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GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS

Mission and Accomplishments of the Occupation in the Natural Resources Field

Natural Resources Section

26 September 1949

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MISSION AND ACCOMPLISHMENTS OF THE OCCUPATION IN THE NATURAL RESOURCES FIELD

I. INTRODUCTION

1. Production from all the natural resources of Japan is the primary concern of Natural Resources Section. Its field of operations includes most of the land area of Japan, and the surrounding seas as well. The significance in the life of the Japanese of the materials and activities with which the Natural Resources Section is concerned can hardly be overestimated.

2. Of the 91,000,000 acres making up Japan, 17,000,000 acres (19 percent) is agricultural land. About 15,000,000 acres of this land is under cultivation, and the remainder is pasture and range land. Forest areas of 62,000,000 acres account for 68 percent of the total, and lakes and rivers 1.5 percent. The remainder consists of inhabited areas, roads, and wasteland such as mountains above the timberline. These factors reveal that a study of the fields covered by the Natural Resources Section involves a study of nearly 90 percent of the total land surface of Japan.

3. The present population of Japan (September 1949) is estimated to be 80,000,000 persons. The Japanese labor force over the age of 14 years totals roughly 36,000,000 persons. About 18,000,000 of these workers are engaged in agriculture and forestry. Another 610,000 are engaged full time in fishing and related pursuits, and 500,000 in mining and the smelting and refining of metals. Thus 53 percent of the total adult working population of Japan is engaged in farming, fishing, forestry, or mining. If part-time employees, seasonal employees, and children were considered, these figures would be greatly magnified. In the United States these fields include only 35 percent of the total population.

4. Natural Resources Section deals, in large measure, with the primary products of the country - the items produced from approximately 90 percent of the land area, and from the seas. These products consist of food from agriculture, fisheries, and wildlife, construction materials, fuel for heating, cooking, and transportation, and manufacturing materials from forests and mines. From these resources must come the largest possible supply for the Japanese population, and material for export as well. In addition to its interest in the basic resources of the country, Natural Resources Section is concerned with the democratization and economic welfare of the people whose livelihood comes from farming, fishing, forestry, and mining - more than one-half of the population.

5. In all of the production fields outlined above, this Section's mission is (1) to maximize immediate production and promote efficient utilization of the materials produced in order to minimize import requirements, and (2) to maximize long-range production in order to reduce Japan's future dependence on foreign sources for its supplies.

6. Natural Resources Section was organized with four technical divisions, to cover agricultural, fishery, forestry, and mining and geological activities, respectively, and the necessary service divisions. After four years of experience, the organization is as shown in NR Chart 1.

7. Japanese food production is very important not only to Japan but also to the United States, for we have taken the responsibility of

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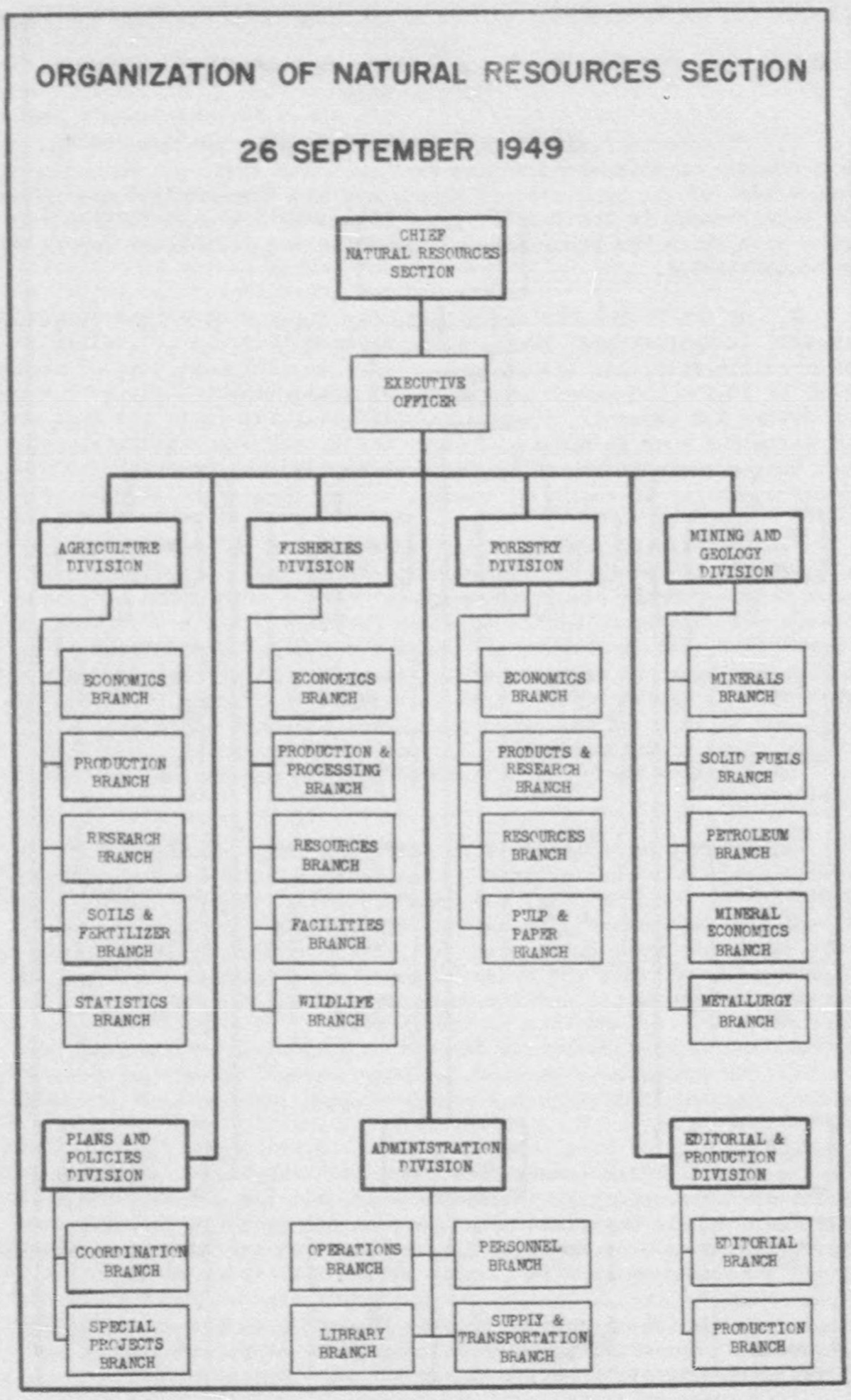

NR CHART 1

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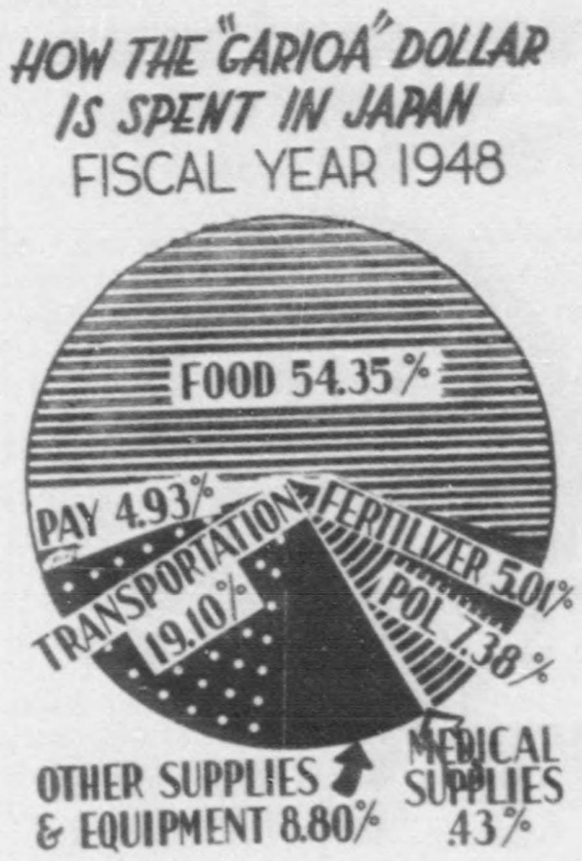

NR Chart 2

insuring that the Japanese do not starve, at least during the period of the Occupation. This commits us to making up any deficit which may exist between Japan's production and its minimum needs.

8. The importance of Japan's food supply to the Supreme Commander for the Allied Powers and the United States is reflected in the breakdown of the latest available figures on United States funds expended for aid and relief in Japan. In 1948 more than 50 percent of these GARIOA funds were spent directly for food, and food and fertilizer expenditures together accounted for nearly 60 percent (NR Chart 2). A large percentage of the remainder was used indirectly for the production of food, since much of the cost of transportation, supplies, petroleum products, and pay is applied toward moving and processing foods. It has been determined that approximately 95 cents of each GARIOA dollar was expended on importation, production, or processing of foodstuffs.

9. With responsibilities covering nearly 90 percent of the land area, 53 percent of the adult working population, and 95 percent of the funds used for relief, Natural Resources Section has realized the urgent need for detailed study of all problems bearing upon the resources situation. The following general description of each of the four fields covered by this Section sets forth the objectives pursued, progress made, and the programs under way at present.

II. AGRICULTURE

1. Introduction: a. The two most important agricultural problems confronting the Occupation in Japan have been insufficient food production and the low economic status of the rural community. Topography and the pressure of a large farm population on a limited acreage have had much to do with the relatively small area under cultivation, and with the small, uneconomic farm units, widespread tenancy, and the low standard of living of those who till the soil. The Japanese are good farmers, but even their skill cannot overcome the limitations imposed by a total of only 15 million acres of cultivated land and 82 million people. In the past Japan could not attain food self-sufficiency even in years of abundant crops, but has had to rely on imports to make good the deficit. Now that former overseas sources of supply are no longer available, maximizing food production is one of Japan's most urgent needs.

b. The scarcity of arable land in Japan gave rise to many abuses in the land tenure system and in the field of agricultural taxes and credit. These abuses, coupled with domination of agriculture by

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bureaucratic and nonagrarian interests, multiplied the difficulties of the Japanese farmer in attaining a level of economic security comparable to the remainder of the population. National policies designed to expand industrial production and foreign trade relegated agriculture to an inferior position in the economy. Those dependent upon the land for their livelihood did not share to any substantial degree in the improved standard of living that resulted from the increased national income.

c. The low economic status of the Japanese farmers over the years has created among that group a feeling of hopelessness and restlessness. Agrarian unrest in turn has provided no small part of the stimulus to Japan's imperialistic foreign policy. Tenants particularly, and farmers generally, have been in large measure sympathetic to extremist political movements by Japan's militaristic exponents.

d. In recognition of the nature of Japan's economy, the Occupation has directed its agricultural programs toward two major objectives, namely, maximum food production, and the achievement of social and economic stability of the farm population. The brief report that follows outlines the nature and scope of the agricultural programs instituted.

2. Production Statistics: a. Stimulated by expansion of trade and population, Japan increased its staple food output 96 percent between the 1880's and the decade immediately preceding World War II. Rice and wheat accounted for most of this gain. At the end of World War II hostilities, however, many of its people faced the threat of starvation. By 1945 fertilizer shortages, combined with bad weather and other disrupting influences, had reduced harvests. Since that time production has gradually increased. In 1948 staple food crop harvests were six percent above the 1931-40 average, but not as high as the 1939 record crop. Increase came chiefly from sweet and white potatoes and barley.

b. In the period extending from the 1880's to 1921, Japan had expanded its cultivated areas from 12 percent of the total land mass to 16 percent, resulting in a total cultivated area of about 15,000,000 acres. After that time the area remained relatively constant until the war, when military requisitions reduced it by about 500,000 acres.

c. Annual harvests of minor cereals, beans, and peas followed the upward trend of the staple crops until about 1920, but declined thereafter. The trend in vegetable and fruit production continued upward for a longer period. However, with major emphasis on staple food crops during and since the war, the trend reversed. In 1948 production ranged from 23 to 40 percent less than prewar for these groups.

d. Among industrial crops, mulberry for silkworms (which more than doubled in average annual acreage from the 1881-90 decade to the 1931-40 decade) has been cut back during and since the war to less than two-thirds of the 1881-90 figure. This decrease has been due to loss of foreign silk markets and need for land for food production. Tea production is little more than one-half of the prewar average. On the other hand, the 1948 tobacco crop was 42 percent more than in 1931-40.

3. Fertilizer: a. With soils naturally low in fertility and with intensive cropping, Japan must rely heavily on fertilizers. When World War II began, the nation had ample facilities to produce most of its nitrogenous and phosphatic commercial fertilizers but had to import phosphatic rock. Limited equipment and lack of indigenous deposits made it necessary also to ship in the inorganic potash used. Peak fertilizer production was reached during the period 1936-40. When war hostilities

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ended, the fertilizer industry was in a serious condition. Since then commercial fertilizer supplies have increased steadily, largely as a result of action by Allied authorities, including imports of large quantities and introduction of measures to increase domestic production. The supply of nitrogenous fertilizer for farm consumption has risen from 439,000 metric tons in fiscal year 1946 to 1,464,000 metric tons in 1949; phosphatic fertilizer used by farmers increased during that period from 32,156 metric tons to 1,033,125 metric tons, and potash supplies consumed have mounted from 902 metric tons to 159,000 metric tons.

b. A system of fertilizer allocations, begun during the war, has been recast by the Occupation to insure timely deliveries and equitable distribution between crops and areas. Importance of compost, animal manures, and night soil in crop production has been emphasized continuously. Current use of compost and night soil is estimated to be above the 1936-40 average.

4. Insect and Disease Control: Plant insects and diseases, although estimated to reduce crops in Japan by at least 12 percent annually, received minor control attention prior to 1947. While some good resulted from laboratory investigations, field work had been neglected. Use of pesticides in the dust form was practically unknown. Insecticide supplies, reduced during the war, have been adequate in 1949. Experimental work has been encouraged on insect control, the use of dusts, and the use of new insecticides. DDT and benzene hexachloride, newly developed insecticides which can be produced in Japan, have relieved the pressure on other chemicals, particularly diesel oil and pyrethrum for control of rice leaf hoppers. Other insecticides have been imported for testing. In addition to larger supplies and more effective kinds of pesticide, efforts are being made to improve control practices. The principle and use of insecticide dusts and aerosols are being emphasized to obtain more effective control of pests. An Agricultural Chemical Control Law was promulgated in 1948 to assist in overcoming the inferior quality of pesticides. A Plant Quarantine and Emergency Pest Control measure will be presented to the next session of the Diet. NR is assisting the Japanese Government in the programs discussed above and is sponsoring an extensive research program designed to develop more effective controls of plant pests, particularly rice borers.

5. Seed Situation: a. Improved seed is a major factor affecting crop production in Japan. Methods of plant breeding, and seed increase inspection, certification, and distribution as means of increasing food production have been greatly improved under the guidance of Natural Resources Section. Hybridization and back-crossing have only recently received attention from Japanese scientists, and long-range increase in yields through these techniques may be expected.

b. Under the Occupation, pronounced advances have been made in the production of certified seed of white potatoes. Seven foundation seed farms were established in 1947 and increased emphasis placed on seed production. This program is reflected in banner potato production in 1948 and 1949 despite inclement weather over much of the potato area of Japan during the 1949 growing season.

c. Notable improvement has also been made in the selection, curing, and storing of seed of sweet potatoes. Methods of curing introduced by Natural Resources Section now permit long-time storage and the planting of sound seed, and are paving the way for improving the main crop storage.

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6. Livestock: a. Livestock plays a minor role as a direct food in Japan. Before 1868, the nation consumed almost no meat or milk. Up to 1941 animal foods, other than fish, amounted to only a little more than one percent of the total food consumed. Even this amount decreased during and after World War II, largely because of lack of concentrate feeds. Horses and draft cattle are necessary to provide farm draft power; the present number of draft animals is considered sufficient for that purpose. More dairy cows, dairy goats, and sheep are needed for increased production of protein food and other products. Swine have increased markedly in recent years despite the shortage of concentrate feeds. Poultry has regained only a slight portion of the 70 percent decrease it suffered during the period 1941-46.

b. Under SCAP direction, the livestock control companies were dissolved. Government livestock breeding stations are still maintained, although their need has not been demonstrated. NR is encouraging policies to establish an economically sound livestock program. These policies include increased indigenous feed production (especially improved forage production), to the extent possible without decreasing the amount of staple food grown and livestock breeding production and utilization by private enterprises, at maximum levels consistent with feed imports. Government aid in the form of improved research and education facilities, and farmer access to long and short term credit at low interest rates are also included in these policies.

7. Food Storage and Preservation: The Japanese climate, with hot humid summers and rains in the late spring and fall harvest seasons, magnifies food storage and preservation problems. The six million tons of sweet potatoes deluging the fall markets present an especial difficulty. Storage facilities are inadequate, and freezing weather in winter prevents later shipment. Grain storage is adequate in capacity but is not rodent-proof or air-conditioned. Vegetables are preserved by salting, pickling, or drying, but major losses result during market movements from lack of refrigeration and shipping facilities. The Japanese are now paying particular attention to potato spoilage problems. Sweet potato storage on farms has been receiving increasing emphasis since 1947; the government will pay 70 percent more for farm-stored sweet potatoes after 1 March 1950 than during the peak season. A five-year plan has been launched to provide 110,000 metric tons additional space for potatoes each year. Currently 215 buildings to provide an annual storage capacity of about 25,000 metric tons are under construction.

8. Land Reclamation and Improvement: a. Recognizing land reclamation and improvement as a basic means of increasing food production, the Japanese Government has provided subsidies for this activity for many decades. Neverthaless, land reclaimed from 1910 to 1939 averaged slightly less than 30,000 acres per year; gains from reclamation were largely offset by diversions of agricultural land to other uses. From 1937 to 1944, because of military acquisition, cultivated areas decreased about 500,000 acres. After the surrender, the government placed increased emphasis on land reclamation. Under SCAP direction the Land Reform Law was written; it included authority for the government to acquire uncultivated land for reclamation and established procedures for sale of reclaimed land to cultivators. A new Land Improvement Law, promulgated in June 1949, provides for more effective land improvement conducted by associations of the local people concerned.

b. With the increased emphasis on reclamation since 1945, the government has acquired 2.7 million acres of uncultivated land for reclamation and 845,000 acres have been reclaimed.

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c. SCAP consultants have assisted the Japanese authorities not only in implementing legislation and instructions but also in the solution of technical problems in actual field work. Guidance has been given in developing standards for the selection of land to be reclaimed, in planning and settling reclaimed areas, and in designing and constructing land improvement projects.

9. Soil Survey: Basic knowledge of the soils is essential to proper evaluation of Japanese agriculture, and to establishment of policy and development of programs for increasing food and feed crops. The first soil maps of Japan were made under a program instituted in 1882, and by 1945 all cultivated land, except parts of Hokkaido, had been mapped. In 1936, however, aware of the inadequacies of their soil maps, Japanese soil scientists began the study of foreign classification methods. Few maps were completed under the revised scheme. A reconnaissance soil survey was initiated under the Occupation in late 1945. The survey, by United States soil scientists, makes use of an internationally known system of classifying soils by the morphological characteristics of the soil profile. Field work has been completed, and preparation of a series of eight reports is now in progress.

10. Food Collection: a. As the Japanese Government tightened its economic and other controls in the years immediately preceding and during World War II, it instituted a system of food collection from farmers and rationing to non-farm families. Only rice was collected in the first year - 1940. Wheat and barleys were added in 1941 and sweet potatoes and white potatoes in 1942. The system was used through the remaining war years. Food shortages necessitated continuance by the Occupation of the collection and rationing system. Use of the system apparently will be necessary for a number of years to come.

b. About 80 percent of all staple crops is subject to collection. Before planting time each year, the Ministry of Agriculture and Forestry, on the basis of "normal" production, determines delivery quotas and assigns them to prefectures. The prefectural governments sub-allot the quotas to counties (guns) and cities; the counties sub-allot them to towns and villages, which in turn assign them to individual farmers. Quotas may be revised downward at harvest time if crop conditions warrant. Authority to increase quotas at harvest time will be considered at the next session of the National Diet.

c. Consumer goods in short supply are made available on a priority basis to farmers as an incentive to stimulate crop deliveries.

d. The 1942-44 war years showed a continuously high total collection level, followed by a sharp drop in 1945 and progressive increases through 1948. Deliveries of each of the staple crops in 1948 exceeded those of 1947. The outlook for 1949 collections is encouraging.

e. The Natural Resources Section maintains close and continuing surveillance over all phases of the food collection program, including food production, assignment and revision of collection quotas, and actual collections by the Japanese Government.

11. Crop Reporting: a. In 1878 Japan began to collect national statistics on area and production of all major crops, based on reports from prefectural government officials. Field sampling to determine yield at harvest time was commonly used by local crop surveyors as early as 1933, but prior to 1947 little attempt was made to forecast production ahead of harvest.

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b. A lucrative "black market", and fear of actual hunger growing out of the war served as incentives for farmers and local officials to underreport both crop plantings and yields. As a result, the accuracy of national crop area and production reports was impaired. Following a study by an expert from the United States in 1946, a new crop reporting system was set up, with control and supervision centralized in the Ministry of Agriculture and Forestry. Under this system, the accuracy of farmers' reports on acreage of crops is measured by means of sample surveys, and yields are determined by field sampling. These operations are conducted by trained personnel in prefectural offices of the Ministry of Agriculture and Forestry. Acreage surveys in 1948 accounted for more than a million acres of staple crops that farmers had failed to report.

c. Japan's food deficit must be met by U.S. appropriation, so a reliable crop reporting system is mandatory. The present system is superior to that used prior to 1948, but many problems remain. Effective guidance eventually should place the Japanese crop reporting system on a high plane of efficiency and effectiveness.

12. Agricultural Research: a. Japan's lack of sufficient arable land to provide food for her growing population makes an effective agricultural research system imperative to insure highest returns from the agricultural resources. When the Occupation began, research work was scattered, with little coordination, among several hundred experiment stations and research institutions. The arrangement resulted in duplication of effort and inefficient use of funds. Further, equipment was inadequate in many of the stations.

b. On advice of Natural Resources Section specialists, the Japanese Diet enacted legislation in 1948 to provide for elimination of nonessential stations, consolidation of research institutions, application of research to immediate and practical farm problems, and prompt dissemination of findings to farmers. An Agricultural Improvement Bureau was established in the Ministry of Agriculture and Forestry in August 1948. A plan for consolidating research institutions was approved by the Cabinet in July 1949 and is scheduled for accomplishment by 1 April 1950; under this plan 135 stations will be closed and 53 will be combined with the 191 remaining. Natural Resources Section specialists conducted a school in experimental methods in March 1949. Under the guidance of these specialists various experiments have been conducted which utilize experimental design methods only recently known to the Japanese.

