projects that will build on past work and investigate new products and quality control measures.

C. Market Development

1. Assist industry, including foundations, to promote albacore consumption.
2. Assist in developing alternative domestic and foreign markets.
3. Assist industry in making use of the surplus food commodity program if requested.

Work in 1985

1. Publish analysis of domestic and export market potential for albacore.
2. Complete assessment of FY-84 S-K albacore marketing grants.
3. Participate in foreign and domestic food shows.
4. Advise and cooperate with development foundations and other industry groups in marketing albacore products.
5. Investigate the possibility of including albacore products in the surplus food commodity program.
6. Conduct FY-85 S-K solicitation for albacore marketing projects that complement past successful projects.

D. Financial Assistance

1. Measure financial assistance needs of the entire industry.
2. Provide financial assistance.

Work in 1985

1. Continue present level of financial assistance through the Fisheries Loan Fund and Fishery Obligation Guarantee Programs.

9. RECREATIONAL FISHING

Importance. Albacore is a highly prized species in the southern California sport fisheries. In some parts of the year, recreational fishing for albacore generates a significant portion of the income for the sport fishing industry. With an estimated two million recreational fishermen in southern California, all opportunities to increase their access to marine fishing are important for NMFS to pursue.

Present Situation. There is growing concern among recreational fishermen's groups concerning sport fishing opportunities. They have argued that fish taken in a sport fishery have greater economic value than fish taken commercially and that the sport fishery should therefore have preference over commercial fisheries.

Future Needs. The need for recreational fishing opportunities including access (i.e., charterboats, marinas, etc.) is expected to increase. The amount of fish needed to support the expanding sport fishery will also grow. Should allocation between recreational and commercial fisheries become necessary, managers will need to know what the tradeoffs would be economically, biologically and socially. We will need a better understanding of the economic impact of the sport fishery in order to assess potential tradeoffs concerning albacore. The proposed work requires angler surveys and other appropriate data collecting activities to compile a substantial body of information on the demographic characteristics of albacore anglers. This information will be used to determine the economic valuation and motivational significance of various factors hypothesized to effect the quality of the albacore angling experience. Other proposed work will analyze the demand for California albacore angling in order to derive a net economic value for this recreational activity, particularly, the effect on angler economic benefits and participation rates stemming from marginal changes in access prices, the individual's socio-economic circumstances and real or perceived changes in albacore angling qualitative factors.

Operational Elements

Expand recreational fishing opportunities and improve the recreational experience.

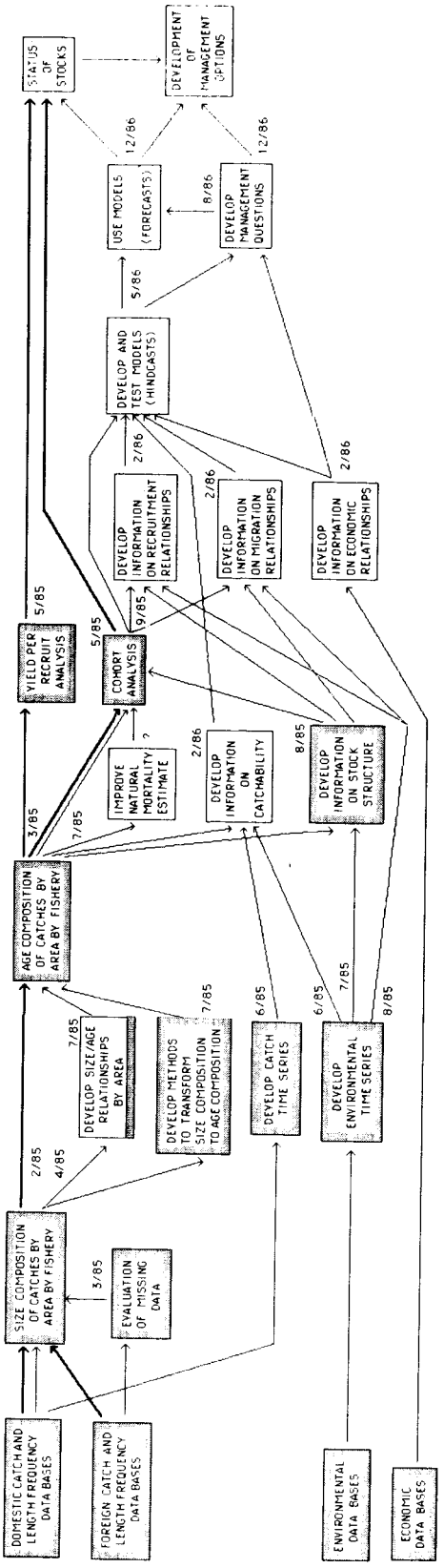
A. Estimate value of albacore to recreational fishery.
B. Determine what access improvements are needed.
C. Determine what conditions detract from the recreational experience.
D. Assist recreational fishermen with information on albacore biology and on environmental conditions.
E. Economic valuation of California angling for albacore tuna

Work in 1985

1. Advise recreational fishermen's organizations of available environmental data.
2. Evaluate the southern California albacore recreational fishery.
3. Report on sources of conflict between commercial and recreational fishermen off southern California.
4. Provide a statistical and analytical data base to be used in analyzing albacore partyboat angling activity and the corresponding net economic value derived from this activity.
   a. Angler surveys
   b. Demand analysis

APPENDIX 1

OPERATIONAL PLAN FOR NORTH PACIFIC ALBACORE



Appendix II

ALBACORE FIELD RESEARCH BY VESSEL TYPE

CHARTERED FISHING VESSELS

Population age structure.