13. Agricultural Extension: a. Planned distribution of technical knowledge to farmers in Japan was provided by legislation enacted in 1899 establishing a government-controlled system of agricultural associations to improve crop practices. Under this system the government provided for one or more technicians in each village to work with farmers. In addition, cooperatives, organized under a law of 1900, helped finance operations of farms to supply superior seed and in some instances employed technicians to advise farmer members.

b. During World War II the associations and cooperatives were combined into a national association which was given control over crop quotas, collections, and rationing of critical materials. Agricultural technicians were given control and policing duties. The national control organization and its member associations were dissolved by direction of the Occupation authorities.

c. Legislation enacted in July 1948 provided for an agricultural advisory service. Prefectural governments are completing the organization of Agricultural Improvement Sections to work with the

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national government in developing such a system. More than 6,000 village farm and home advisors have been appointed, and more than 3,300 rural youth clubs have been organized. Natural Resources Section specialists are working with the Japanese on plans for on-the-job-training programs to develop advisory techniques and leadership skills.

14. Land Reform: a. Prior to the Occupation 70 percent of the Japanese farmers rented all or part of the land they cultivated. The pressure of population on limited land resources perpetuated a feudalistic land tenure system requiring payment of exorbitant rents in kind often amounting to 50 to 70 percent of gross farm production. Japanese land reform legislation enacted by the Diet and promulgated 21 October 1946 has two main objectives: (1) transfer of land ownership to farmers who actually till the soil and (2) improvement of farm tenancy practices for those who continue as tenants. The program emphasizes private individual ownership of land rather than state or collective ownership. During the initial transfer phase, which is virtually completed, almost one-third of the cultivated land in Japan - more than 4.5 million acres involving about 30 million tracts - has been purchased by the government from former land owners for resale to cultivators. An estimated 12 percent of the cultivated land will remain in tenancy to provide the necessary amount of tenure flexibility. The land reform program also includes provisions to insure fair tenancy practices for the remaining tenants such as written farm leases, rent ceilings, cash rentals, restrictions on land transfer, and safeguards against arbitrary changes in rental contracts. Current operations include the registration of title transfers, collection and payment for lands sold and purchased by the government, and continued improvement of tenancy practices.

b. The Natural Resources Section provided technical advice and guidance in the preparation of the legislation on which the land reform program is based. Specialists consulted with Ministry of Agriculture and Forestry officials, furnishing advice and guidance on administrative policies adopted and maintaining continuous contact with the progress of all activities.

15. Agricultural Cooperatives: a. The minute size of the average Japanese farm management unit requires that farmers pool their efforts and resources through cooperation. The prewar Japanese government took advantage of this situation to construct a monopolistic hierarchy of agricultural associations through which the government controlled almost all aspects of farm life. Membership was compulsory for all farmers.

b. SCAP policy has required dissolution of this basically militaristic set-up and its replacement by a genuine agricultural cooperative movement free from domination by nonagrarian interests and dedicated to the economic and cultural advancement of the farmer. The Agricultural Cooperative Association Law, which became effective on 15 December 1947, provided for the organization of democratic agricultural cooperatives based on internationally recognized cooperative principles. By 30 June 1949 a total of 31,329 local and individual cooperatives had been organized. These had federated into a total of 993 federations of agricultural cooperatives by the same date. Volume of business records for the year 1948 showed that cooperatives handled a major portion of farmer purchases, sales, financial deposits, and loans. Membership in these cooperatives is voluntary. Each member has one vote. The primary purpose of the cooperatives is maximum service to participating members rather than payment of dividends on invested capital. Results of officer elections for these organizations in March through May 1949 show that over 80 percent of the present officers have never been directors or auditors in the former agricultural associations. This indicates a substantial change of leadership in rural communities.

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c. Problems remaining include improving the operating efficiency and placing the new organizations on a sound financial basis, building membership loyalty, retaining the present freedom from political control, and strengthening democratic management.

16. Crop and Livestock Insurance: a. Japan's deficit food position requires that agricultural production be maintained on land which would be considered submarginal in a country which produces surpluses of food. Compulsory crop insurance, supported in part by government subsidy, and voluntary livestock insurance have been in operation with limited benefits since 1929 and 1939 respectively as measures required to keep submarginal land in production.

b. Japan's present insurance system, as authorized in the law of 15 December 1945 for Compensation Against Agricultural Loss, is a revision of the system existing at the time of surrender. The changes were designed to bring the system into harmony with basic Occupation Objectives and to correct administrative and procedural difficulties. Insurance coverage on staple food crops is compulsory in order to guarantee maximum effectiveness of the program in terms of crop production. Premiums are fixed for each area in accord with that area's past record of losses. Livestock insurance is voluntary unless the general membership of the local agricultural mutual association votes to make it compulsory. Insurance of other property and produce is optional. Administration is placed in local agricultural mutual relief associations operated by farmers, and in prefectural federations of these local associations. The Japanese Government exercises only limited general supervision.

c. Agricultural mutual relief associations established on a local basis numbered 10,663 as of 30 April 1949. Each prefecture had one federation. Local associations insure with prefectural federations, which in turn reinsure with the national government. Losses in excess of the amount collected as premiums are met by government subsidy. The principle of subsidy is established partly in recognition of the nation's responsibility to participate in costs incurred for benefits which accrue to the nation, and partly to keep premiums within the farmers' capacity to pay.

d. The Natural Resources Section assisted the Ministry of Agriculture and Forestry officials in preparing the present crop and livestock insurance legislation, in developing and implementing administrative policies, and in analyzing the progress of insurance activities under the new law.

III. FISHING INDUSTRY

1. Introduction: a. The Japanese, to a greater extent than any other major nation, have developed the resources of the sea to supply their needs. This development has been stimulated by the very limited land areas suitable for cultivation, the pressure of population, and the need of this population for food, and by the concentration of the population on the shores of productive seas with steep mountains at their back and the open seas before them. More than one million people are engaged full or part time in exploiting the resources of the sea. Practically every species of sea animal and plant is used for human consumption or for industrial purposes, and the Japanese fishermen before World War II had spread out to fish a greater area of the high seas than was ever before exploited by one nation.

b. In prewar years, the production of Japanese fishermen operating from the home islands averaged about 9,300,000,000 pounds. This amount

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was more than double the production of the United States, the second most important fish producing nation of the world. About 7,900,000,000 pounds of Japan's prewar production came from the areas now authorized for Japanese fishing, with most of the remainder coming from northern areas (which are now under the administration of U.S.S.R.) and smaller quantities from the Yellow Sea and high seas outside the present area. Even though Japanese fishing boats ranged widely over the high seas about 85 percent of Japan's total production came from waters lying within sight of the coast of the four main islands.

2. Recent Production: a. During the last part of World War II Japanese fishery production decreased greatly as a result of shortages of petroleum for operating fishing boats, shortages of fishing gear, loss of the larger fishing boats taken over by the Japanese navy, and disruption of the handling and distribution of fish on shore as a result of bombing attacks. No dependable data are available for the amount of fish produced during 1945, which was the low point in fish production, but it was far below the prewar level.

b. Following the surrender, fish production was rapidly increased by the construction of new fishing boats and the distribution of petroleum and of fishing gear made up from manila and cotton fibers released by the Japanese armed forces when they were demobilized. By 1947 production had been restored to a level approaching the prewar average for the same area, except for sardines and herring. Before the war these species supplied about 3,000,000,000 pounds to the annual catch, but in recent years their abundance in the sea has decreased, for reasons not understood by fishermen or scientists. This decline in the sardine runs has been paralleled on the coast of California where little more is known about the cause than in the Japanese fisheries.

c. By 1948 the Japanese fishing fleet had been restored to its prewar level, but supplies of fishing ropes, nets, and twine produced mostly from manila and cotton left by the Japanese armed forces had been nearly exhausted, and current imports of these materials were far short of requirements. As a result of this shortage of supplies and the continued scarcity of sardines, aquatic production in 1948 dropped to about 6,000,000,000 pounds, a level considerably below that of the previous year.

3. Fishing Supplies: a. The growing scarcity of fishing supplies first became evident during field surveys made by fishery experts of Natural Resources Section in the spring and summer of 1947, to determine the status of fish production. These specialists estimated that production would drop at least 25 percent in 1948 and more in the following years unless funds for purchase of such materials were greatly increased. As a result of this warning, an emergency allotment of more than $15,000,000 was made available late in 1947, and additional funds totaling nearly $45,000,000 were spent for fisheries supplies during the following year. After these funds became available, raw materials, consisting mostly of manila and cotton fibers and petroleum products, were purchased and brought into Japan where they were processed and began reaching the fishermen in rapidly increasing quantities during the fall of 1948. As a result of this program, sufficient quantities of materials reached the fishermen during 1949 to replace most of their old worn-out gear. With this restoration of gear, production in 1949 is expected to approach 7,000,000,000 pounds, the highest level since hostilities ended and considerably more than prewar production from this area, except for sardines and herring. The large quantities of materials distributed in 1949 have done much to restore the fisherman's equipment to normal condition so that requirements for 1950 and the ensuing years will drop to the level required for normal replacements.

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b. With adequate supplies of fishing materials and further development of resources where research shows this to be possible, production of aquatic products in 1950-51 is expected to increase progressively. If sardines and herring return to the Japanese waters in numbers comparable to those found before the war, production will considerably exceed the quantities taken during prewar years from the area now open to fishing.

c. The current Natural Resources Section program in the field of fisheries supplies requires continued checking, through field trips, on Japanese requirements for fishing materials, expediting action to obtain adequate funds and procure needed supplies, and maintaining surveillance over distribution to see that materials reach the fisherman and are most effectively used. Surveillance is being continued over the Japanese fishing boat building program to insure that an adequate number and tonnage of boats are available to meet changing needs. At present most categories of Japanese fishing boats include somewhat larger numbers than were in service before the war. The entire powered fleet totals 450,000 boats of 1,100,000 gross tons. In order to avoid exhaustion of the present fishing grounds and inefficient use of limited fishing materials, no new construction is being authorized except for replacement purposes. If development of new fisheries or extension of the present fishing area results in a need for more boats, suitable increases in the fishing fleet will be authorized.

4. Fishing Areas: a. The problem of fishing areas is extremely important to Japan, not only because the area available to Japanese fishermen affects the quantity of fish produced but also because the use of high seas areas by the Japanese is of much concern to the people of the Allied powers and other neighboring nations. The original limitation of fishing area was placed on Japanese fishing as a security measure and to prevent complications which might arise from the contacts of Japanese fishermen with those of other nations. Limitation on area has been continued for these reasons and also to give the Japanese fishermen an opportunity to demonstrate whether they had changed some of the attitudes and activities which had made Japanese prewar fishing objectionable to the people of many other nations. These activities included overexploitation of fishing grounds and failure to observe international agreements and practices.

b. Natural Resources Section personnel are advising and encouraging the Japanese Government and fishing industry in eliminating these objectionable characteristics. Violations of the authorized fishing area have occurred, but at present the Japanese Government is setting up and operating a fishery inspection system to detect and report boats fishing outside of the authorized areas. The research program conducted by the government is being reorganized to increase its efficiency and effectiveness; it is being redirected to place greatest emphasis on determining methods for administering the fisheries in order to provide the largest possible sustained production. This attitude contrasts with the prewar programs which stressed exploitation and expansion of fishing grounds and processing of products, with little or no work on sustained yield. Under the new program the Japanese Government has begun an extensive research on the fisheries of the East China Sea to determine the degree of exploitation which will result in highest sustained yield. Results so far indicate that the present trawling fleet is considerably larger than the area can support. A program was inaugurated in the summer of 1949 to reduce the fleet by 350 boats. Additional reductions will be made later if further research indicates that the fleet is still too large.

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c. In recognition of the progress made by the Japanese Government and the fishing industry in reducing the violations of the authorized fishing area and correcting over-exploitation where it had been shown to exist, the Supreme Commander on 19 September 1949 authorized the Japanese Government to extend the area of Japanese fishing operations to the east as far as the international date line. This was the first extension authorized since the summer of 1946. It indicates that the Japanese Government is correcting those abuses which lead to intensive opposition of other nations to the expansion of fishing areas. (NR Chart 3)

5. Processing and Sanitation: Advice and guidance are being provided the Japanese by NR specialists on methods of handling and processing aquatic products to improve quality and eliminate spoilage and other wastage. Outstanding examples of this program in operation are the Antarctic whaling expeditions authorized by the Supreme Commander for the Allied Powers in 1946, 1947, and 1948. Japanese Antarctic whaling operations before World War II paid little attention to international conventions which protected small whales and female whales. Processing methods used did not obtain maximum returns of food products from the whales. The post-surrender whaling expeditions have been under the direct supervision of SCAP representatives who have required that maximum use be made of all parts of the whales and that all international conventions be observed. This supervision plus the technical advice supplied have resulted in increasing the yield per blue whale unit (one blue whale or the equivalent) from the 18-ton average of the Japanese 1940-1941 expedition to about 48 tons for the 1948-1949 expedition. Japanese observance of international conventions regarding size of whales, and use of whale parts, also has been exemplary.

6. Democratization: a. Japanese fisheries operate in a far different manner than those of the United States, where anyone can enter most fisheries if he has the finances to purchase equipment. In Japan most fisheries are operated under a system of fishing rights which functions in a manner not greatly different from land ownership in agriculture. These rights have been developed over the centuries as a result of the feudalistic system and of the population pressure which has forced the people to seek new sources for food production. Under the conditions existent in Japan, these rights have desirable features for they help prevent over-exploitation and exhaustion of aquatic resources. However, these rights also have led to abuses similar to those found in absentee ownership and sharecropping in agriculture.

b. Another development under the Japanese system was the establishment of a series of fisheries control associations, with only one association allowed in each community. These organizations were dominated by the government and by local village bosses. After a long period of study by NR experts working with the Japanese Government, corrective legislation was developed to eliminate the old control associations and set up procedures for the operation of cooperatives based on the democratic procedures found to be effective in western countries. After public hearings on the proposed legislation it was passed by the Diet under pressure from fishermen's groups. This legislation allows fishermen to organize one or more cooperatives in each producing area; membership is restricted to active fishermen, and secret balloting with one vote per member is required. Persons not eligible for membership in the cooperatives may utilize their services but do not have the right to vote. By September 1949, 89 percent of the 3,131 fishery associations were in the process of dissolution and 811 cooperatives had been formed, with many additional cooperatives awaiting only formal administrative approval of their applications. It is expected that about 6,000 cooperatives will be formed to replace the 3,131 associations, and formation will be substantially completed by 1 July 1950.

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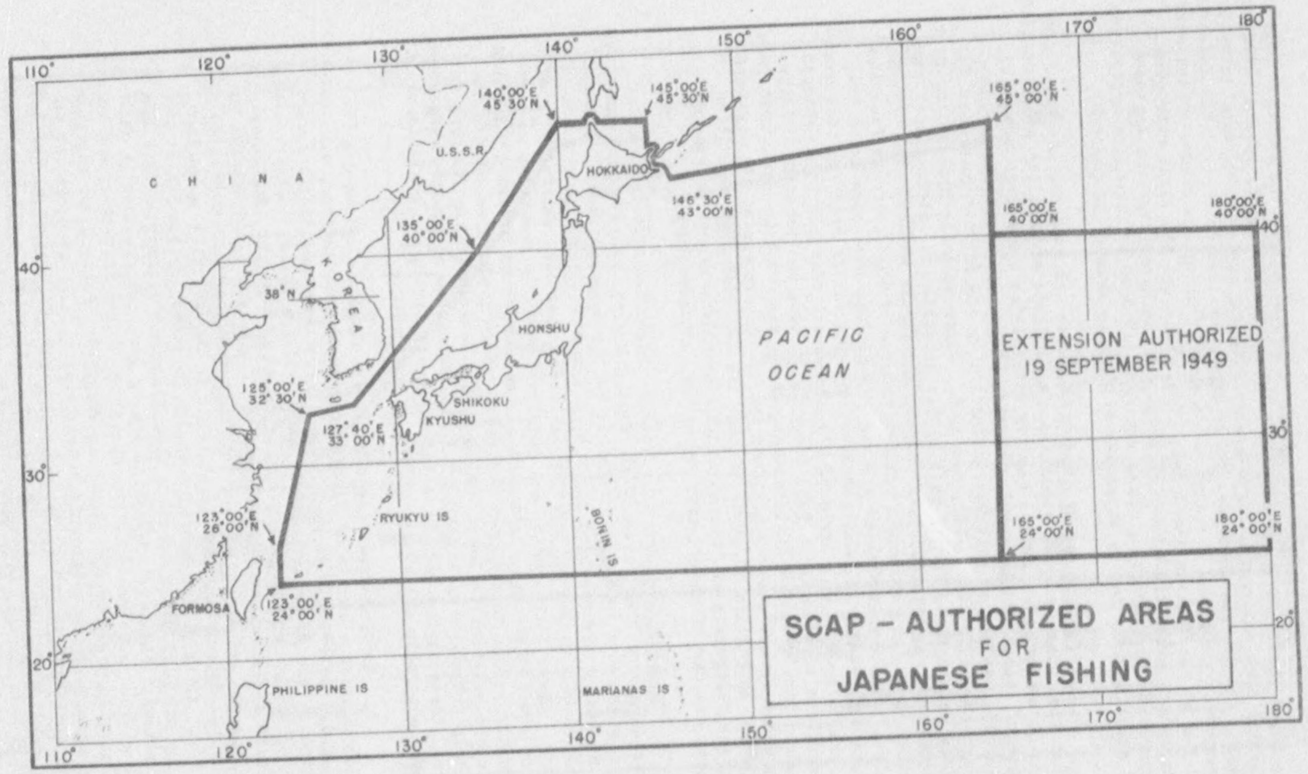

NR Chart 3

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c. Legislation to reform the system of fishing rights, with the objective of enabling the fisherman to own the right which he operates, has been drafted by the Japanese Government. This legislation now is being considered by the Japanese Diet.

7. Administrative Organization: The Japanese Government and the fishing industry have been encouraged through example and advice to utilize technically trained persons in government jobs dealing with the fishing industry. As a result of this program the Japanese Fisheries Bureau has been reorganized as a Fisheries Agency. All of the officials of this Agency, except for the administrative personnel, have technical training in the fishing industry for government. They are gradually reorganizing the Agency to promote more efficient operations and to work closely with the industry on problems of greatest importance to development of fishing. This change is obtaining increasing support from members of the industry but meets with opposition from some quarters for it represents a reversal of the old Japanese concept that the industry functions for the benefit of the government.

IV. WILDLIFE

The wildlife of Japan supplies a considerable amount of animal protein to the rural population in areas where such proteins are most needed. Most hunting rights are owned by hunting associations and are operated to provide game for market rather than recreation. Food shortages during the war caused excessive killing, resulting in decreases in wildlife so great that even song birds are rarely seen. Furthermore the control of harmful insects by birds has been greatly reduced. The Japanese have been encouraged and advised in revising their game laws to provide protection for beneficial birds and other wildlife and to make possible the maximum sustained yield from these resources, whether for commercial shooting or sport. They also have been assisted in studies of fur seals to provide information needed in development of international treaties bearing on the exploitation of fur seals.

V. FOREST CONDITIONS

1. Introduction: a. Although Japan has the highest ratio between forest area and cultivated land of any country outside of the tropics and Finland, it is faced with a serious forest situation. Stating the problem in its simplest terms, Japan's timber is being cut much faster than it is being replaced through growth.

b. Forests occupy 68 percent of the total land area and are of paramount importance in the general land use pattern of the country. The resources of these forests are vital to the national welfare through their contribution to a self-sustaining economy. Forests are especially vital to the Japanese people as a source of fuel and timber since per capita consumption of wood in Japan is one of the highest in the world. Because of the extremely mountainous terrain which requires forest cover as watershed protection, the forests have an important influence on food and power production; they regulate water supply, control floods, and prevent erosion and silting of reservoirs and farm lands.

c. Despite their vast forest areas the Japanese do not have timber resources to meet their needs indefinitely without rigid conservation measures. Present demands are being met at the expense of future requirements. Japan has imported wood since World War I, when this policy was adopted in order to preserve the balance between use and growth. Importation of wood continued, in general, until the late 1920's when

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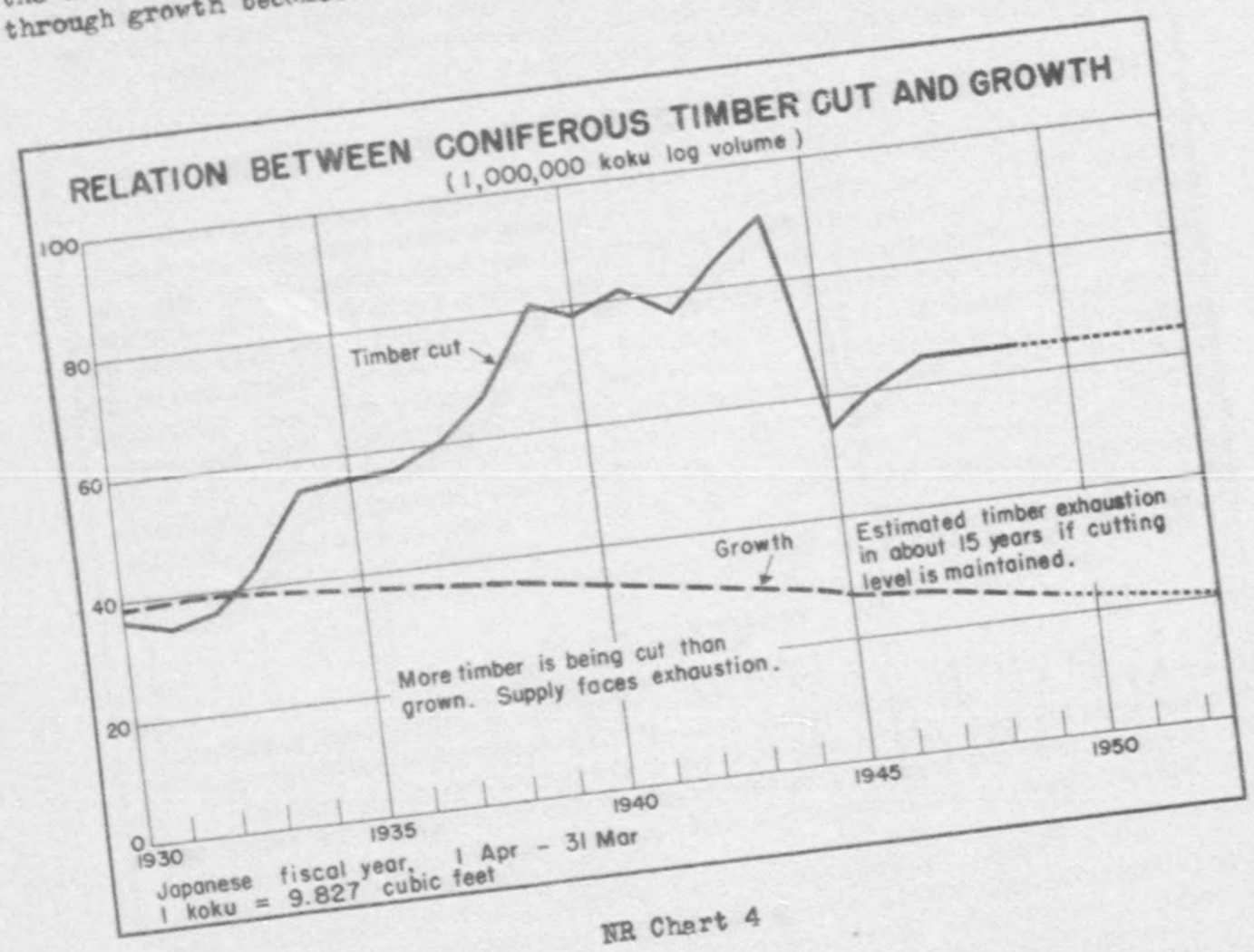
the demands of Japan's militarists made it necessary to expend export credits on more strategic war materials. As a result of this change in policy, Japan's forests were subjected to overcutting to such an extent that during the years of World War II the drain reached four times the amount of growth. During the Occupation, demands have continued at a high level. Wood has been used primarily for essential reconstruction and rehabilitation, but, no matter how great the need, the result is that the coniferous timber stands are being overcut at an annual rate more than two and one-half times the growth. If this rate of overcutting continues, it is estimated that these important stands of timber will be virtually exhausted within 15 years. Nevertheless, current production plans of the Japanese call for increased cutting in forests during the next five years. This situation is made even more serious by the fact that, in successive years of overcutting, replacement of timber through growth becomes less and less (NR Chart 4).



NR Chart 4

d. The effects of overexploitation are evident through increasing damages to agricultural areas, hydroelectric and irrigation developments, and lines of transportation and communications, as a result of extensive soil erosion and increasing incidence of floods.

e. Other important contributing factors to Japanese forestry problems have been and are insufficient reforestation, inadequate research and extension, and depredation of pine bark beetles. Of the forest land in Japan, less than 25 percent supports coniferous timber stands which supply nearly 85 percent of all timber cut, and 20 percent supports broadleaved timber stands from which 15 percent of the

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timber is cut. Of the total forest areas at present 11 percent needs reforestation, another 11 percent is wasteland (called "genya"), and nearly 10 percent is inaccessible.

f. There is no easy formula for the rapid correction of the results of poor forestry practices in the past. Trees grow slowly, and forest programs require many years. It is estimated that 80 to 100 years will be required to rehabilitate Japan's forests to approach maximum productivity.

g. In order to shorten and bridge the gap between the existing timber supply and the time when new resources come into harvest, the Natural Resources Section is furnishing guidance and advice to various Japanese Government agencies on the following specific programs: improved silvicultural practices, reforestation, wood preservation, opening of inaccessible forests, use of wood substitutes, improved timber utilization processes, reduction of timber cut by importation, and embargo of raw timber exports.

h. For more than three years, the forest situation has been studied and data gathered by the Natural Resources Section. These data illustrate the complete reliance of the Japanese on their forests. They show the inadequacy of present forest production and the urgent need for remedial action. On the basis of this information the Natural Resources Section is now taking steps to formulate an over-all forest conservation policy, and through guidance and assistance to the Japanese to establish adequate management plans as a partial solution to the forest and timber supply problems. Progress has been made during the past year in the development of programs in forestry education, research, and extension.

2. Fuelwood Forests: a. Fuelwood forests present an important problem which is not generally recognized. These forests are, in the main, the result of clearcutting broadleaved forests. Regrowth has been mostly by stump sprouting and the resulting stands are known as coppice or brush forests. The creation of coppice forests and their continued cutting without regard to potential productivity have resulted in serious forest and soil deterioration. Without special silvicultural treatment, coppice forests produce only low grade timber and that at a reduced rate. The important problem of the fuelwood forest is to increase productivity on a portion of the area to the demand level, by special cultural treatment. The remainder of the area can be converted to coniferous stands, which will result in greatly increased timber production. The productivity of the fuelwood forests of Japan is a minor fraction of the maximum possible; it can be increased to three to five times the present yield when recommended practices have been implemented fully.

b. Efforts are being made to increase yields of these fuelwood forests. Forest legislation providing for improved forest management practices on private forest lands is being formulated. Under the Visiting Expert Program, a forest management specialist is being obtained to analyze the hardwood forest situation and make specific recommendations to this end.

3. Management Practices: Better silvicultural practices can improve the timber supply situation immediately. Major advances can be made by the implementation of silvicultural practices which have been recommended by Natural Resources Section foresters. The institution of selective cutting practices on private forest lands is particularly important in Japan, where the existing method of forest management is to clearcut the timber stands. A serious flood and erosion problem has resulted from this practice. Records indicate that enormous losses have

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occurred through damage to food crops and soil. Erosion of forest soils is resulting in deterioration of site quality. Silting in of reservoirs is causing damage to hydroelectric installations and reducing storage capacity of water for irrigation and domestic use. The application of selective cutting practices to the timber stands will immediately prevent an increase in the seriousness of this situation. Adoption of this cutting system would immediately arrest the enlargement of the area in need of reforestation, increase the growth rate of existing stands to many times their present production, materially reduce loss through soil erosion and floods, and conserve forest soil resources. Legislation is being formulated by the Japanese to provide for these improved forest management practices on all forest lands.

4. Reforestation: The need for reforestation is recognized by foresters to be one of Japan's most important national problems. At present, nearly 8,000,000 acres need reforesting. With NR guidance, plans have been prepared by the Forestry Agency, in cooperation with prefectural officials and private owners, to reforest these 8,000,000 acres. Reforestation of these lands will contribute substantially toward solving the national timber supply problem. In addition to the above program, a five-year school reforestation program envisaging the planting of 250,000 acres of trees by school children was launched in 1949.

5. Insect Control: Another serious problem in Japan is the elimination of extensive timber losses resulting from insect infestations. Several species of pine bark beetles in Japan are taking a heavy toll of the pine timber. Losses from insect damage more than offset the total annual increment in these stands. More than enough timber to supply Japan's entire annual need for railroad ties is killed each year by pine bark beetles. During 1948 the Japanese estimate that they lost more than 53,000,000 cubic feet of pine timber through damage by these insects. The significance of these losses is demonstrated by the fact that at present coniferous timber, of which pine is an important component, is supplying more than 85 percent of Japan's sawlog requirements. Much of the damaged volume is salvaged, but a large portion is so scattered through infested areas as to be economically unusable and unsalvagable. High costs of control, lack of recognition of the seriousness of infestation, ineffective control measures, and lack of technological knowledge of preventive measures have been serious handicaps to the control program. Efforts are currently being made to obtain additional technicians in this field to furnish advice and guidance to the Japanese and introduce the newest technological developments for prevention and control of the pine bark beetle. Intensified campaigning for the control of the present infestation and prevention of new attacks by the pine bark beetle are being encouraged by the Natural Resources Section.

6. Forestry Extension Programs: a. Important work in promoting good forestry practices has been accomplished under the guidance of NR technicians in forest extension. One phase of the agricultural extension program started early in 1948 was the extension forestry program which was initiated in Fukushima Prefecture. This program is designed to improve farm forestry practices. The general procedure followed in organizing these programs is to establish a prefectural extension committee, after which the directors and staff of technical specialists are selected, and actual work undertaken.

b. Early in 1948, the Japanese Agricultural Improvement Bureau, in cooperation with the Forestry Agency, issued a bulletin to the prefectural governors encouraging the inclusion of a technical forester on the prefectural extension staff of specialists. Further

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progress in forest extension was realized when the Forestry Agency was reorganized into three divisions, one of which was designated as the Extension Division. New legislation is being drafted to establish an effective forestry extension organization in the Japanese Government. This legislation will provide for a minimum of seven extension specialists at the central government level who will operate as direct liaison officers between the Central Forest Experiment Station and the prefectural forestry offices. The new bill will provide for the addition of one or two extension specialists in each prefectural forestry office, as well as 1,100 field extension agents to be assigned on the basis of one agent for each five forest owners' associations. Under the proposed bill the prefectural forest extension agents would be subsidized by the central government to the extent of 50 percent of their annual salary. This plan visualizes an energetic program of forest education and extension. In scope, it would affect all private forest owners in Japan. The importance of this program is indicated by the fact that five million small private owners produce nearly 70 percent of the timber being consumed in Japan. Forest industry which is largely dependent upon this production for its raw material is the second most important industry in Japan. The implementation of this program is dependent upon the appropriation of funds in the Japanese budget for the 1950 fiscal year.

7. Utilization of Materials: Relatively complete utilization of raw forest products is practiced in Japan. Slashings from logging operations and materials which cannot be used for the production of merchantable timber are used for firewood or converted into charcoal. However, improvement of milling processes is definitely needed in Japan. Lack of proper practices frequently results in logs being used for purposes which do not utilize their maximum worth. With NR guidance and encouragement, the Japanese are attempting to use sawmill waste for the production of alcohol and yeast by the process of wood saccharification. Research on wood saccharification to investigate the latest technologies for the production of alcohol and yeast is being conducted at several universities. Three industrial concerns have installed pilot plant equipment for wood saccharification and have indicated their intention to install large-scale operations, providing experimental operations prove successful. Two of the largest pulp and paper mills located in Hokkaido have installed equipment for the production of alcohol from sulfite waste liquors. These units were put into operation early in 1949. One mill has a capacity of 360 kiloliters of 95 percent ethyl alcohol per year and the other a capacity of 600 kiloliters per year. These developments represent distinct progress in improving the utilization of timber resources.

8. Wood Pulp: The wood chemical industry is of major importance to the economy of Japan. This industry not only provides all of the paper and paper products so important to the welfare of the people, but has the potential ability to supply at least 50 percent of their textile requirements. The principal raw material for this industry is timber, which is being consumed at a rate far exceeding its replacement through growth. Technologists for the Supreme Commander for the Allied Powers have been instrumental in improving the efficiency of the use of wood for the manufacture of wood pulp. Improved technology has resulted in increasing wood pulp yields about 30 percent using the same amount of raw material with no changes in processing plants. Further advice and guidance in the utilization of raw materials, by improving technology for the use of broadleaved species and the recovery of by-products, is necessary to increase utilization of timber resources for wood pulp.

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9. Ultimate Outlook: a. As a result of the intensive study and investigation of forest conditions and problems during the recent years, the true nature of the Japanese forest situation is now being recognized for the first time. Initial progress in improving the situation has been achieved. Success of the programs of recovery and rehabilitation can be accomplished through continued guidance, advice, and material assistance.

b. Japan's forest situation has not reached the point of irretrievable decline. With intelligent, constructive management, complete forest rehabilitation can be accomplished. Japan then could look forward to the time when there will be forests enough to support the timber and fuelwood needs of an even larger population, as well as a surplus to allow exportation of wood. When that time comes, the forests will contribute their full share toward a stable economy and a lasting prosperity for the entire Japanese nation.

VI. MINING AND GEOLOGY

1. Introduction: a. Two major requirements in an industrial economy are a supply of minerals and metals and a source of energy which can provide adequate power for industrial operation. On the basis of estimated 1950 requirements, the mines of Japan are providing at current rates of production one-sixth of its copper; one-seventh of its lead; about seven-eighths of its zinc; less than one-fifth of its iron ore; one-half of its sulfur; five-sixths of its coal; and about one-seventh of its petroleum. It is estimated that production of coal, pyrite, sulfur, and possibly zinc can be increased to meet full requirements, with some surplus for export, and that Japan can produce three-fourths of the copper it needs, and lesser amounts of other minerals. The greatest possible utilization of indigenous minerals is extremely important, not only because foreign exchange will be limited and the United States will have to finance imports, but because for some years Japan probably will be forced to buy on a seller's market. Available foreign supplies will not be plentiful.

b. Although Japan's requirements are far in excess of its production of minerals and metals, because of the fuel and power shortage the actual demand for mine products has been, in some instances, less than production. As industrial activity continues to increase, the demand for mine products will grow. The Natural Resources Section has attempted to place the mining industry in a position to meet this demand when it does come. Improved drilling and blasting methods have been introduced; changes have been suggested in stoping methods to cut down the amount of waste rock being mined in narrow veins in Japan's ore deposits; development work, which was seriously neglected during the war, has been encouraged; new mining techniques have been advocated to raise efficiency in Japanese mines.

2. Metallurgy: In the metallurgical industry, operating as it is at but a fraction of capacity because of power, fuel, and raw material shortages, the principal step which can be taken is to prepare to meet a rising demand for the products of the industry by improving technical methods. Possibilities for improvement are exemplified by a copper refinery in Tochigi, where introduction of an improved method in the final step of copper refining reduced fuel consumption 27 percent, while the purity of copper produced was increased. Improved techniques such as this can do much to reduce the fuel shortage.

3. Petrolsum: a. Japan's production of crude oil from its own wells has never been much over 10 percent of its total crude oil requirements. However, any petroleum produced in Japan at least reduces the

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quantity which must be imported. Furthermore, indigenous oil is important because several types of special purpose oils are derived almost entirely from Japanese sources. At the beginning of the Occupation almost all of the known potential oil producing areas had been drilled, and the exploration program was falling far short of meeting the need for new reserves of petroleum. As an example of the situation that existed, the 1946-47 exploration and exploitation drilling program was bringing only one successful producing well out of every twelve which were drilled. This condition resulted from the lack of acceptable basic information. This is particularly true of the exploitation drilling program which merely involves drilling wells in fields which supposedly are thoroughly mapped. As a result of the entire 1946-47 program, only 20,000 kiloliters of new reserves were discovered, slightly more than one month's production at current rates.

b. Under guidance of SCAP, a long-range petroleum exploration program was set up by the Petroleum Resources Development Promotion Council, formerly the Petroleum Exploration Advancement Committee. The Council, which was organized in January 1947, is composed of leading petroleum geologists from the Imperial Oil Company, Japanese Geological Survey, Mining Bureau, and Japanese universities. As a direct result of the work of the committee in guiding the petroleum program, in 1947-48 one out of three exploitation wells was successful, and one out of six exploration wells was a producer. Two small new fields with recoverable reserves of some 200,000 kiloliters of petroleum were discovered. A more significant development in the petroleum picture is the discovery that petroleum production may possibly be obtained in Hokkaido from large areas previously overlooked by the Japanese. Much of the 1948-49 program was directed toward intensive work in that area.

4. Pyrites: a. Pyrites are used to produce sulfuric acid which in turn is used in Japan to manufacture two principal fertilizers, superphosphate and ammonium sulfate (nitrogenous fertilizer), as well as other important products. During World War II, pyrite mines were exploited by overproduction and neglect of development and maintenance. The most accessible ore was mined, and back filling was neglected, leaving large ore reserves unavailable for immediate extraction. Machinery and equipment deteriorated from lack of necessary repairs and replacements.

b. In 1946, domestic pyrite production was 620,000 metric tons. With guidance from the Natural Resources Section, production was raised to 1,200,000 metric tons in 1948 and is expected to rise to approximately 1,540,000 metric tons in the 1951 fiscal year. The annual needs for pyrite are about 1,700,000 metric tons, so imports have been necessary to supplement indigenous production. The increased efficiency obtained through improved mining methods introduced by American experts thus has reduced the imports needed to sustain the Japanese economy. Eventually Japan is expected to be able to provide enough pyrite from domestic sources to eliminate the need for further imports.

5. Phosphate Rock: a. Japan has negligible supplies of the raw material (phosphate rock) which, in addition to pyrites, is needed to produce superphosphate fertilizer for agricultural uses. A survey of the nearest and most dependable sources of phosphate rock indicated that Angaur Island in the Palau Group has the most available deposits.

b. The Angaur Project, which includes the mining, drying, and shipping to Japan of phosphate rock from the island, therefore was organized under the supervision of the Natural Resources Section and has supplied a substantial proportion of Japan's requirements since 1947.

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c. The only other source of phosphate rock for Japan would require the expenditure of United States funds for the outright purchase of the rock, which would cost approximately $24 per ton to import. The rock brought in from Angaur has cost less than $1.00 per ton, and the net saving in United States funds to be realized during the fiscal years 1950 and 1951 is estimated at $3,000,000 annually.

d. Continued supervision of the Angaur Phosphate Project is required to insure the efficient utilization of American equipment and fuel, as well as to insure compliance with international agreements with respect to the former Mandated Islands.

6. Coking Coal: Another important program has as its principal objective making Japan self-sufficient in coking coal for production of metallurgical coke for use in manufacturing iron and steel. During the past year, coking coal valued at $50,000,000 has been imported from the United States, because Japanese coal is of such a high volatile nature that it must be blended with other low volatile coals in order to produce a usable grade of metallurgical coke. Visiting specialists from the United States are assisting in supervision of coke-making techniques which will permit use of a much smaller percentage of imported coal with the indigenous product.

7. Mine Safety: a. Before and during the war, the mines of Japan were owned by individuals or corporations and operated with heavy government subsidies. The emphasis was on production with little attention paid to safety practices. Injury and damage were considered an expense necessary to production, and such costs were included in the price of material produced, but the problem was otherwise neglected. Japanese miners had little idea of safety, and mine operators neglected what we consider to be their responsibility for the safety of workers. Consequently, accident rates were appalling, many miners forsook their jobs to take up less hazarddus pursuits, and the skills gained by experience were lost through a large turnover of employees.

b. After a study of these conditions, Natural Resources Section mining experts recommended mine safety codes, and the Supreme Commander for the Allied Powers placed responsibility on the Japanese Government for implementing these codes. Guided by American experts, the Japanese established a well-staffed, competent agency to handle the functioning of the mine safety codes. A growing safety consciousness on the part of both management and labor is already evident. Accident rates which in 1946 were 50 deaths and 2,934 injuries per million metric tons of coal produced already have dropped to about 20 deaths and 1,119 injuries per million metric tons. In the United States in 1945 these rates were 1.72 deaths and 82.9 injuries per million tons of coal produced. The mine safety codes have not been in operation long enough to approach maximum effectiveness. However, the results to date indicate that conditions already are so much better that much greater improvement can be anticipated. Eventually safety records comparable to those of the United States may be achieved.

8. Mining Laws: Natural Resources Section technicians and experts also have advised the Japanese Government regarding the objectives of affording greater opportunities for individuals to engage in mining operations and thereby extend the development of mineral resources; ending monopolistic practices by shortening the period of prospecting rights and requiring actual development work by those desiring to retain mining claims; and establishing a more effective means of settling disputes between farmers and mine operators for damage to cultivated land by

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mining operations. Although the necessary implementation of these recommendations is not complete, work is well under way and excellent results are anticipated.

9. Summary: Through assistance and advice to the Japanese, the Supreme Commander for the Allied Powers is attempting to maximize the production of needed minerals, metals, and petroleum and to introduce more efficient methods which will promote more effective use of Japan's scarce supplies. Some of the programs are designed to insure maximum long-term production in addition to increasing the immediate supply. Results to date have shown that this program is a sound one.

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THE JAPANESE LONG-LINE FISHERY FOR TUNAS

By Sidney Shapiro

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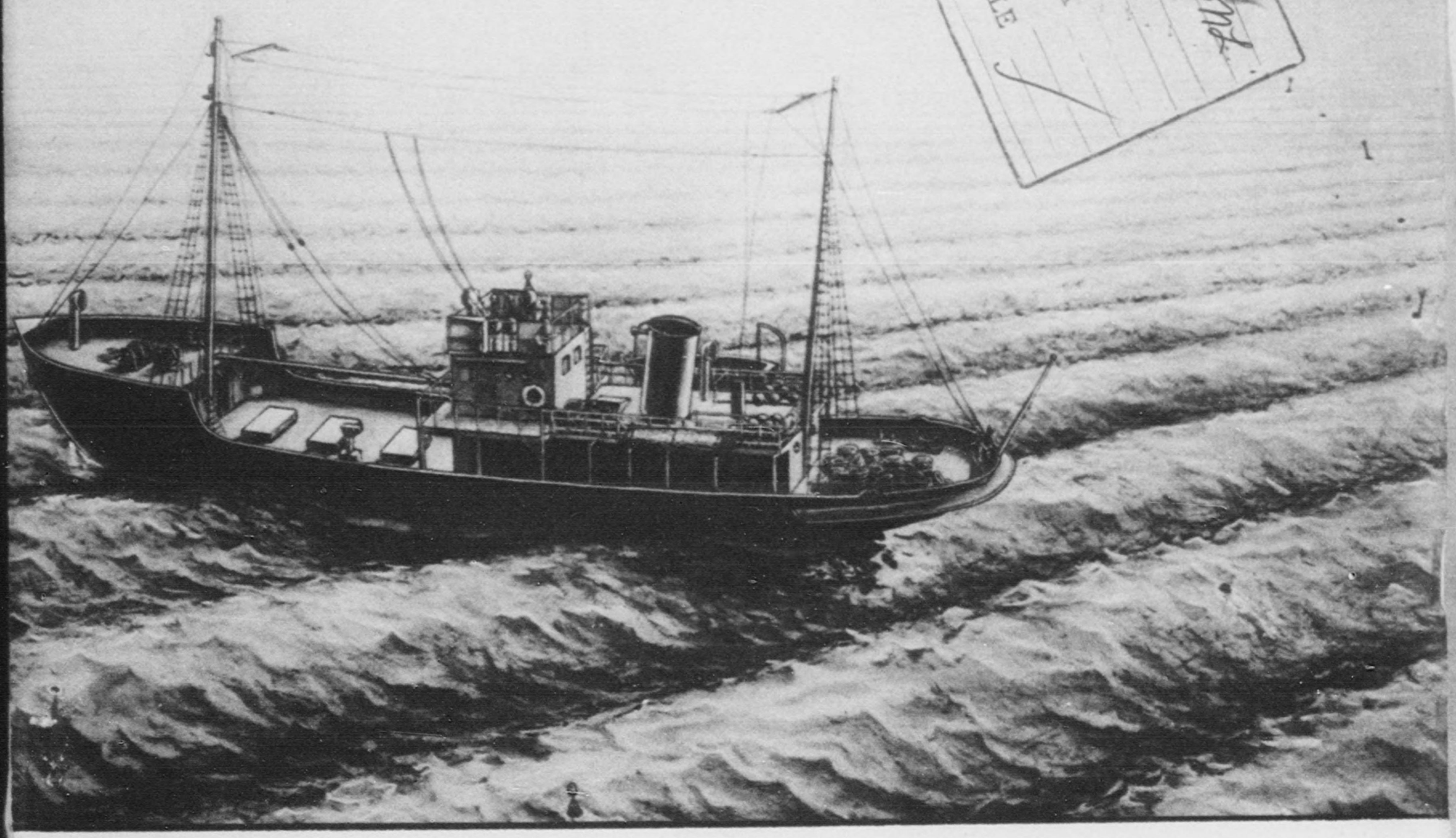

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THE JAPANESE LONG-LINE FISHERY FOR TUNAS

By Sidney Shapiro*

ABSTRACT

Under normal conditions, the Japanese fishing industry has been able to produce the largest tuna catch made by any single nation--recording during the prewar years (1936-40) an annual catch in the neighborhood of 400 million pounds. Of this amount, about 65 percent (or 260 million pounds) was taken by the surface-fishing pole-and-line gear and 25 percent (or 100 million pounds) by the subsurface-fishing long-line gear. Other gear of minor importance, such as, the set net, drift net, circling net, and trolling jig, accounted for the remaining 10 percent of the catch.