Knowledge of the age structure of the albacore present in the different fishing areas is one of the most critical factors required for analyses of the effects of the various fishing fleets on the population and on each other. The age structure of the albacore population in the various regions is presently estimated by using the age/size structure of the catch of the vessels operating in the region. The real age structure of albacore in a region may differ from that observed in the catches due to the age selection of the gear type used in the region. For example, jig boats catch the youngest albacore, mostly 2 and 3 year olds; bait boats catch a somewhat older distribution of fish; and longliners catch mostly young adults, 4 to 6 year olds, and some older fish. Therefore the only feasible way to assess the age structure of albacore in the traditional U.S. fishing areas is to fish an array of gear that is capable of catching albacore over a wide range of ages/sizes. This could be done by using jig, bait and longline gear in the same area at the same time. However, this would require a multivessel experiment and would be very expensive. The method which we are presently using is the use of gillnets with a wide range of mesh sizes. Recent work with this gear suggests that it is feasible; however, the JORDAN has not proven to be suitable for gillnetting. The proposed future research on the age structure of albacore in the traditional U.S. fishing areas will involve chartering commercial gillnet vessels which have both the equipment and experience necessary for handling large volumes of gear.

Work in 1985

Charter vessel for 20 days to operate offshore of southern and central California.

Proposed work in 1986

Charter vessel for 30 days to operate offshore of Oregon and Washington.

Habitat definition

Albacore range over a huge portion of the north Pacific; however, their occurrence in fishable concentrations is restricted in both time and space. This is assumed to be caused by interactions between environmental factors and the behavior characteristics of albacore. Success in albacore fishing is largely dependent upon finding these fishable concentrations and one aspect of the research program is centered upon gaining an understanding of the environmental factors associated with these concentrations of albacore. The research need for this type of information is due to the fact that there have been extended periods of time in the past when albacore have not been available in various portions of the traditional U.S. fishing grounds. It is important that we know if these variations are due to fluctuations in the abundance of albacore or if they are unrelated to the abundance and caused by particular sets of environmental conditions. Past research suggests that fishable concentrations of albacore are often associated with frontal formations; however to date temperature and salinity measurements alone have not been found to adequately describe the associations. The proposed albacore behavioral research involves tracking albacore, which have been tagged with a sonic device, and in measuring their associated environment including a grid of depth profiles consisting of temperature, salinity, oxygen concentration, and water clarity. Associated research will apply the small scale behavioral results to large scale environmental data fields including satellite remote sensing data on sea surface temperature and ocean color.

Proposed work in 1985-87

Charter vessel for 15 days to operate offshore of southern and central California.

or

NOAA vessel for 15 days to operate offshore of southern and central California.

NOAA RESEARCH VESSELS

RV CROMWELL

Albacore which enter the fishery in the Pacific Northwest appear to migrate through the central Pacific via the Kuroshio extension and the area downstream from it. The U.S. fishery is expanding into the central Pacific and fishing success here as well as the time of arrival and abundance of albacore in the Pacific Northwest appear to be associated with the environmental conditions in the Kuroshio extension and the region to the east of it. NMFS work in this region is presently centered on an evaluation of resources and environmental features associated with sea mounts. This work is being carried out by other elements of the Honolulu lab. Since the CROMWELL is scheduled to work in the area, there is an excellent opportunity to schedule hydrographic surveys and albacore resource studies in this transitional region.

Work in 1985

30 days of vessel time with the RV CROMWELL in the central north Pacific

RV CROMWELL

The U.S. albacore industry is proposing exploratory fishing in the South Pacific in 1986. We are therefore proposing that the RV CROMWELL carry out exploratory fishing and oceanographic descriptive work in association with the industry sponsored vessels. This work will also be carried out in cooperation with the ORSTOM sponsored albacore research program and hopefully, in cooperation with the New Zealand albacore research program.

Proposed work in 1986

30 days of vessel time (plus transit time) with the RV CROMWELL to operate in the South Pacific in February 1986.

Proposed work in 1987

The RV CROMWELL is expected to operate approximately 180 days in the South Pacific during 1987. The proposed work includes an as yet undetermined number of vessel days for albacore research which will be coordinated with the ORSTOM and New Zealand programs.

INDUSTRY SUPPORTED RESEARCH

Commercial gillnetting for albacore is developing. This development is likely to occur outside of the 200 mile zone. Presently we have very little information concerning the potentials of this fishery. The Oceanic Division is planning to have an observer on board one of the gillnetters for about 30 days during the summer of 1986.

The industry is again sponsoring a tagging program which will result in the tagging of about 2000 albacore in 1985. The program is directed at tagging 2-3 year old albacore and will involve from 15-18 albacore fishing vessels. Total costs to the industry will be about $18,000. The Coastal Division will coordinate the work with the industry, handle tag recoveries and analyze the results.

Several albacore vessels are expected to participate in a NMFS/Industry program to acquire oceanographic observations.

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J. A. WHIPPLE, M. JUNG, R. B. MacFARLANE and R. FISCHER
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P. A. JOHNSON and B. W. JOHNSON
(October 1984)

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T. POLACHECK
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