The long-line gear is essentially a method by which hooks are lowered to fishing depths of about 100 to 350 feet below surface level. The Japanese have thus been able to obtain a part of their tuna catch at times and from places which could otherwise not be tapped by the surface-fishing methods widely in use in Japan and other nations throughout the world. Among the more important of the areas developed by the Japanese long-line fishermen are the winter albacore grounds located near Midway Island in the mid-Pacific, the tuna grounds of the Ryukyu Archipelago, and the yellowfin tuna grounds in the southwest Pacific Ocean.

Two main types of long-line gear, the construction and use of which are described in this report, have been developed by the Japanese--the albacore type for subsurface fishing at depths of about 100 to 200 feet, and the black-tuna type for deeper fishing at about 150 to 350 feet. The albacore-type gear generally catches albacore and big-eyed tuna, the black-tuna type takes black, big-eyed, and yellowfin tunas. Although each type of gear yields primarily an abundance of the species for which it has been designed, the catch composition is usually varied, and some marlins, swordfish, and sharks, as well as the various tunas, may be taken on an albacore or black tuna long line.

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NOTE: The data presented herewith have been obtained during an 18-month tour of duty with the Fisheries Division, Natural Resources Section, Supreme Commander for the Allied Powers (SCAP), Tokyo, Japan. Assistance in arranging field trips to observe the operation of the long-line gear and in supplying detailed information regarding its construction and use has been given by Mr. Shigene Takayama, Chief, Fishing Gear Section, Tokai Fisheries Experimental Station, Tokyo, Japan. Mr. Katsuyuki Kita, draftsman for Fisheries Division, Natural Resources Section, and Miss Alice Hunt, Pacific Oceanic Fishery Investigations, Fish and Wildlife Service, Honolulu, T. H., have prepared the illustrations. The paper was written while the author was assigned to the Pacific Oceanic Fishery Investigations of the U. S. Fish and Wildlife Service.

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The Japanese experience in developing a long-line fishery has shown that a period of intensive exploration has been necessary to locate productive fishing grounds. Since it was difficult to detect the presence of the far-ranging tunas when they are swimming at subsurface levels in many parts of a vast ocean, commercial vessels were unwilling to invest the money and effort required for initial operations. Therefore, Japanese national and prefectural fisheries organizations sponsored the exploratory phase needed to develop a sizable offshore long-line fishery. Over a period of several decades, their exploratory vessels compiled and disseminated to the industry information on the location of productive grounds and the hydrographic conditions under which the best catches were likely to be made. Thus, data on the locality of best catch, when correlated with information on optimum water temperatures, configuration of ocean bottom, and type of ocean current, have been useful in indicating to commercial vessels the situations under which the long-line gear can be operated to maximum advantage.

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INTRODUCTION

Tuna fishing is carried on to some degree by almost every maritime country located in the tropical and temperate zones of the world. However, the resource has been exploited to support thriving fisheries only where a large consumer's market for tuna exists and where fishing effort is intensive and of a progressive nature. Of the many regions where tuna fishing is practiced, the most important are those located along the Pacific coast of North and South America and in the western Pacific. Production from these regions, largely by the United States and Japan, respectively, has accounted for the bulk of the world's tuna catch. Under normal conditions these countries have taken in excess of 90 percent of all tunas caught throughout the world during the last several decades.

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A further comparison of production statistics shows that in the prewar years (1936-40) the Japanese recorded the largest annual catch of tuna and tuna-like fish[1/] obtained by any single nation. During this five-year period an annual average production of about 400 million pounds was attained by vessels operating from Japan Proper. Although the United States tuna fisheries have expanded to major proportions during the past several decades, they have still not reached the level of normal Japanese production. The peak catch for United States tuna vessels has been recorded in the latest production figures available--the 1949 catch being 332 million pounds, or about 80 percent of the normal prewar Japanese catch.

The American catch was obtained solely by surface-fishing tuna vessels. In a representative year, 1940, the pole-and-line live-bait fishing gear contributed approximately 70 percent to the total tuna catch, and purse seines about 25 percent. Trolling for albacore accounted largely for the remaining five percent.

The major part of the Japanese catch was also obtained through the use of the pole-and-line gear. On the basis of personal observation and analysis of Japanese statistical records, the pole-and-line catch is estimated to be about 65 percent of a normal year's total. The second most important Japanese tuna gear was the subsurface-fishing long line, and this caught approximately 25 percent (or 100 million pounds) of tunas. Other gear of minor importance, such as the set (or trap) net, the drift net, the circling net, and the trolling jig, accounted for the remaining 10 percent of the catch.

The expansion of the American tuna industry has come about primarily through an increase in the Pacific fishing fleet and the continued extension of the fishing grounds to greater distances from home ports, so that many of the major fishing areas are now located in such distant regions as the ocean waters adjacent to Central and South American countries. Progress in the development of the Japanese tuna industry has been due, in part, to these same factors--the building of a larger fleet and the intensification of fishing operations from home waters to more distant localities. However, the development of the Japanese tuna fisheries has also been furthered by the introduction of the long-line gear, and exploitation of subsurface waters has thus been possible. That subsurface fishing has contributed markedly to the Japanese catch has been noted above--approximately 100 million pounds of tunas being taken from ocean waters not reached by surface-fishing gear.

American expansion in the tuna industry is continuing. This is evident from the fact that, in their search for new fishing grounds, many of the larger fishing companies have under serious consideration the possibility of extending their operations westward into the mid-Pacific regions. Indications are that such operations may eventually materialize, but it is also possible that the American fisherman has neglected sources of supply closer to home--and those are the deeper ocean waters which cannot be fished by the pole-and-line or the purse-seine gear.

The use of the long-line gear for subsurface fishing also offers the American tuna fisherman an opportunity to continue peak operations throughout the year. Although the long-line gear has been operated by the Japanese at all seasons in a

1/ Tuna long-line boats operating in the offshore pelagic waters take, in addition to tunas, a large number of marlins, swordfish, and sailfish. The Japanese generally include these species in their tabulation of the tuna catch. During the 1936-40 period, a breakdown by species was attempted and statistical records show an average yearly marlin, swordfish, and sailfish catch of slightly over 15 million pounds. However, this recorded catch may be less than the actual, since a number of vessels probably continued to report these species as tunas.

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number of areas, the most important catches have been made during the winter months in the central Pacific near Midway Island and in the Ryukyu area. American fishermen now carry on the bulk of their tuna operations during the spring, summer, and fall months, with a period of minor activity during the winter months, principally January and February. The use of the long-line gear may aid in locating and making available to the Americans such desirable species as the yellowfin tuna, the bluefin tuna, and the albacore at times of the year when they cannot be caught by surface-fishing methods. In this respect the waters located at a distance off the northwestern United States might yield a winter fishery for the albacore and the big-eyed tuna (a species presently not taken by American fishermen), as they have for the Japanese in the far and midwestern Pacific. Also, yellowfin tuna grounds, which can be fished by the long-line gear throughout the year, may materialize in the tropical eastern Pacific, as they have in the vicinity of the southwestern Pacific islands.

The purpose of this report is to present material that may assist American fishermen in the construction and operation of the long-line gear. This method has produced a large over-all catch in the western Pacific, but American tuna fishermen may not consider the unit-vessel catch obtained by the Japanese sufficiently large to warrant its adoption and continued use in the eastern Pacific. Japanese tuna vessels—both those that fish with the pole-and-line gear on the surface and with the long-line gear below ocean surface—would be considered inefficient by American standards. A 100-foot Japanese vessel, with a crew of 50 to 60 men for pole-and-line fishing or 20 to 30 men for long-line fishing, will catch an average of 40 to 50 metric tons of tuna on a voyage of four to six weeks. This low efficiency of operation is typical of many Japanese fisheries, for labor costs to their vessel owners are negligible by comparison with those in the American tuna industry. Should American tuna vessels show interest in adopting the long-line gear as a major tuna-fishing method, it may be necessary to modify its operation by increased mechanization, or by more efficient handling of the gear. Thus, smaller crews may be able to operate the gear with a correspondingly larger return for the unit of effort expended. The information regarding the Japanese long-line gear is, therefore, presented to American fishermen only as an initial step in guiding them towards the development of a subsurface fishery for tunas.

ORIGIN OF THE LONG-LINE GEAR

The early development of the Japanese long-line gear was associated with the black tuna (Figure 1) fishery. Bones unearthed from excavations of shell mounds in the northeastern Kanto and the mid-central Tohoku regions of Honshu, Japan, have been indentified as those of the black tuna,[2/] indicating that this species has been consumed by the people of Japan since ancient times. The flesh of this fish has always been prized by the Japanese, and is marketable in any quantity for use chiefly as "sashimi" (raw fish, sliced and eaten as an appetizer).

Prior to the advent of modern mechanized methods for commercial fishing operations, the bulk of the Japanese tuna catch was obtained from coastal waters primarily by pole and line, set (or trap) net, and drift net. The black tuna, a wide-ranging pelagic species that approaches close to the Japanese coast during its annual migration, was generally taken by huge set nets placed in shallow waters adjacent to the shore. This method of trap fishing was, and still is, used effectively to obtain the black tunas that migrate into waters less than 200 feet deep.

2/ The black tuna, Thunnus orientalis, is comparable to the American Pacific coast bluefin tuna, Thunnus thynnus, but adequate studies have not been made to determine the exact relationship of the two forms.

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FIGURE 1 - BLACK TUNA (THUNNUS ORIENTALIS) LANDED AT JAPANESE FISHING PORT OF SHIOGAMA. WEIGHT ABOUT 500 POUNDS.

However, the species was also occasionally taken by hook-and-line fishermen operating boats where waters were deeper than 200 feet. Fishermen were thus aware of the possibility of expanding the black tuna fishery to deeper waters, but it was desirable that a more efficient gear be devised for obtaining large fish from levels below the surface of the water.

The long-line gear, as now used in the tuna industry, was initially constructed through the attempts of the fishermen to obtain black tunas from subsurface waters. One of the first available records of the application of a long-line gear to the capture of this species was by the fishermen of Mera, a small fishing village located at the entrance to Tokyo Bay. The original long line had been imported from Wakayama Prefecture some 250 years previously, and was used locally for diverse fishing operations; the type of operations are unknown. About 1890 the Mera fishermen adapted the gear for tuna long-line fishing with coastal sailing and hand-propelled skiffs. For a number of years the fishermen prospered and the local long-line fishery for the black tuna grew to sizable proportions. However, as the gear was operated most effectively during rough and stormy weather, many lives were lost and, after a decade or so, the fishery almost disappeared because of the fishermen's dislike for the hardships encountered while operating small motorless craft at a distance from shore.

With the introduction of engined vessels into the Japanese tuna fisheries in 1906, a major shift in the intensity of fishing operations resulted and the emphasis changed from coastal to offshore operations. The advent of motorized

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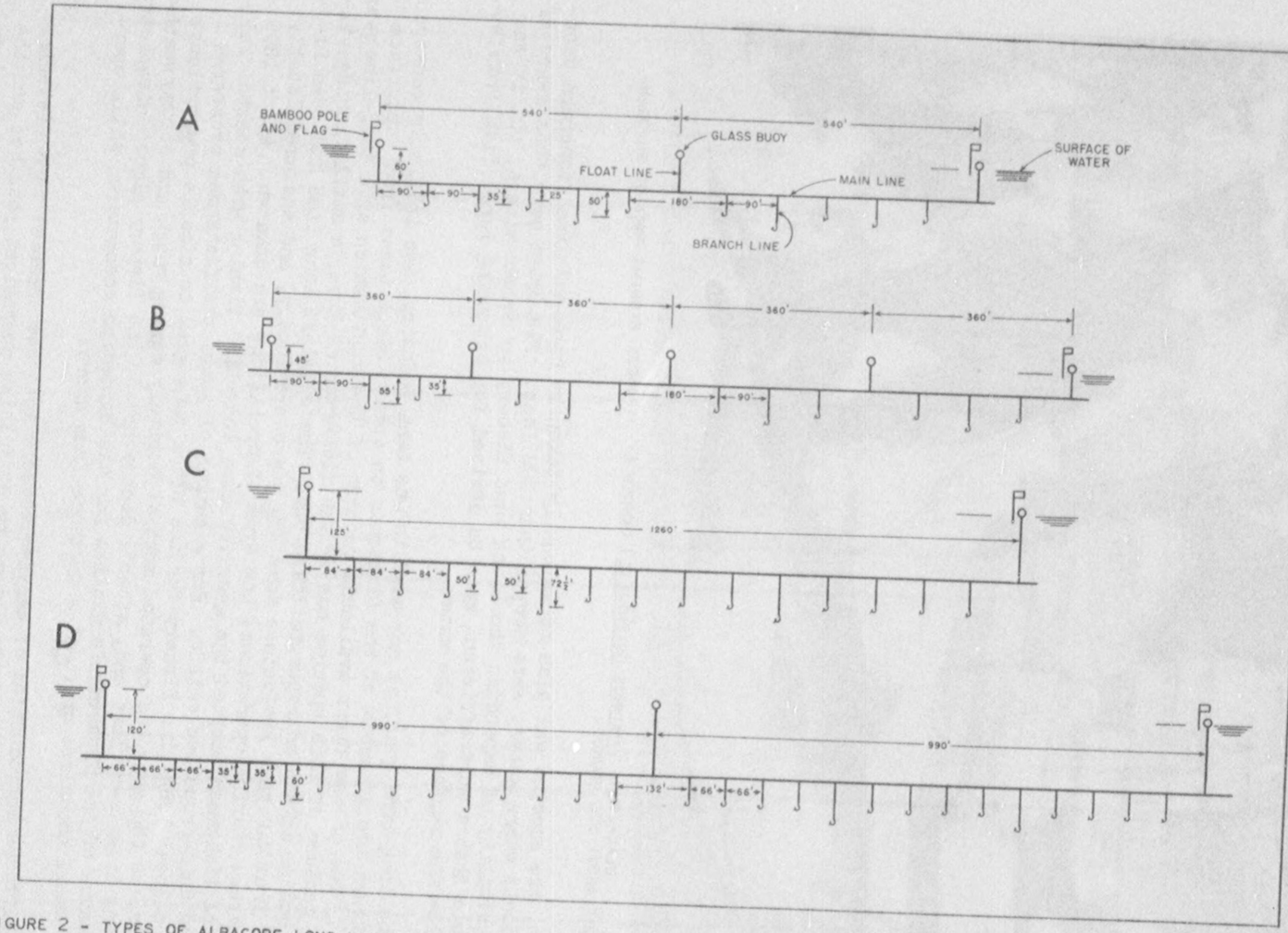

FIGURE 2 - TYPES OF ALBACORE LONG-LINE GEAR FOR SHALLOW SUBSURFACE FISHING. ALBACORE AND BIG-EYED TUNA ARE CAUGHT PRIMARILY WITH THESE GEAR. EACH BASKET (THE DISTANCE BETWEEN TWO FLAG BUOYS) MAY CONTAIN FROM 10 TO 30 BRANCH LINES. SINCE ALL BASKETS OF A LONG LINE ARE SIMILAR, ONLY A SINGLE BASKET OF EACH TYPE IS SHOWN.

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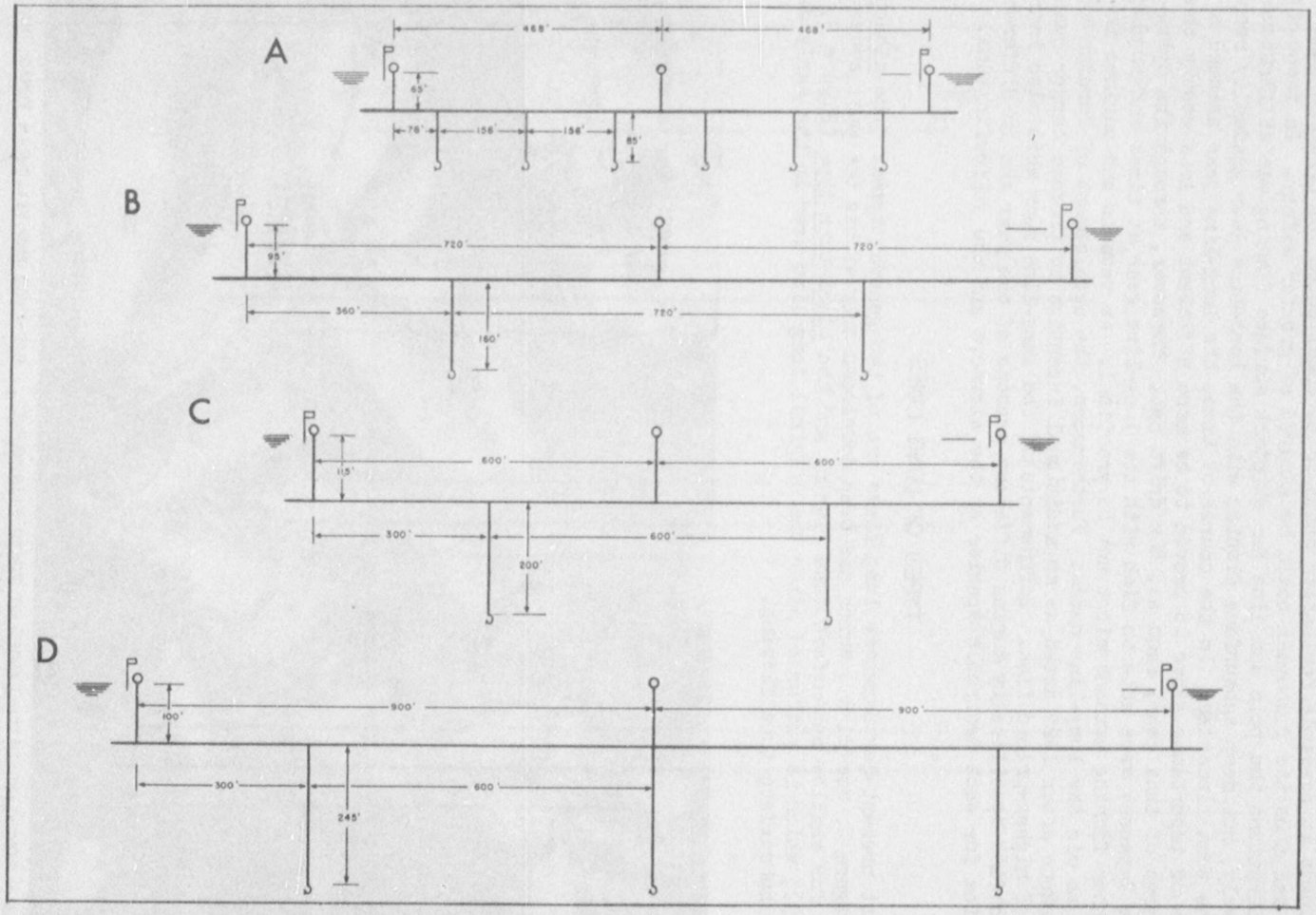

FIGURE 3 - TYPES OF BLACK TUNA LONG-LINE GEAR FOR DEEP SUBSURFACE FISHING. BLACK, YELLOWFIN, AND BIG-EYED TUNAS ARE TAKEN PRIMARILY WITH THESE GEAR. EACH BASKET (THE DISTANCE FROM ONE FLAG BUOY TO THE NEXT) MAY CONTAIN FROM TWO TO TEN BRANCH LINES. THE DEEPER THE GEAR IS DESIGNED TO FISH THE FEWER THE NUMBER OF BRANCH LINES USED. SINCE ALL BASKETS OF A LONG LINE ARE SIMILAR, ONLY A SINGLE BASKET OF EACH TYPE IS SHOWN.

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vessels made it possible for larger boats to be constructed for offshore tuna fishing and thus the fisherman could be assured of greater safety. In these offshore operations the pole and line for skipjack surface fishing was at first used exclusively, but deep subsurface fishing with the long-line gear gradually reentered the tuna fisheries. In the course of time, the long-line gear assumed a position of importance since it proved to be more efficient and less costly than other forms of tuna gear, such as, the drift net. Moreover, through its operation the Japanese were able to fish with the long-line gear at times and in places where other fishing methods might not be practical. As vessels and engines improved, so did the long-line catch. Furthermore, the development of foreign export markets after 1929 acted as an additional incentive to produce larger quantities of higher-priced fish. Refinements of the long-line gear were also introduced to fish specifically during different seasons of the year and in different localities for such desirable species as the albacore and the yellowfin tuna.

TYPES OF LONG LINES

Most present-day Japanese long lines are of two general types: the albacore type (Figure 2, see p. 6), which has been developed only within the past several decades for shallow subsurface tuna fishing and the black-tuna type (Figure 3, see p. 7), which is patterned after the original long line used in the early days of deep subsurface tuna fishing.

FIGURE 4 - LONG-LINE CATCH LANDED AT TOKYO FISH MARKET. BIG-EYED AND YELLOWFIN TUNAS, MARLINS, AND SWORDFISH PREDOMINATE IN THIS CATCH.

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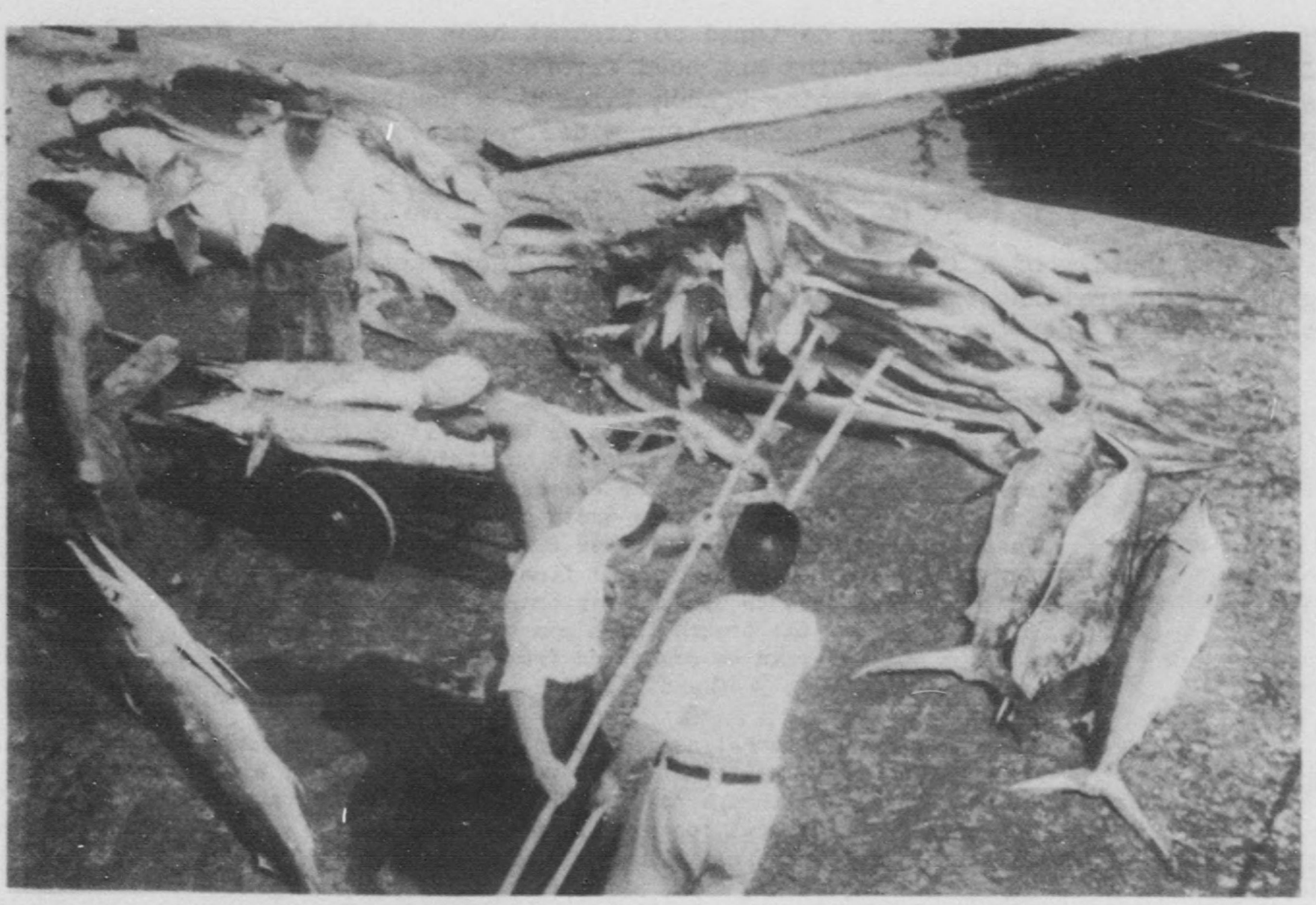

FIGURE 5 - MARLINS AND SHARKS FROM A LONG-LINE CATCH. TOKYO FISH MARKET.

Long lines, specifically designed for catching albacore (Thunnus germo), rapidly came into use when the large export market for canned and frozen white-meat tuna developed subsequent to 1929. Exploratory surveys indicated that albacore, generally, were found swimming closer to the surface than the black tuna and were more densely schooled. As a result, the long lines were constructed to fish at depths of about 100 to 200 feet, and the distance between branch lines was reduced to as little as 50 or 60 feet. Baskets of albacore-type gear were designed to contain from 10 to 30 branch (or hook) lines.

The black tuna long line is used to fish at comparatively deep levels, about 150 to 350 feet or more, and generally the branch lines are spaced at intervals of about 150 to as much as 600 feet. A basket of black tuna gear may contain from 2 to 10 branch lines; the deeper the gear is designed to fish, the fewer the number of branch lines used. In the initial stages of its use, black tunas taken in the deeper waters close to the Japanese coast composed the bulk of the catch but, as fishermen gradually extended their operations further offshore, other species of tunas, such as the yellowfin tuna (Neothunnus macropterus) and the big-eyed tuna (Parathunnus mebachi), were taken in large numbers.

Although each type of gear tends to catch primarily the species for which it has been designed, the catch composition during fishing operations is usually varied (Figures 4 and 5) and marlins (Makaira mitsukurii, M. mazara, and M. marlina), swordfish (Xiphias gladius), sailfish (Istiophorus orientalis), and sharks, as well as the various tunas, may be taken on an albacore or a black tuna long line. In some areas sharks may compose from 10 to 25 percent of the total long-line catch.

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Long lines are sometimes designed to fish at both shallow and deeper levels. In recent years such construction has been favored by many fishermen, since the addition of several deeper-fishing branch lines to a shallow-type gear (Figure 2) permits the catching in certain areas of a wider variety of species.

BASIC FACTORS IN CONSTRUCTING A LONG LINE

The captain of a long-line vessel considers many factors in constructing the gear and determining the dimensions of the different parts. Among the most important of these are:

1. If the main line were placed on or near the surface of the ocean, passing vessels could cut or tangle it in their propellers. Moreover, wave action, if sufficiently severe, could snap this line. For these reasons the main line is suspended by float lines to a depth of at least 40 to 50 feet below surface level (Figures 2 and 3). Often, captains may design their gear with float lines up to 125 feet long--thus enabling them to use shorter branch lines. If the float line is longer, the branch lines can be made correspondingly shorter and more can be suspended from the main line (see page 16 and Figure 2--C and D).

2. The parts of the long-line gear should be arranged so that they may be set quickly while the vessel is running at a uniform speed. Although the long line is composed of numerous parts, all are put together in a manner so as to expedite the handling of the gear (Figures 6 and 7). Before a fishing voyage starts, float, main, and branch lines (including hooks) are tied together and arranged in a basket in proper sequence for setting out (Figure 8). When the long line is used during the actual fishing operation, only flag markers (bamboo poles) and buoys need be added and the hooks baited.

3. Many Japanese vessels, especially those that operate considerable distances from shore, handle large amounts of long line. These vessels may set as much as 50 miles of gear during a single operation. To haul this gear aboard, either by hand or by using a niggerhead, would be a wearisome task. Modern long-line vessels all carry a line hauler (Figure 9), the sheaves of which are coupled either to gears driven by an electric motor or to gears which operate from a shaft powered by the main-engine drive. In order to permit the ready passage over the sheaves of the knots which attach float and branch lines to the main line, the parts of the long line are tied together with knots that are not bulky (Figures 6 and 7). This is an additional convenience in permitting the main line to be hauled in without too much need for stopping the line hauler. A great deal of stopping and starting cuts down sharply on the amount of line that can be handled during a daily operation. Moreover, air compression for excessive starting and stopping of the main engine becomes a serious consideration for the engineer.

4. In the early days of exploratory and commercial long-line fishing operations, data were gathered which showed that the behavior of each tuna species in a particular area was distinctive and that the greatest commercial concentrations of each were found at almost specific depths. For example, the species composition of the long-line catch during the winter season in the waters east and southeast of Japan proper is

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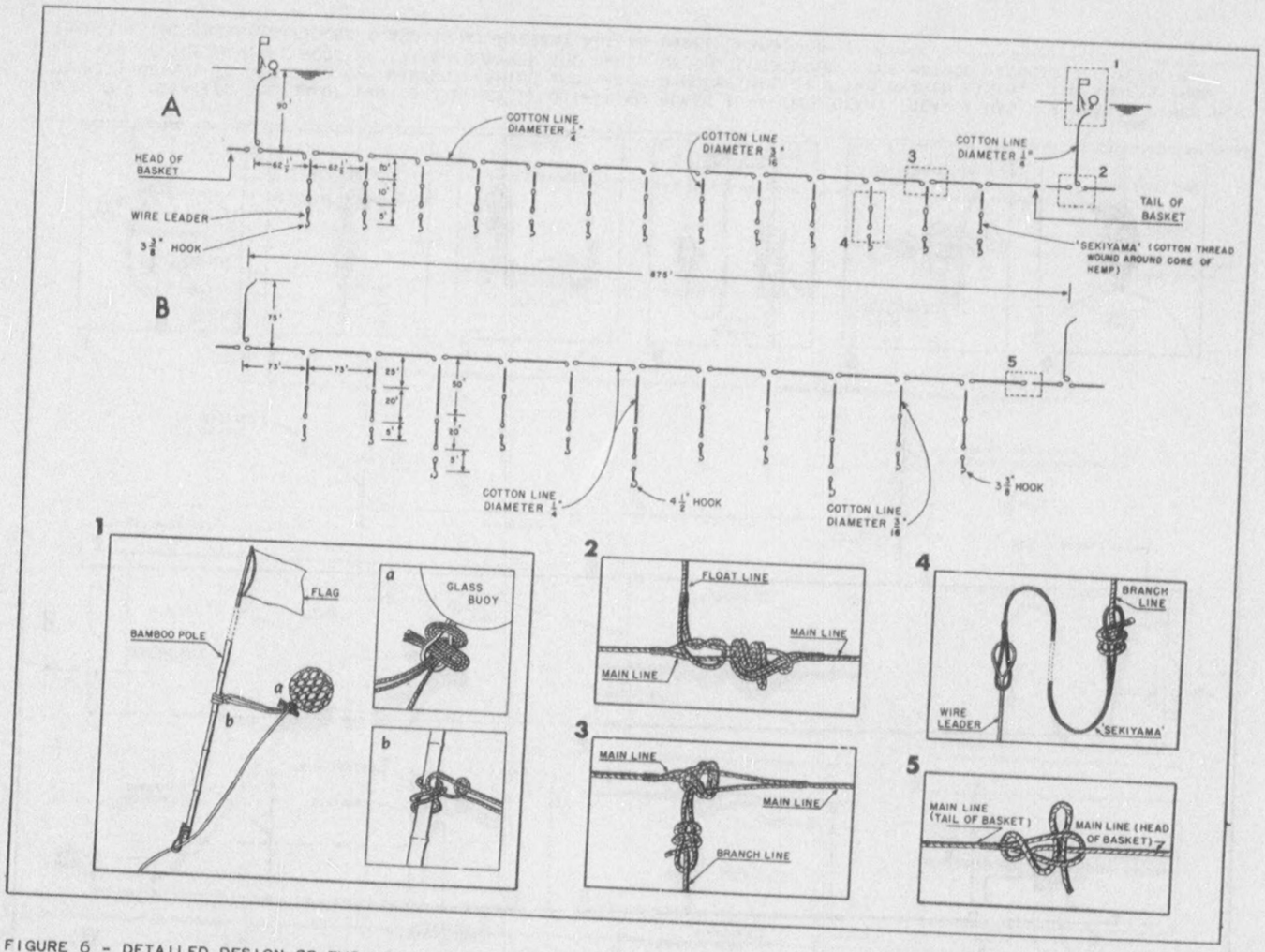

FIGURE 6 - DETAILED DESIGN OF TWO LONG LINES ILLUSTRATING ALBACORE-TYPE GEAR. GEAR A HAS 13 BRANCH LINES OF EQUAL LENGTH ON EACH BASKET OF MAIN LINE; GEAR B HAS 11 BRANCH LINES OF UNEQUAL LENGTH. THE INSETS SHOW THE MANNER IN WHICH THE PARTS OF THE LINE ARE TIED TOGETHER. THIS METHOD OF TYING IS THE MOST RECENT DEVELOPED BY THE JAPANESE FISHERMEN.

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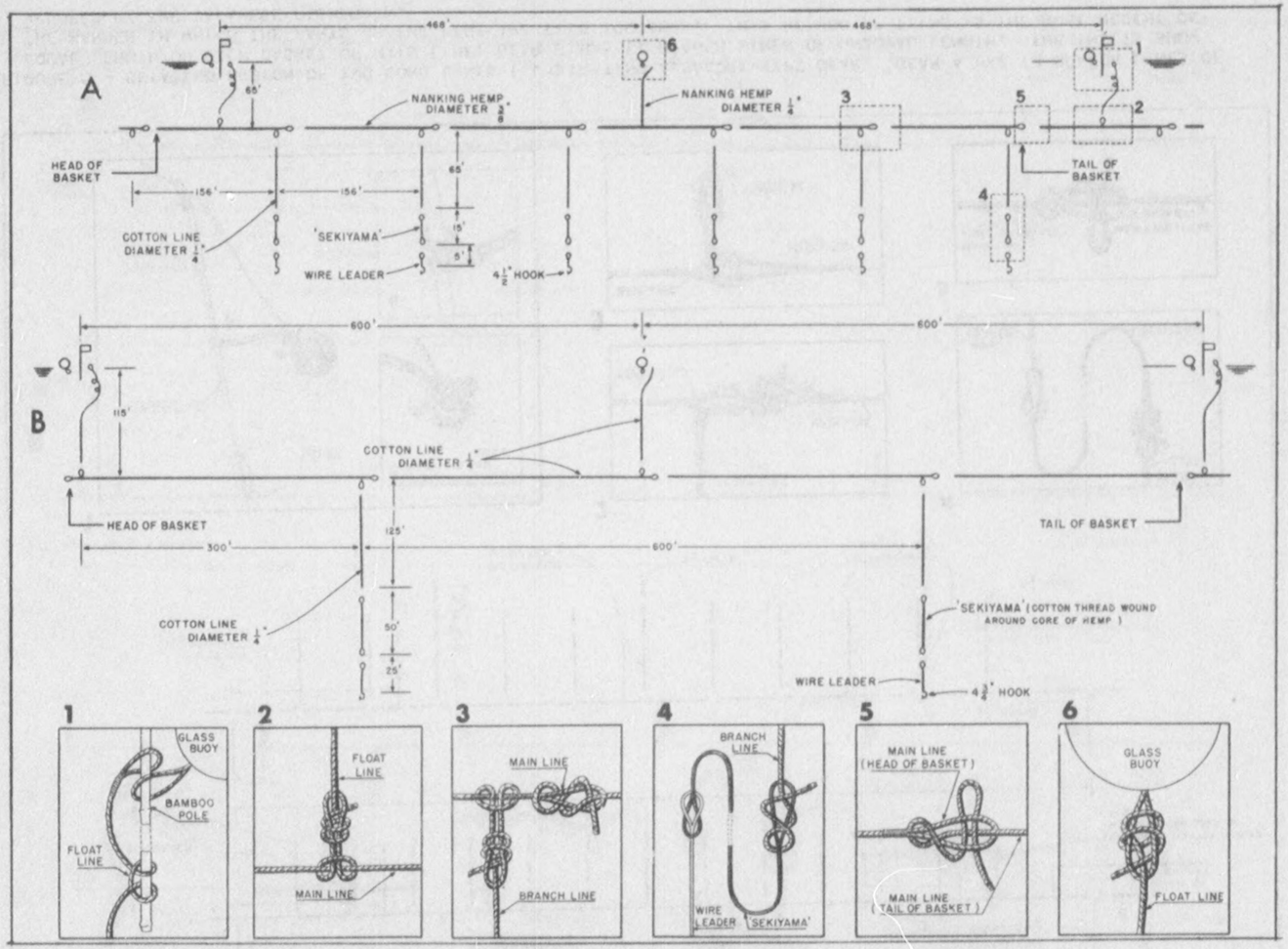

FIGURE 7 - DETAILED DESIGN OF TWO LONG LINES ILLUSTRATING BLACK TUNA-TYPE GEAR. GEAR A HAS SIX BRANCH LINES PER BASKET; GEAR B IS DESIGNED FOR DEEPER FISHING AND, ACCORDINGLY, HAS ONLY TWO BRANCH LINES. THE INSETS SHOW ANOTHER OF THE MANY METHODS OF TYING TOGETHER THE PARTS OF THE LONG LINE. THE METHOD ILLUSTRATED IS OLDER THAN THE ONE SHOWN IN FIGURE 6 AND IS AT PRESENT NOT AS WIDELY USED.

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largely black, yellowfin, and big-eyed tunas taken from depths between 250 and 350 feet; whereas, during the winter season in the area nearby Midway Island, albacore and big-eyed tuna, in the proportion of two to one, have been taken in large numbers from depths of about 100 to 200 feet. Accordingly, the captain of a vessel designs his gear for the types of tunas he prefers to catch and the area in which he wishes to operate.

FIGURE 8 - BASKETS OF LONG-LINE GEAR READY TO BE STOWED ABOARD VESSEL. EACH BASKET CONTAINS FLOAT, MAIN, AND BRANCH LINES (INCLUDING HOOKS) ARRANGED IN PROPER SEQUENCE FOR RAPID HANDLING DURING THE SETTING-OUT OPERATION.

5. Recent developments in the long-line fishery have indicated that the same species of tuna inhabits different levels of water in different regions. For example, black tuna long-line fishing is carried on in two major areas off the Pacific coast of Japan--during the winter, in the warm Kyushu sea region and during the summer and fall, in the cold Hokkaido sea region. In the Kyushu area, the fish are quite deep; whereas, in the northern waters they approach closer to the surface. Fishermen often operate in both areas during their respective peak seasons, using the same gear but adjusting the level of the main line by shortening or lengthening the float line. Once constructed, the main and branch lines are used without changing their lengths.

6. The length of the float line plus the length of the branch line is only one of several factors determining the depth at which the hooks will fish. When the long-line gear is placed in water, the main line tends to sag where it is not supported by float lines. In a single basket, the number of float lines in relation to the length of the main line is thus an additional factor in determining the fishing depths of the various branch lines. Adding more float lines between the flag buoys will reduce the amount of sag. The captain can also control the fishing depths of the various hooks during a particular operation by either giving the main line more or less slack when it is set out (see page 20).

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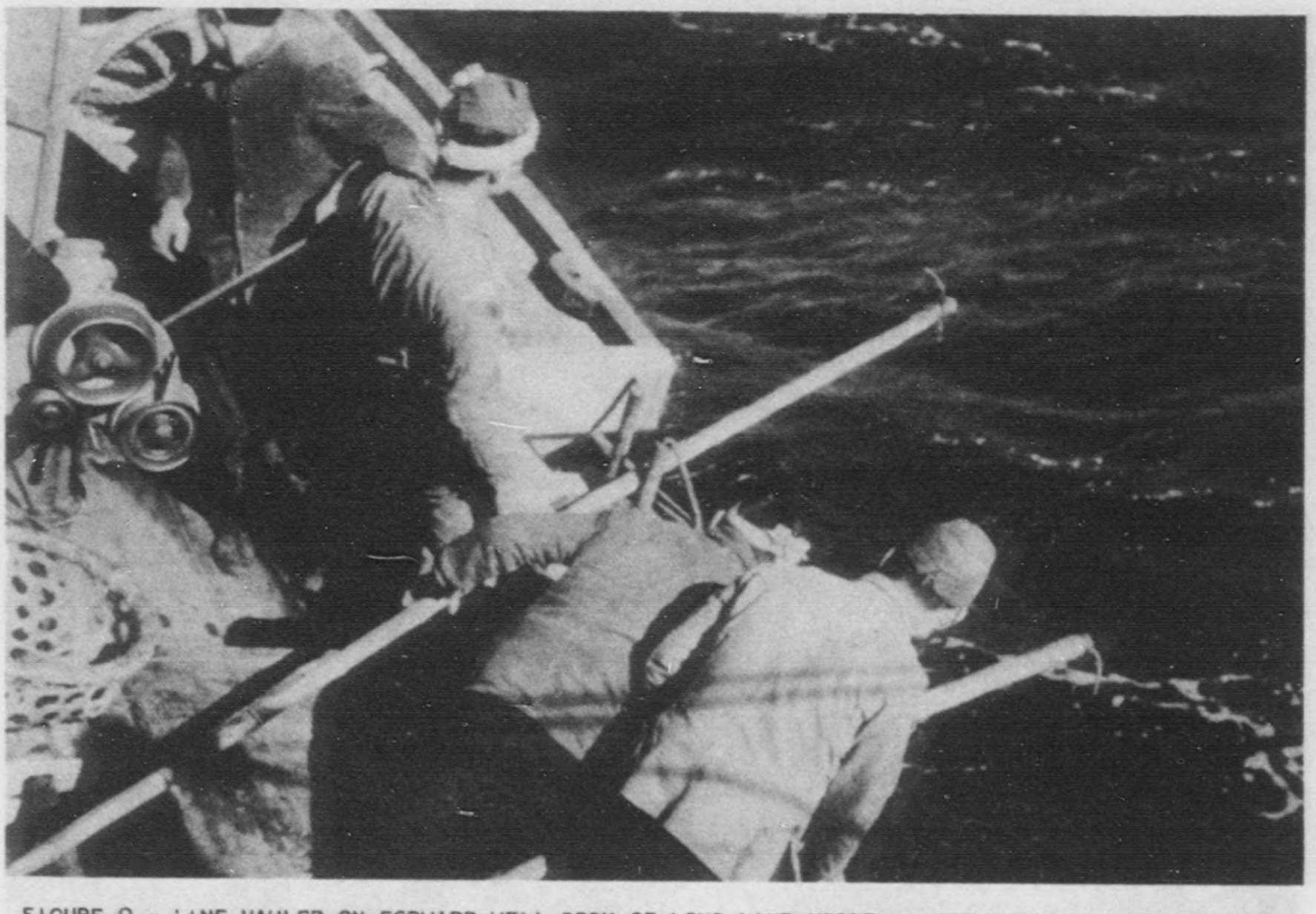

FIGURE 9 - LINE HAULER ON FORWARD WELL DECK OF LONG-LINE VESSEL. THE MAIN LINE PASSES OVER THE ROLLER WHICH IS SET ON THE DECK RAIL AND IS FED INTO THE HAULER SHOWN AT THE LEFT OF THE PHOTOGRAPH.

PARTS OF A TYPICAL LONG LINE

BASKET: The long-line gear is essentially a method by which numerous hooks are lowered to depths at which it is desired to fish. A vessel of large size will generally set out many miles of line. In order to handle complex gear, which can easily tangle during any part of an operation, the main line is divided into baskets or sets (Figures 6 and 7). Each basket, from its head to the tail, is identical in construction; therefore, it will only be necessary to describe and illustrate the parts of a single basket.

MAIN LINE: The portion of the gear that is suspended horizontally below the surface of the water is known as the main line. To it are tied the lower ends of the float lines and the upper ends of the branch lines. The length of a single basket of main line varies with the preference of the individual fisherman and may be from 800 to 2,000 feet long.

The main line is prepared by first measuring out sections of cotton, hemp, or Manila line; the number of sections usually correspond to the number of hooks in a basket of gear (Figures 6 and 7). One length of line can be used for the entire main line of a basket, but the handling of such a length is more difficult than is the case where the main line is made up of sections. Then, should the main line kink or twist when being hauled in, the knot joining any two sections may be untied and the gear straightened out in order for it to come aboard prop-

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erly. Moreover, as occasionally happens, the current will put too much slack in the main line, causing the branch lines to tangle about it. To prevent this, the slack can be reduced by removing from the water a number of sections of the main line without interrupting the fishing operation.

The material most often used for the main line is tightly-woven cotton line of medium to hard lay, with a diameter varying from 1/8 inch to 1/4 inch. The line of larger diameter is generally preferred by a long-line vessel, but some captains, fishing solely for albacore, may utilize the less expensive line of smaller diameter. In addition to cotton line, Nanking hemp (diameter 3/8 inch), Manila line (diameter 3/16 inch), or a mixture of cotton and Nanking hemp (diameter 1/4 inch) have been used for the main line by some Japanese long liners.

FLOAT LINE: The main line is suspended to its horizontal position by float lines, which are attached to floats or buoys. The length of the float line is similar for all baskets on the same gear but, as noted previously, different captains favor different lengths; these lengths may vary from 45 to 125 feet (Figures 2 and 3).

A float line, with a buoy at the top to keep the line suspended vertically and a bamboo flagpole to serve as a marker, is always put on the main line at the beginning or head of each basket. Other float lines may or may not be used to hold the main line of a basket in a horizontal position. This is entirely a matter of preference for the individual fisherman. Using more float lines per basket of gear reduces the sag in the central part of the main line. Thus, by either constructing gear with one or more float lines in the central part of the basket, or without any, it is possible to control to some extent the depth to which the hooks in the center will descend. Many fishermen prefer considerable sag, for the hooks will then fish at various depths.

The material used for the float line is often the same as that used for the main line. However, it is possible to utilize cotton, hemp, or Manila line of slightly smaller diameter than the main line. Old or slightly worn main line may sometimes be used as a float line.

FLAGPOLE: Bamboo poles with a small piece of colored cloth or a tuft of bamboo twigs on the upper tip are used, generally one to a basket, to serve as a marker in indicating the whereabouts of the long line in water. The float line and a buoy are attached to the flagpole in a manner so as to keep the pole upright during the fishing operation (Figures 6-A-1 and 7-A-1).

BUOYS: Three types of buoys are in use--glass, metal, or wood. Glass or metal buoys, with a diameter of 10 to 12 inches, are preferred because of their greater buoyancy and, since they do not become water-soaked, can be used over a long period of time. Floats of paulownia wood, having a diameter of about four inches and a length of three to four feet, are utilized by some vessels. Other vessels may use glass and wood buoys alternately—a glass buoy at the head of the float lines that are attached to the flagpoles, followed by a wood float tied to the float lines in the center of the baskets. A wood float has the advantage in that, if the line is tied to one end of the float, the float will serve as a signal to indicate that there is a fish on the section of the basket below it. The weight of the fish pulls on the float line causing the wood float to stand erect or wave about. This arrangement is especially desirable where the long-line gear should be patrolled at frequent intervals and the fish removed because of the presence of sharks or seals. On occasions when an extremely large

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fish has taken the hook, its weight pulls the long line down and the buoy with it. In these instances failure to sight a buoy indicates a fish on the line and it is removed.

BRANCH LINES: The lines that do the actual fishing are suspended from the main line at pre-designated intervals. Branch lines are almost always made up in the following order (Figures 6-A-4 and 7-A-4): a length of line, either cotton, hemp, or Manila; a "sekiyama" (cotton wound around a core of ramie, wire, or Japanese hemp); a wire leader; and a tin-plated iron hook. The only exception to this arrangement is that the "sekiyama" and the wire leader are sometimes omitted in long lines designed specifically for albacore fishing. This is possible since the fish taken by such long lines are generally below 60 pounds in weight. The branch line is permitted to hang freely; no lead weight being used to hold it down.

Swivels are often placed at some point along the branch line to minimize twisting when a hooked fish is threshing about.

For the most efficient operation, and to prevent tangling of adjacent branch lines, the distance between two branch lines is greater than their individual lengths. Thus, the longer the branch lines, the further apart they are placed and the fewer the number suspended from the main line.

There is sound justification for the use of a "sekiyama" between the line and the wire leader. Ordinary line is apt to twist and kink when hanging free in the water, whereas the tightly-wound "sekiyama" is rigid and tends to hold the baited hook away from entanglement with the line above it.

For the upper section of the branch line many vessels prefer cotton line, which is of the same or slightly smaller diameter than that of the main line. Nanking hemp or Manila line is occasionally used by some captains. The core of the "sekiyama" is either 30-thread hemp or ramie, or 9-strand wire. Cotton line (usually 3-strand, 9-thread) is wound crosswise about the core. The wire core, although desirable for its strength, has the disadvantage of rusting. The wire leader used varies from 9 to 16 strands, and the tin-plated iron hook, which must be stout in order not to be broken at the shank or straightened out, measures (in its extended length) from $3\frac{1}{2}$ to $5\frac{1}{2}$ inches. It has been noted that some long lines are designed to fish at both shallow and deeper levels. If this is the case, the shorter branch lines are usually constructed with thinner line and wire and with smaller hooks (Figure 6B). There appears to be a correlation between the size of the fish and the depth of the water; the larger fish are taken from deeper levels and the branch lines are accordingly made stouter the deeper they are expected to fish.

TYPES OF LONG-LINE VESSELS

It is possible to operate a tuna long line from most any type of fishing vessel, and many craft designed for other operations will fish with the long line during months that would otherwise be inactive (Figure 10). However, the Japanese have settled on standard plans for constructing long-line vessels that will operate the long-line gear solely (see front-cover photo). The trend in recent years has been to build large vessels, since most of the major tuna operations are carried on at considerable distances from home ports.

Long-line vessels from the most widely used standard classes have the following dimensions:

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erly. Moreover, as occasionally happens, the current will put too much slack in the main line, causing the branch lines to tangle about it. To prevent this, the slack can be reduced by removing from the water a number of sections of the main line without interrupting the fishing operation.

The material most often used for the main line is tightly-woven cotton line of medium to hard lay, with a diameter varying from 1/8 inch to 1/4 inch. The line of larger diameter is generally preferred by a long-line vessel, but some captains, fishing solely for albacore, may utilize the less expensive line of smaller diameter. In addition to cotton line, Nanking hemp (diameter 3/8 inch), Manila line (diameter 3/16 inch), or a mixture of cotton and Nanking hemp (diameter 1/4 inch) have been used for the main line by some Japanese long liners.

FLOAT LINE: The main line is suspended to its horizontal position by float lines, which are attached to floats or buoys. The length of the float line is similar for all baskets on the same gear but, as noted previously, different captains favor different lengths; these lengths may vary from 45 to 125 feet (Figures 2 and 3).

A float line, with a buoy at the top to keep the line suspended vertically and a bamboo flagpole to serve as a marker, is always put on the main line at the beginning or head of each basket. Other float lines may or may not be used to hold the main line of a basket in a horizontal position. This is entirely a matter of preference for the individual fisherman. Using more float lines per basket of gear reduces the sag in the central part of the main line. Thus, by either constructing gear with one or more float lines in the central part of the basket, or without any, it is possible to control to some extent the depth to which the hooks in the center will descend. Many fishermen prefer considerable sag, for the hooks will then fish at various depths.

The material used for the float line is often the same as that used for the main line. However, it is possible to utilize cotton, hemp, or Manila line of slightly smaller diameter than the main line. Old or slightly worn main line may sometimes be used as a float line.

FLAGPOLE: Bamboo poles with a small piece of colored cloth or a tuft of bamboo twigs on the upper tip are used, generally one to a basket, to serve as a marker in indicating the whereabouts of the long line in water. The float line and a buoy are attached to the flagpole in a manner so as to keep the pole upright during the fishing operation (Figures 6-A-1 and 7-A-1).

BUOYS: Three types of buoys are in use--glass, metal, or wood. Glass or metal buoys, with a diameter of 10 to 12 inches, are preferred because of their greater buoyancy and, since they do not become water-soaked, can be used over a long period of time. Floats of paulownia wood, having a diameter of about four inches and a length of three to four feet, are utilized by some vessels. Other vessels may use glass and wood buoys alternately—a glass buoy at the head of the float lines that are attached to the flagpoles, followed by a wood float tied to the float lines in the center of the baskets. A wood float has the advantage in that, if the line is tied to one end of the float, the float will serve as a signal to indicate that there is a fish on the section of the basket below it. The weight of the fish pulls on the float line causing the wood float to stand erect or wave about. This arrangement is especially desirable where the long-line gear should be patrolled at frequent intervals and the fish removed because of the presence of sharks or seals. On occasions when an extremely large

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Long-line vessels from the most widely used standard classes have the following dimensions:

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Category					
Construction	Gross Metric Tons*	Length	Breadth	Depth	Horsepower
		..... (Feet)			
Steel	195	110.1	21.7	10.7	400
	160	103.5	20.4	10.2	320
	135	97.9	19.7	9.7	250
Wooden	95	81.5	18.1	9.0	210

*The volume of the entire vessel divided by 100 cubic feet.

Vessels of 195 gross tons may operate as many as 200 baskets of gear during a single day's fishing. The smaller vessels handle a correspondingly smaller amount of gear; a 95-gross-ton long liner generally operates in the neighborhood of 100 baskets. The Japanese have recently constructed a few vessels of more than 200 gross metric tons, and these fish up to 300 baskets of gear.

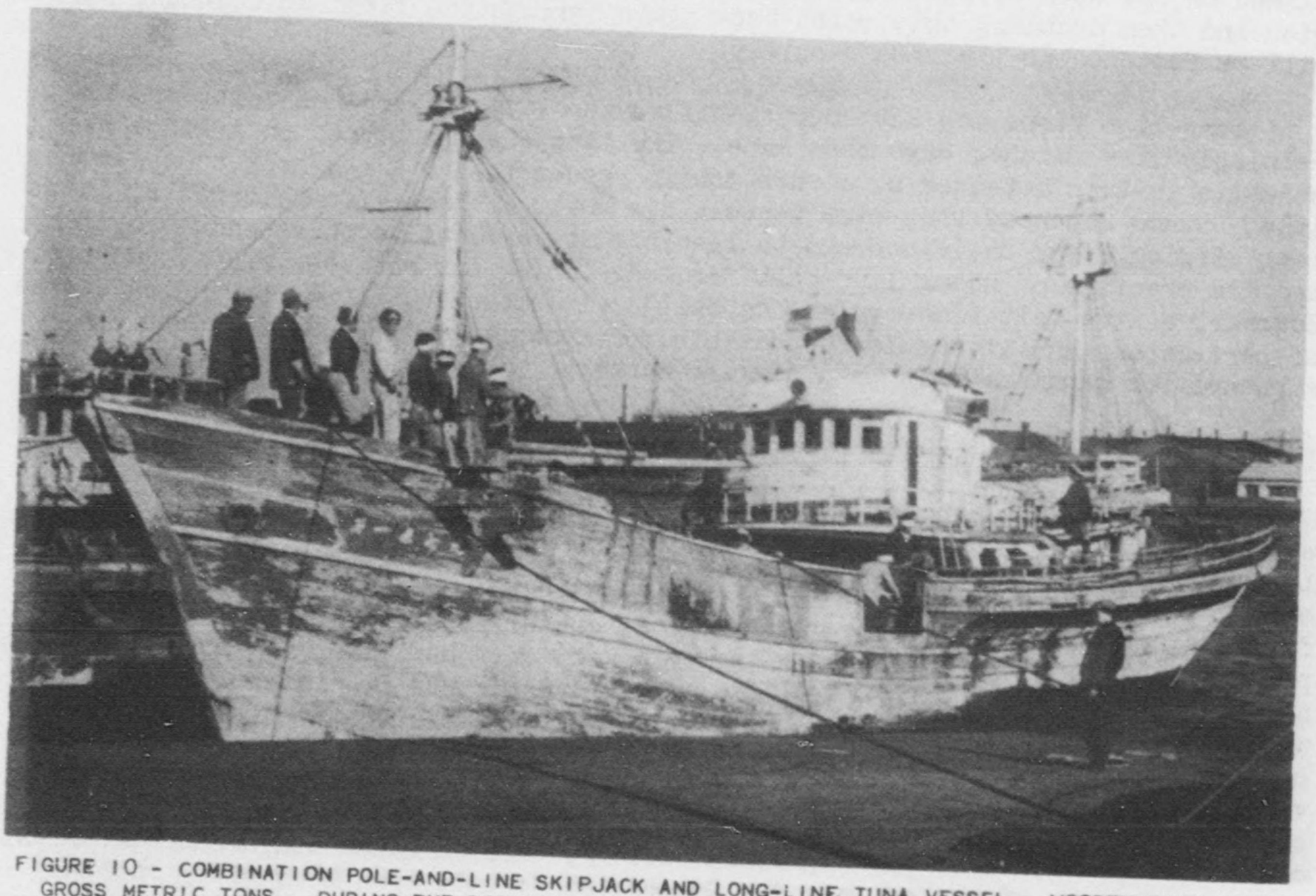

FIGURE 10 - COMBINATION POLE-AND-LINE SKIPJACK AND LONG-LINE TUNA VESSEL. WOODEN TYPE OF 95 GROSS METRIC TONS. DURING THE SPRING, SUMMER, AND FALL, THIS VESSEL FISHES FOR SKIPJACK WITH LIVE BAIT; DURING THE WINTER, FOR OTHER TUNAS WITH THE LONG-LINE GEAR.

For ease of operation in setting or taking up the gear, a long-line vessel is built with a moderately low fore and afterdeck. Since the long line is set out over the aft rail, the afterdeck has sufficient level space for handling the baskets of gear. On the modern-type vessels, hauling in is done by heading into the line so that it comes aboard over either the starboard or port side of the bow, and a low main foredeck facilitates pulling in the gear and removing the fish from the branch lines. A line hauler is placed on the main deck forward of the pilot house near the side over which the line is hauled. Hatches to the cargo hold are on the main deck close to the line hauler. The fish are pulled aboard through an opening in the main-deck rail and bulwark immediately aft of the roller, which is set on the main-deck rail and over which the main line passes into the line hauler. When not in use, buoys, flagpoles, and baskets of line are secured on top of the deckhouse.

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BAIT FOR LONG-LINE FISHING

Obtaining adequate bait for long-line operations does not offer the serious difficulties often encountered in the live-bait skipjack fishery. Sardine, anchovy, mackerel, saury, flying fish, cuttlefish, or squid are among the more important of the baits used. Firm, fresh bait is preferred, since it will stay on the hook longest without tearing out. A round-bodied fish is said to be more desirable than a somewhat flattened form, for the latter tends to fall over on its side in the water and does not appear as lifelike as the rounded form. On long voyages, the bait is either frozen or salted. The hooks are generally baited by putting the barbed point through the eyes of the fish. Cuttlefish and squid are placed on the hook by putting the barbed point through the fleshy posterior region and then doubling this point back again through the flesh so that the bait will be fastened to the hook securely.

Long-line fishermen have occasionally used live mackerel as bait, and exceedingly fine catches have been made. The live fish is placed on a small hook, which is in turn attached by a short chain leader to the large hook on the branch line. Since Japanese long-line vessels are built without live-bait wells, it has been difficult for the fishermen to keep the mackerel alive on extended voyages, and the practice of using live bait for long lining has not been widely adopted. However, a live-bait fishery for the skipjack has been developed to a high degree of perfection, and it should be possible for tuna long-line vessels to be constructed for handling bait in a similar manner.

METHODS OF LOCATING LONG-LINE FISHING GROUNDS

The success of the Japanese long-line fishery has been based largely on the ability to locate fishing grounds that are capable of yielding abundant quantities of fish. A period of exploration to locate productive grounds has been necessary since it is impossible to detect by ordinary methods the presence of the far-ranging tunas when they are swimming at subsurface levels in many different parts of a vast ocean. As commercial interests were unwilling to invest the money and effort necessary to locate promising fishing grounds in distant waters, Japanese national and prefectural fisheries organizations sponsored the exploratory phase needed to develop a sizable offshore long-line fishery. Their exploratory vessels compiled and disseminated to the industry a huge amount of data on the catch obtained during their fishing voyages. Moreover, these catch records were correlated with various oceanographic factors, such as water temperature, current drift, and depth of the ocean bed. Commercial vessels were thus given not only the general location of new fishing grounds but also the hydrographic conditions under which the best catches were likely to be made.

A number of the major developments in the Japanese long-line fishery can be attributed directly to exploratory fishing operations by the national and prefectural vessels. The location and eventual exploitation of the albacore grounds nearby Midway Island were almost entirely due to their efforts, and a sizable winter fishery for producing the exportable white-meat tuna was established. In the South Seas, major long-line explorations were under way during the greater part of the 1930 decade, and major fishing grounds, principally for the yellowfin tuna, were located near the equatorial belt of the southwest Pacific. Closer-to-home smaller-scale explorations witnessed the development of the Ryukyu region as a long-line fishing area.

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On the basis of their exploratory work, Japanese investigators claim that the tunas caught by the long-line gear are primarily on a feeding migration and it is best to set the gear across the path of movement of the fish or near an obstacle in their path. The migrating tunas tend to follow the course of a current, and the long line can be set where a strong current exists and the tunas are known to be plentiful. However, areas where the tunas are available are more easily located by looking for barriers to movement. Barriers to movement may be an island, a reef, a submerged bank, or a difference in water temperature between two water masses.

Where reefs, banks, islands, or submerged shelves act as barriers to movement and change the direction of current flow, they are often inhabited by a diverse and plentiful assemblage of reef and bottom fish. The voracious tunas, finding such fish an attraction, remain nearby or move alongside these barriers before continuing their migration in a new direction. The Ryukyu area can be cited as a region in which the most productive long-line grounds have been found to be those where the migratory tunas are hindered in their movements by shallow banks, islands, or reefs which change the course of the current. Other productive grounds in the Ryukyu area are located where the shallow waters surrounding the island groups drop off sharply to great ocean depths, as they do to the east and south of the archipelago, for the tunas apparently find excellent feeding alongside these shelves.

Where temperature barriers exist, water currents of different temperatures are present and the colder mass of water acts as a wall into which the warm-water tunas hesitate to enter. The zone of contact between two currents is often irregular and there is much mixing between the cold and warm waters. Places of mixture between currents are considered excellent feeding localities, for the colder waters have a greater abundance of food than do the warmer waters. The migratory tunas, searching for food, can take advantage of the fact that an abundance of pelagic crustaceans and other animals, which comprise a large share of their diet, are swept from the colder waters which they normally inhabit into the warmer waters at the zone of mixture between currents. As they are feeding at these temperature barriers, the tunas can be taken in numbers large enough to make commercial operations feasible.

A Japanese long-line vessel exploring a new region for tuna will set gear where it is able to find obstacles of the type mentioned above. The exploratory vessels look for localities:

1. Where the ocean bed drops off sharply to greater depths or where reefs or banks (either emergent or submerged) are present in an otherwise deep area. Hydrographic maps, which show the contours of the ocean bottom, are valuable aids in locating barriers of the submerged type. Echo sounders have recently come into wide use for exploring areas which are not well charted.

2. Where a strongly flowing current is present or where there are obstacles (reefs, islands, or banks) in the path of a current. In the tropics, the waters near coral banks are considered ideal places for exploratory fishing operations.

3. Where areas of convergence or divergence between two adjacent currents or masses of water are present. These are located by recording water temperatures at surface and below-surface levels.

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All exploratory vessels, while moving about, have trolling lines out. The efficiency of catch with trolling jigs is low as compared to the long line. However, some investigators believe that when a few tunas are taken from near-surface levels, they signify the possibility of tunas at deeper levels. This has been found to be applicable along the coastal areas of Japan but does not hold true for the mid-Pacific albacore grounds and other off-shore areas.

After explorations have indicated an area to be suitable for further exploitation, Japanese commercial vessels, partly subsidized by government funds, continue the development of that area. Profitable trips to the newly-located fishing grounds eventually result in intensive exploitation by commercial vessels. The reports of exploratory vessels aid the commercial vessels in that, since the area has already been surveyed, the captain can proceed to the general locality which has been shown to be productive. There, the commercial fisherman follows much the same procedure used by an exploratory vessel, and determines the exact locality for setting out the line as follows:

1. From hydrographic charts, the fisherman can locate submerged banks or ocean bottom which fall away to great depths. The gear is then set out diagonally with the flow of the current (Figure 11) over or beside these barriers.

2. Fishermen often set long-line gear where a strong current is present, especially if an island or a reef is in the vicinity. Floating substances, such as logs and seaweed, serve to indicate the flow of the current. The gear is set out diagonally with the flow (Figure 11) and in a direction away from the island or reef, if any are nearby.

3. The line of contact between cold- and warm-water masses, if one is known to be present in the general vicinity, is located by recording surface-water temperatures. A sharp drop in temperature within a small area indicates a transition zone from warm to cold water, or vice versa, and the gear is set out along this line of contact (Figure 12).

OPERATION OF LONG-LINE GEAR

The long-line gear is almost always set out over deep water, where it would be impractical to anchor it. After remaining in the water for any length of time, the line will tend to adjust itself to current drift. Therefore, in setting out the gear some consideration must be given to the strength or direction of the current. Suppose an area is located that is thought suitable for a long-line operation and the current is flowing at a rapid pace. Theoretically, it would be most desirable to place the line across the current, but the force of the strong flow of water, if the flow is stronger at some points of the current, would put a bow in the line and possibly break it. Accordingly, the fishing vessel starts putting the line down from the strongest part of the current and works out diagonally (Figure 11) towards a weaker portion. Enough slack must be given the line to permit it to adjust to the different forces of the current and also allow the hooks to sink to their proper depth. Since the branch lines are not weighted, the hooks sink slowly, taking from one to one-and-a-half hours to reach their deepest fishing level. Not only does this slow settling permit the flagpoles and floats to adjust to current, but the baited hooks, as they descend, fish all levels of the water from the surface to the greatest depth for which the gear has been constructed. Slack is also necessary when a fish takes a hook; extra weight on a taut line may cause it to snap.

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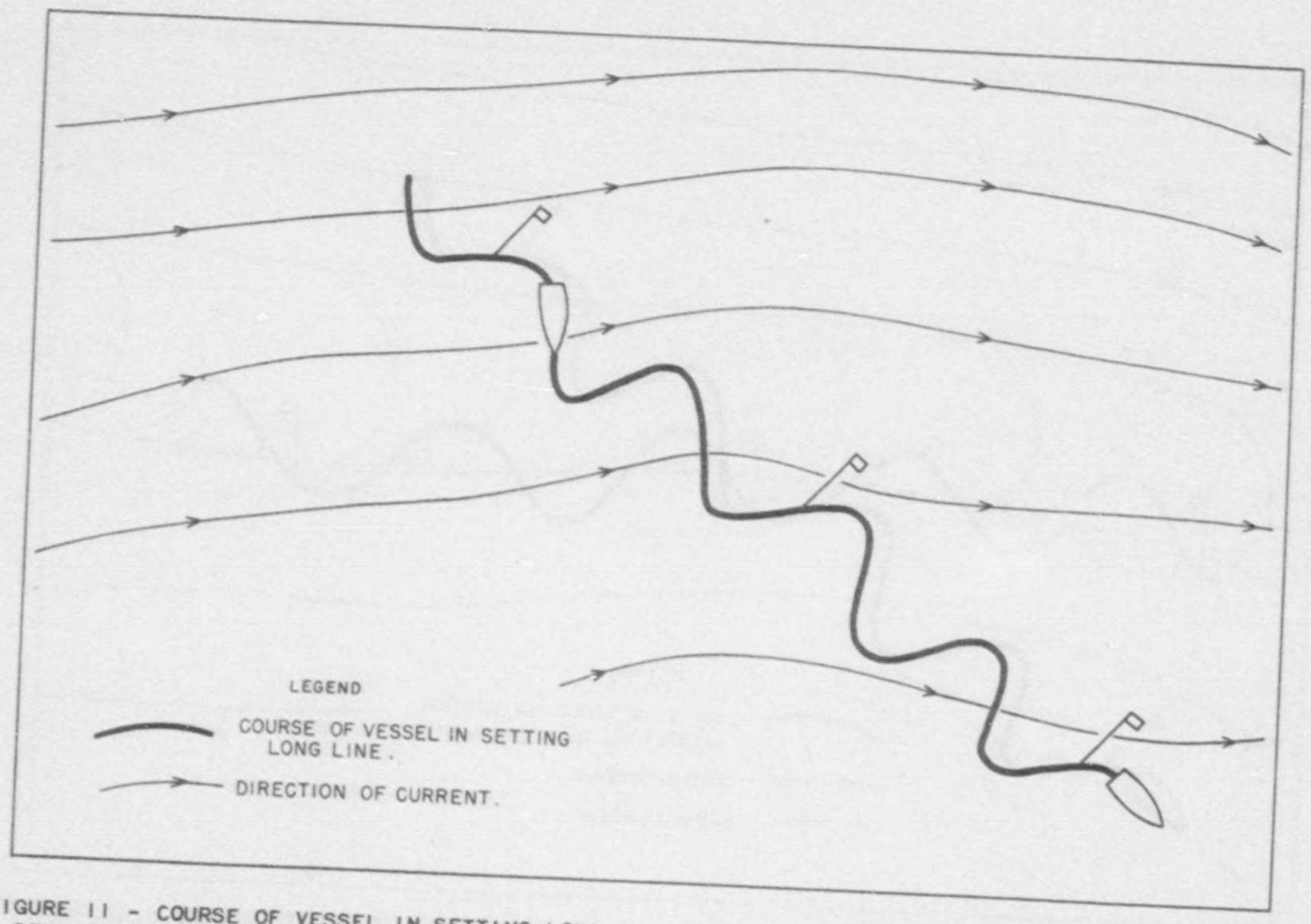

FIGURE 11 - COURSE OF VESSEL IN SETTING LONG LINE WHERE STRONG CURRENT EXISTS. THE LINE IS SET OUT DIAGONALLY TO THE FLOW OF THE CURRENT. CHANGING THE DIRECTION OF THE VESSEL ABOUT EVERY 200 YARDS PUTS SLACK INTO THE LINE AND PERMITS THE LINE TO ADJUST ITSELF TO WEAK-AND STRONG CURRENT DRIFTS. SLACK MAY ALSO BE OBTAINED BY RUNNING A DIRECT COURSE (ALSO DIAGONAL TO THE FLOW OF THE CURRENT), BUT THE SPEED IS REDUCED TO TWO-THIRDS THAT USED WHEN A ZIGZAG COURSE IS FOLLOWED.

Slack in setting the long line is obtained by either of the following methods:

1. The vessel follows a zigzag course and changes direction about every 200 yards (Figures 11 and 12). This is the most commonly used method. The speed of the vessel, while the line is being put overboard, is largely determined by the experience of the crew. If the fishermen are exceptionally well-trained and experienced in the handling of the gear, the vessel can be run at full speed. On most of the modern type long-line vessels this is about eight or nine knots.

2. The speed of the vessel is reduced to two-thirds of its normal full speed ahead, and the line is set out with the vessel following a straight course. The gear is placed overboard as quickly as when a zigzag course is followed.

The gear is set out over the stern rail of the vessel (Figure 13). Before the operation begins, baskets of long line are assembled on the after deck. Floats, flagpoles, and bait are placed nearby. The coils of line comprising a single basket have already been arranged so that the beginning of the line and the first float line are at the top, a coil of main line follows, then a branch line (line, "sekiyama," leader, and hook also arranged in a coil), then another coil of main line, a branch line, and so on to the end of the basket of gear. The line is thus ready for quick and routine handling.

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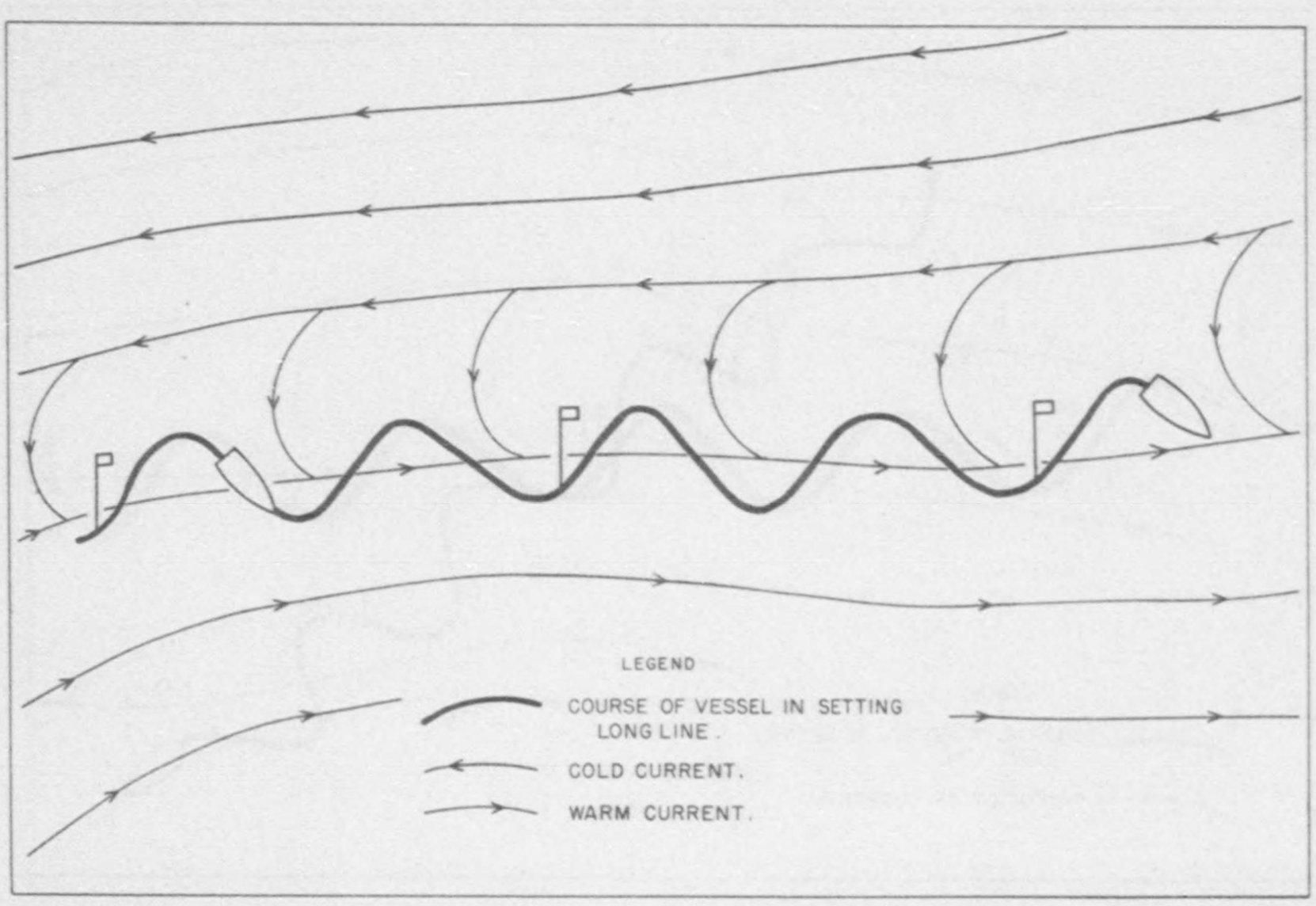

FIGURE 12 - COURSE OF VESSEL IN SETTING LONG LINE WHERE TWO CURRENTS FLOW IN DIRECTIONS OPPOSITE TO EACH OTHER. THE LINE OF CONTACT BETWEEN TWO CURRENTS IS DETERMINED BY RECORDING SURFACE-WATER TEMPERATURES. A SHARP DROP OR RISE IN TEMPERATURE INDICATES A CONTACT AREA, AND THE CAPTAIN ATTEMPTS TO SET THE LONG LINE ALONG THIS CONTACT ZONE. THE ZIGZAG METHOD OF SETTING GEAR IS MOST COMMONLY USED, BUT THE VESSEL MAY FOLLOW A DIRECT COURSE. SLACK IS THEN OBTAINED BY REDUCING SPEED TO TWO-THIRDS THAT USED WHEN RUNNING A ZIGZAG COURSE.

The setting of the line begins with the assembling of a bamboo flagpole and buoy, and their attachment to the head of the float line (Figures 6-A-1 and 7-A-1). Float line, buoy, flagpole, and the section of main line that follows are cast overboard first. The bait handler picks up a branch line from the basket, puts the bait on the hook, and then casts this section of the gear overboard (Figure 13). The next part of the main line is cast overboard, then a branch line is baited and also thrown over. This is repeated until the next float line (if more than one float line per basket is used) is reached; then a buoy is attached (Figure 7-A-6). Attaching the buoys to the float lines and baiting the hooks continues until the end of a basket is reached. The head of the main line of a new basket is attached to the tail of the old basket.(Figures 6-A-5 and 7-A-5) and the process of setting is repeated.

In temperate waters where sharks do not bother fish caught on the long line, the gear is set out in the late afternoon and taken up in the early morning. Not only is the efficiency of catch greater during the night than during the day, but, when the weather is warm, fishermen prefer to haul in gear during the morning hours before the heat of the sun makes working conditions difficult. In tropical waters where sharks are abundant and will mascerate a helpless or dead tuna on the long line, the captain sets gear in the early morning (about 3 or 4 a.m.) and takes-up in the afternoon. The long line is patrolled continuously during the five to

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FIGURE 13 - SETTING OUT THE LONG-LINE GEAR. BAITING OF BRANCH-LINE HOOKS AND SETTING OF GEAR TAKES PLACE OVER STERN RAIL OF LONG-LINE VESSEL. IN THIS INSTANCE, FRESH SQUID ARE BEING USED AS BAIT.

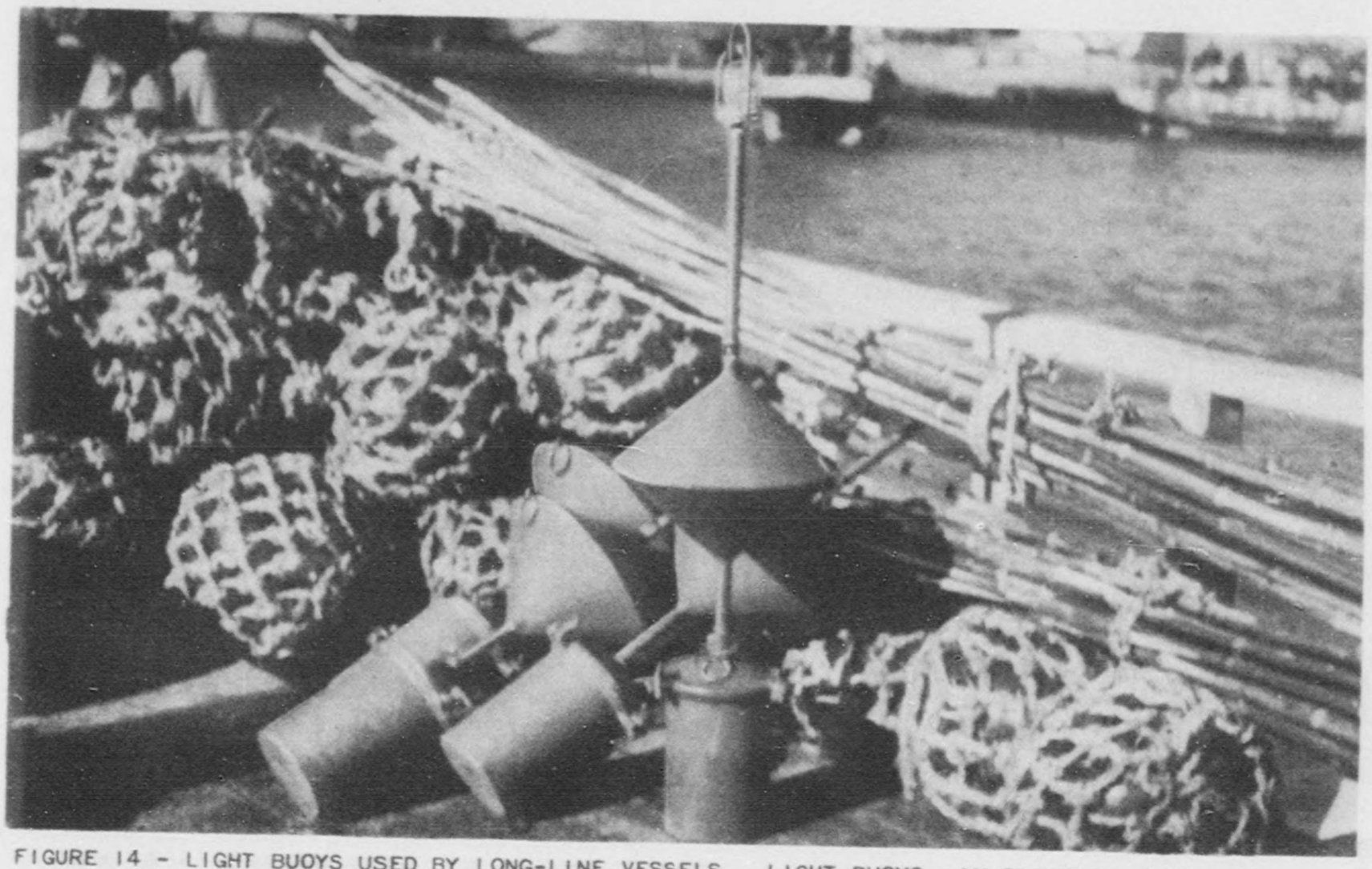

FIGURE 14 - LIGHT BUOYS USED BY LONG-LINE VESSELS. LIGHT BUOYS, IN PLACE OF GLASS, METAL, OR WOOD BUOYS, ARE PUT DOWN AT INTERVALS ALONG THE LINE TO INDICATE THE WHEREABOUTS OF THE GEAR DURING NIGHT OPERATIONS AND TO WARN OTHER VESSELS AGAINST SETTING OUT LINES IN THE SAME AREA.

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FIGURE 15 - HAULING IN LONG-LINE GEAR. THE MAIN LINE IS SEEN PASSING OVER THE ROLLER INTO THE HAULER. IN THE LOWER RIGHT CORNER, TWO FISHERMEN ARE PULLING IN A BRANCH LINE.

six hours between setting and taking-up and, should evidence indicate that a fish may be on the line, that part of the line is raised and the fish removed. During a 24-hour period, a vessel operating 200 baskets will take 2 to 3 hours to set the gear and 10 to 12 hours to haul in.

Light buoys (Figure 14) in place of flagpoles and glass buoys, may be put out at intervals along the line--generally at the beginning of the first basket, at every third basket, and at the end of the last basket. These lights not only serve to indicate the whereabouts of the long line to the fisherman, if the gear should be taken in when it is dark, but they also warn away other vessels that may put their long line out in the same area. Tangling of two sets of gear creates a wearisome task of untangling for two long-liners.

The most difficult task in the operation of a long line is taking in the gear. Which end of the line is hauled in first depends on the direction of wind and the side of the vessel over which the line will be hauled. The line hauler is set on either the starboard or port-forward deck, depending on the preference of the captain. To prevent tangling the line in the propeller, the vessel heads into the gear on the lee side of the line. As the line is brought aboard, it passes over a roller on the deck rail and is fed into the line hauler (Figure 15). The usual speed of the vessel is about three knots, but the actual speed depends on many factors--the experience of the crew, the water current, the direction of the wind, the running capacity of the line hauler, the number of fish caught, and the difficulty encountered in hauling aboard fish of the largest size. Hauling in is best accomplished if too much strain is not placed on the main line. Thus,

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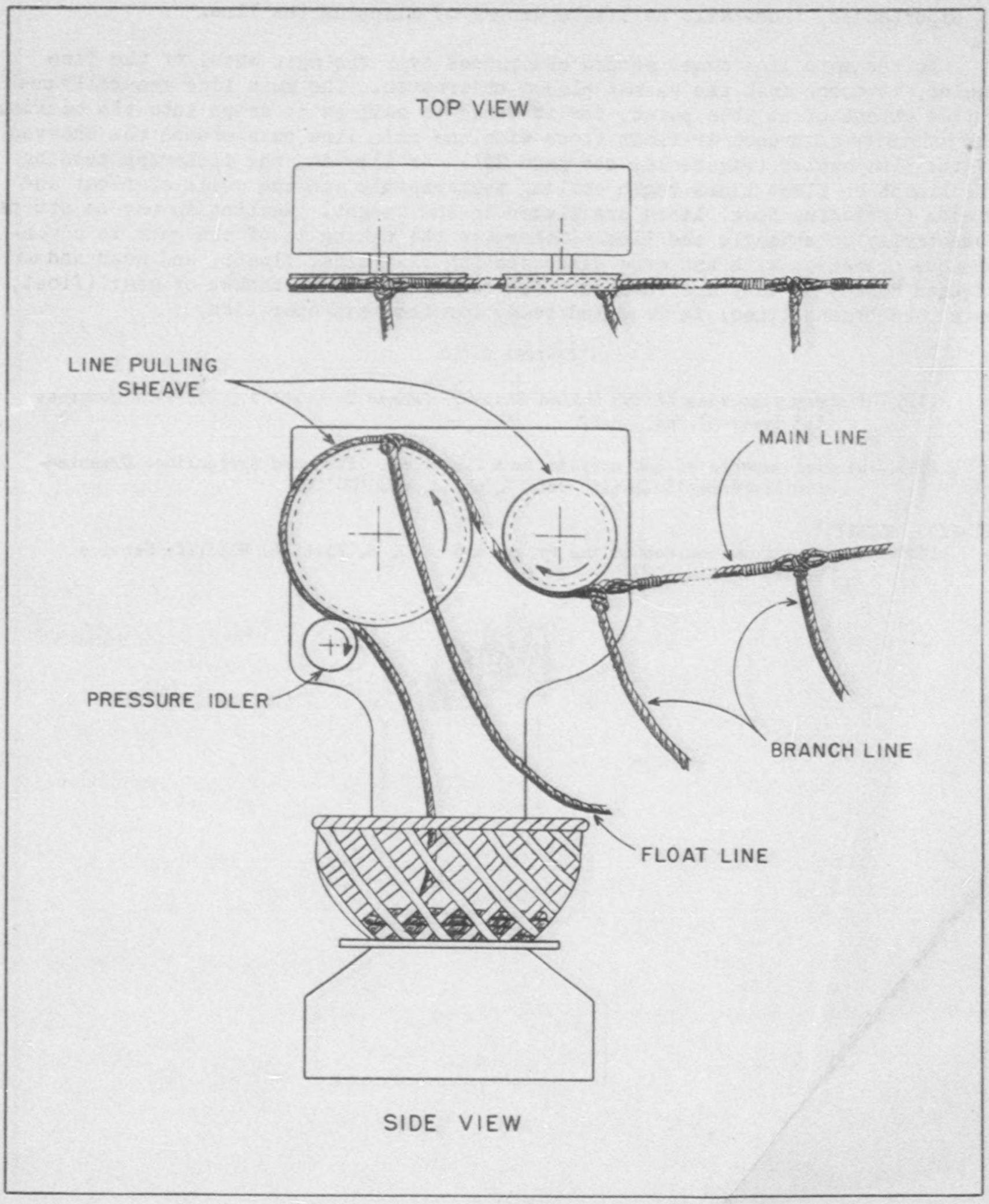

FIGURE 16 - LINE HAULER SHOWING ARRANGEMENT OF SHEAVES. THE KNOTS, ATTACHING FLOAT AND BRANCH LINES TO THE MAIN LINE, PASS AROUND THE SHEAVES WITHOUT BEING UNTIED.

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during the hauling-in operation, if a consistent speed is maintained and the crew is experienced, there will be little danger of snapping the line.

As the main line comes aboard and passes over the main wheel of the line hauler, it drops into the basket placed underneath. The main line generally needs little attention at this point, for it tends to coil as it drops into the basket. The junctures of branch or float lines with the main line pass around the sheaves of the line hauler (Figure 16, see page 25). As they do, the fishermen tending the branch or float lines begin coiling them rapidly and the coils of float and branch (including hook) lines are placed in the basket. Hauling in may be stopped momentarily to untangle the line. Otherwise the taking in of the gear is a continuous operation with the crew disconnecting flagpoles, floats, and head and tail of each basket as they are reached. The remainder of the basket of gear (float, main, and branch lines) is recoiled ready for the next operation.

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EXTENSION BULLETIN 165

MASTITIS

By C. S. Bryan

MICHIGAN STATE COLLEGE
COOPERATIVE EXTENSION SERVICE
EAST LANSING

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

SUMMARY

Mastitis is any inflammation of the udder irrespective of the cause or severity of the condition.

Infection or non-infectious factors may cause either a mild or a severe mastitis. A careful physical examination of each cow's udder and the bacteriological examination of a properly collected milk sample from each cow will indicate the mastitis status of each cow.

Udder infusion treatments are of value only where infection is the cause of the trouble. The choice of product for treatment is determined by the type of infection involved. The treated and recovered cow must be protected from re-exposure and re-infection. Not all treated cows become free from the udder infection.

Good and sanitary milking and herd management procedures are essential for mastitis control. If these are good the udder infusion treatments may be an aid to mastitis control.

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MASTITIS

By C. S. BRYAN
DEAN OF VETERINARY MEDICINE

A dairy cow is only as good as her udder; therefore, any intermittent or permanent alteration of the milk or udder is not conducive to profitable milk production. The following discussion may help the dairyman better to understand the diagnosis, prevention, control and treatment of mastitis.

WHAT IS MASTITIS?

Mastitis is any inflammation of the udder. This can be the swelling or congestion at "freshening" or the swelling resulting from udder and teat injuries, or the pathological change in the udder tissue as the result of activity of disease-producing bacteria. Insofar as the condition of the cow is concerned, the mastitis can be classified as acute or chronic.

ACUTE AND CHRONIC MASTITIS

Acute mastitis may be divided into acute local mastitis and acute systemic mastitis. In the acute local mastitis, the symptoms of swelling, pain, and the production of milk of abnormal physical appearance are confined to the udder. The cow is eating well, and has a good appearance except for the udder changes. The acute systemic mastitis is characterized by a visibly sick cow in addition to the symptoms in the udder. The acute local mastitis may progress in severity to develop into the destructive and highly fatal acute systemic mastitis.

Chronic mastitis is usually characterized by the absence of any painful swelling of the udder and by the production of a decreased amount of milk of normal physical appearance. Therefore, a cow may be infected for periods varying from a few weeks to several years before having an acute attack, and before the owner may become aware of the presence of the disease. The chronic mastitis may "flare-up" and become either acute local or acute systemic in nature.

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If death of the cow does not occur and treatment is started, the acute condition may abate and chronic mastitis persist. This change from chronic to acute mastitis and *vice versa* may occur irrespective of the cause of the disease.

NON-INFECTIOUS AND INFECTIOUS MASTITIS

Udder troubles may be classified as non-infectious and infectious mastitis from the standpoint of cause. Such non-infectious factors as chilling, bruising, and injury of the udder or teats, rough handling of the udder during hand or machine milking, and the adverse effects, in some cows, of irregular or incomplete milking may cause mastitis of an acute or chronic nature, depending upon the severity of the non-infectious agent or condition. Further, the damaging effects of non-infectious mastitis may predispose the udder to infection by bacteria; thus resulting in infectious mastitis. The bacteria may be of several types and may be identified by appropriate bacteriological methods.

DETERMINING THE CAUSE OF MASTITIS

The physical examination of the udder and milk are valuable in determining the clinical condition of the cow and her udder. This information is important when a final decision must be made concerning the disposition and treatment of the individual case of mastitis. However, bacteriological procedures must be applied to properly collected milk samples to make the specific diagnosis of infection – if the infectious bacteria are present – or to exclude infection and, therefore, suggest that the cause of the trouble is non-infectious in nature. The veterinarian and dairyman must know the cause of the mastitis before they can intelligently apply preventive procedures or specific curative udder infusion treatments.

THE UDDER AND MILK

The normal udder should be symmetrical or balanced; any variation from this is suggestive of mastitis. The chronic mastitis infection results in a replacement of the secreting tissue with scar tissue. The milk production of such cows is greatly reduced and may result in one or more quarters "going blind". During acute stages of the disease the udder or part of it may be swollen, feverish, and the milk may be abnormal in appearance.

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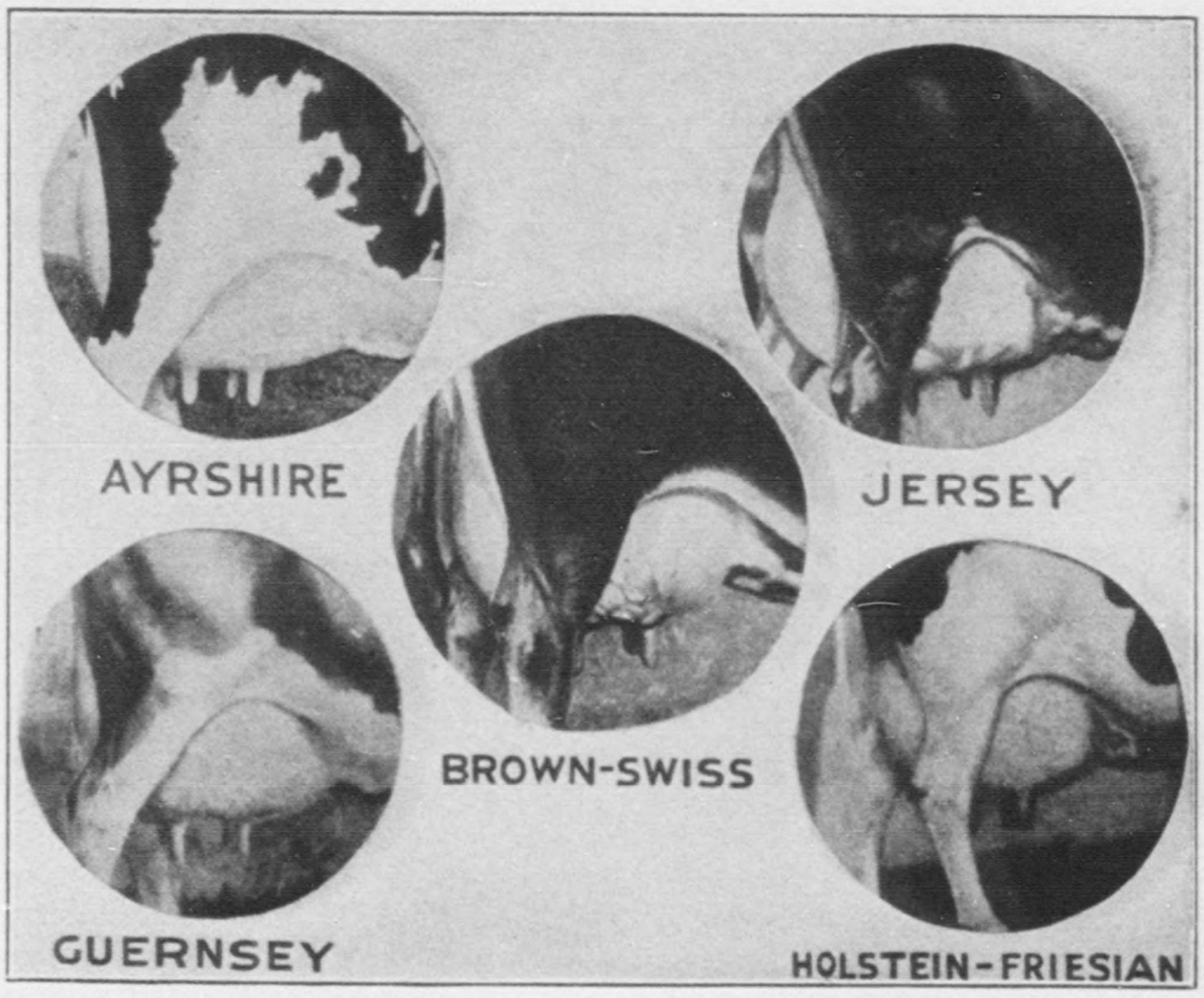

Photo—Dr. C. W. Turner, University of Missouri.

Fig. 1. This illustrates the udders idealized by the various breed associations. It is evident that each breed has its own specific type of udder but, in general all are of good size, symmetrical or balanced, have squarely placed teats of medium size, with the udder well attached below and in the rear. These characteristics indicate the conformation of the ideal udder and should serve as a guide in the selection of cows for dairy purposes.

The diagnosis of mastitis by physical examination is based upon the condition of the milk and changes in the udder. It is important to interpret properly the changes found in the udder, and therefore essential that a qualified veterinarian make the necessary physical examination.

The teats of a heifer prior to freshening or being sucked before freshening, are well-sealed. This seal and the uninjured tissue keep the mastitis bacteria from gaining entrance into the udder. Thus, heifers that have not freshened or have not been sucked or injured on the udder or teats are safe animals to buy or raise as replacement cows.

Some of the signs in the milk that suggest mastitis are: Flakes and pus that clog the filter pad when straining or produce an excessive

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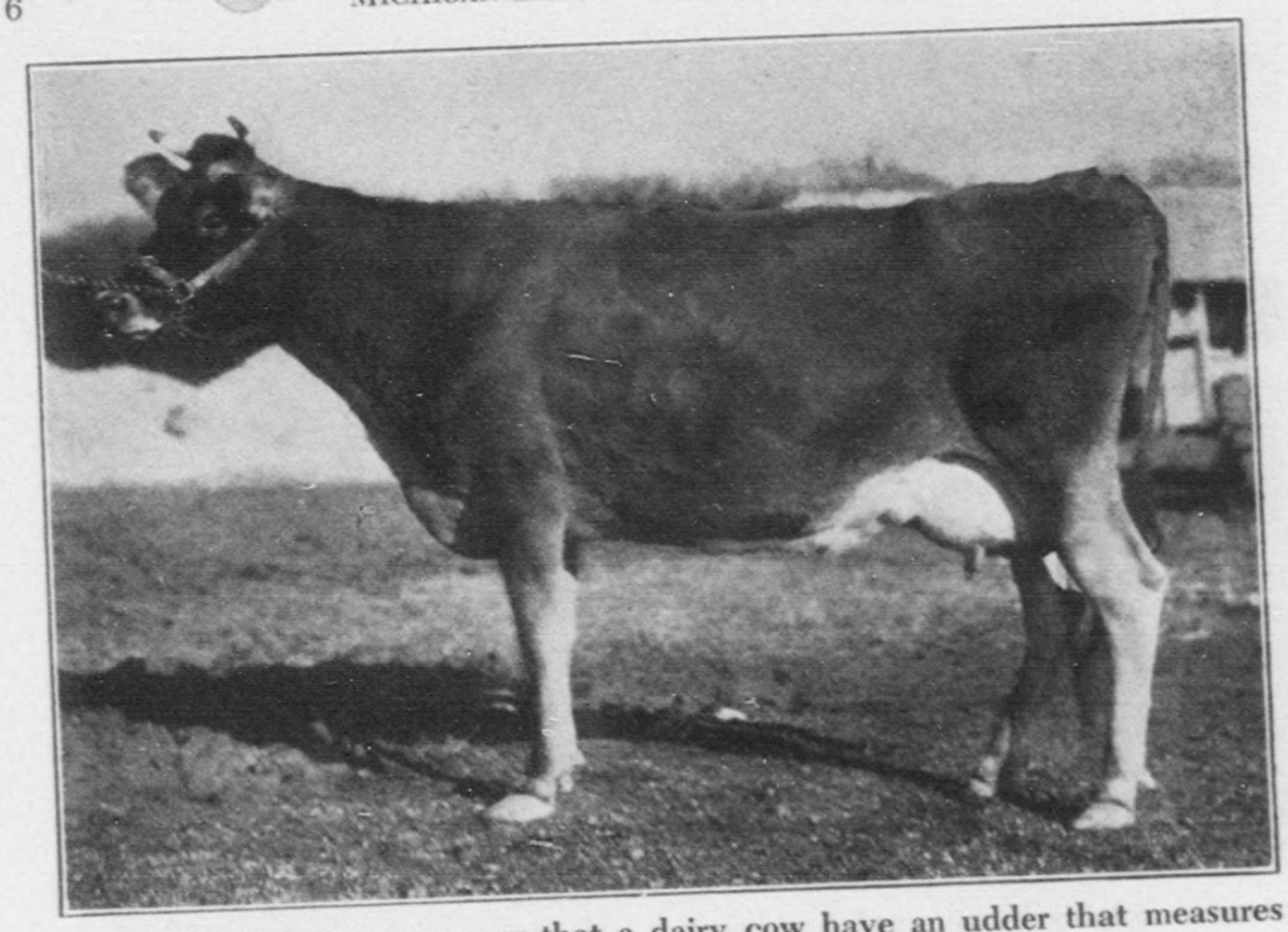

Fig. 2. It is not necessary that a dairy cow have an udder that measures up to the ideal for the breed to be classed as normal. The cow above has a good normal udder. It is possible to find many udders like this one, and for profitable milk production it is advisable that the cows have normal udders. In addition, notice should be made that the good physical condition of this cow is indicative of her general appearance as a comparison will be made with cows in the advanced stages of mastitis.

amount of separator slime if the milk is run through a separator; an indefinite cream line separating gravity cream and skimmilk, and a bloody or watery milk. In the early stages of the infection, the milk is usually normal in appearance, but at this time a laboratory examination will reveal the presence of infection.

MASTITIS IS A MAJOR DAIRY PROBLEM

All evidence points to this being a major dairy problem from both the economic and hygienic standpoints.

1. Shaw and Beam of the Pennsylvania Agricultural Experiment Station, have reported that quarters infected with streptococci produce 22 percent less butterfat than the streptococcus-free quarters. Since many cows are infected in all four quarters a similar decrease in milk and butterfat production may be expected and has been ob-

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served. This makes it necessary to maintain an excessive number of cows to furnish a given amount of milk. Such a procedure becomes expensive from the standpoint of money invested and time and feed consumed in maintaining the excess cows.

2. In studies conducted at Michigan State College, it was found that milk from infected cows was inferior in quality as determined by flavor, chloride content, leucocyte content, sediment test, bacteria count, and methylene blue test. Ninety percent of the milk samples from infected cows in one herd were criticized as having a salty flavor, while only 14 percent of milk samples from a negative herd were so criticized. The animals in the mastitis-free herd giving a

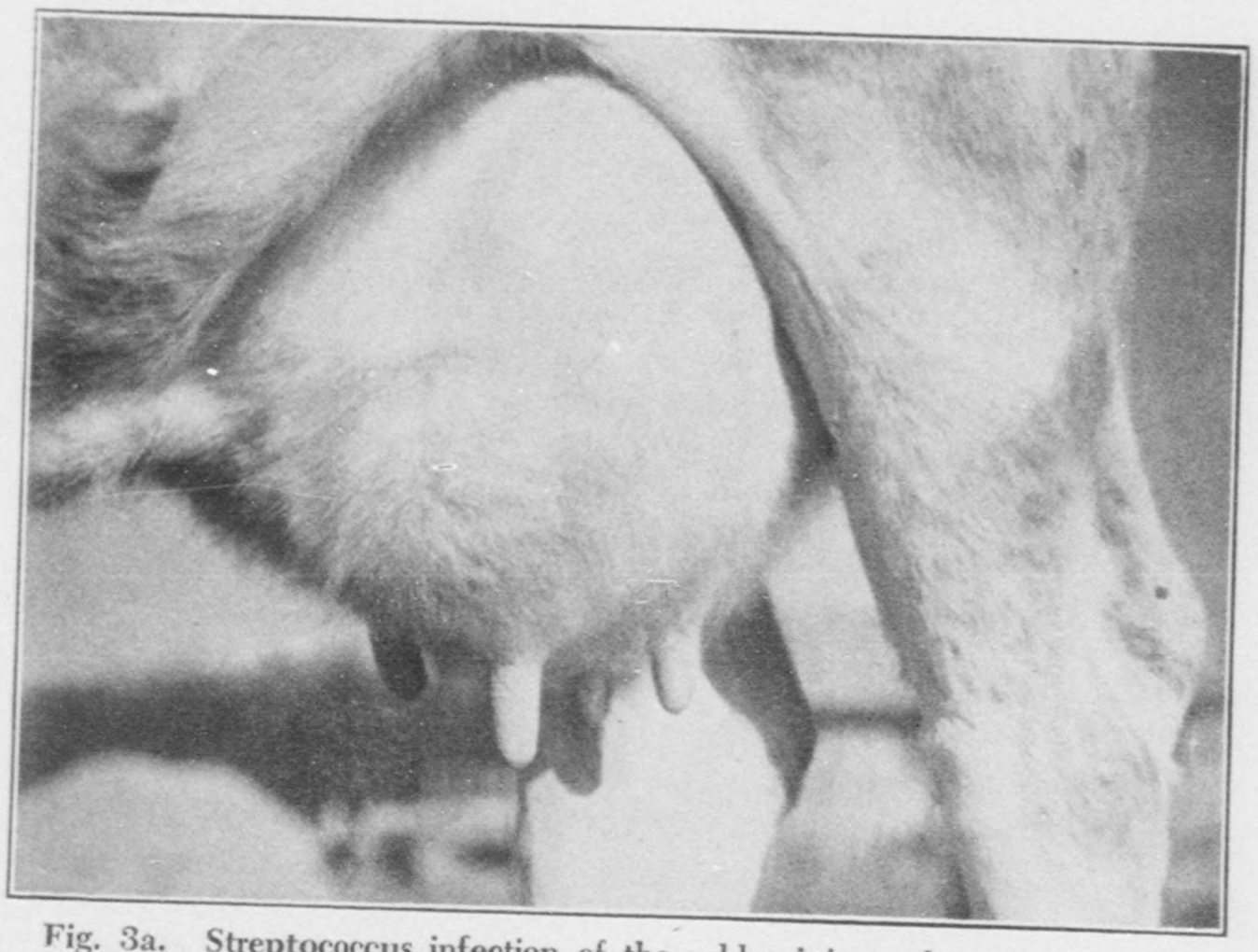

Fig. 3a. Streptococcus infection of the udder injures the secreting tissue, which is then replaced by scar tissue. This replacement is progressive and finally results in altering the appearance of the udder. An unevenness of the udder may develop because of the swelling of one or more quarters or the decrease in size of one or more quarters or both. The changes found in the udder do not indicate the length of time that a cow has been infected; in some cases scar tissue forms rapidly while in others it forms slowly. This udder is affected with chronic mastitis and is characterized by an enlargement of the left front quarter, together with decrease in size of the left rear quarter. Scar tissue is present in both quarters, and streptococci are being passed in the milk. The milk-producing ability of such an udder is greatly reduced. (See Fig. 3b.)

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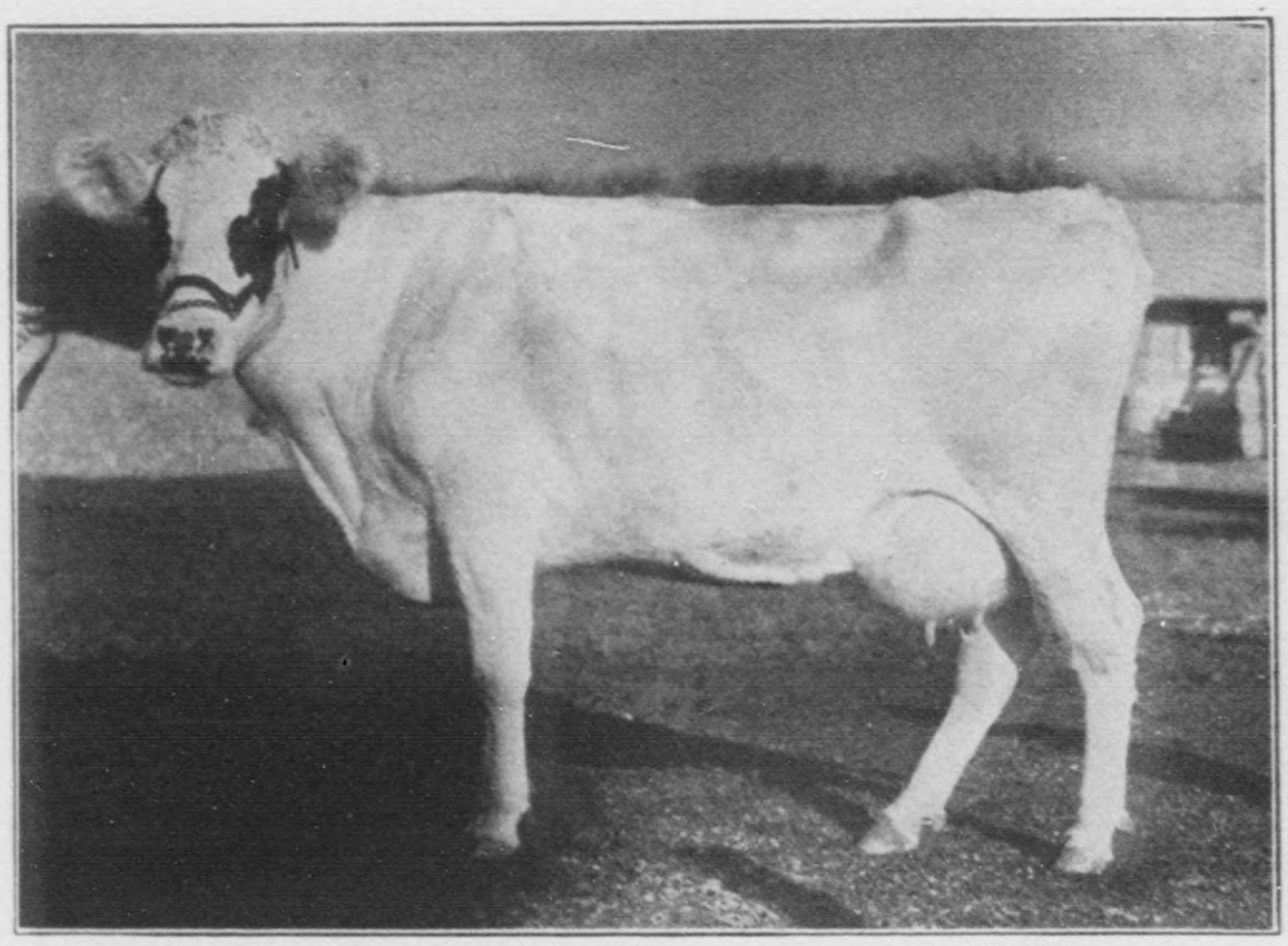

Fig. 3b. Cows suffering with chronic mastitis, of which this cow is an example, may not show any change in their general physical condition even though there are local physical alterations in the udder. A close-up examination of the udder is more convincing than a word picture would be concerning the unevenness of the udder. (See Fig. 3a.)

salty milk were near the end of their lactation period when such changes may normally occur. Only 50 percent of the infected cows produced a Class 1 milk (good) as judged by the methylene blue test, as compared with 98.5 percent of the non-infected cows. In like manner, 68.5 percent of the infected cows produced milk with a bacteria count of more than 1,000 per cubic centimeter as compared with 5.8 percent of the non-infected cows. The milk obtained from normal udders has 50 to 500 bacteria per cubic centimeter, and the number should not exceed 1,000 if low-count milk is to be produced. Were it not for the dilution of such abnormal milk with normal milk, more complaints would be received from consumers about those deficiencies.

3. The easy spread of most infectious mastitis causes an increase in herd wastage. The animals that "go bad" because of the infection must be eliminated, even at a great loss of money.

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4. Infected milk should not be consumed in the raw state because of the possibility of human infection. This may take the form of epidemics of septic sore throat, if bacteria of human origin are involved. The milk from infected cows can be rendered safe by proper pasteurization. Efficient home pasteurization can be done by **placing the milk into the upper part of a kitchen double boiler,** (with the lid in place to prevent surface film formation), **with water in the lower part and applying heat until the WATER boils, or by continuing to keep the water in the lower part of double boiler at a rolling boil while the milk in the top part** (with the lid in place to prevent surface film formation) **is in place for a 10-minute heating period.** Small one- or two-gallon capacity electric pasteurizers, available commercially, may be used to effectively home-pasteurize milk.

5. It has already been pointed out that infectious mastitis-affected cows may produce a milk containing less fat and less milk sugar

Fig. 4. The streptococcus infection may become sufficiently active to break through the outside udder tissues. The open sores become drains for the pus and bacteria found within the infected udder. The cow pictured in Fig. 4 is such a case. In this case the open sores are on the opposite side of the udder from that shown in the picture. This not only makes the udder unsuitable for the production of milk and aids in the further spread of the infection in the herd, but the mastitis may change the general physical condition of the cow. The slaughter value of such an animal is greatly decreased, and she usually is sold at a great loss as compared to her value prior to suffering from mastitis.

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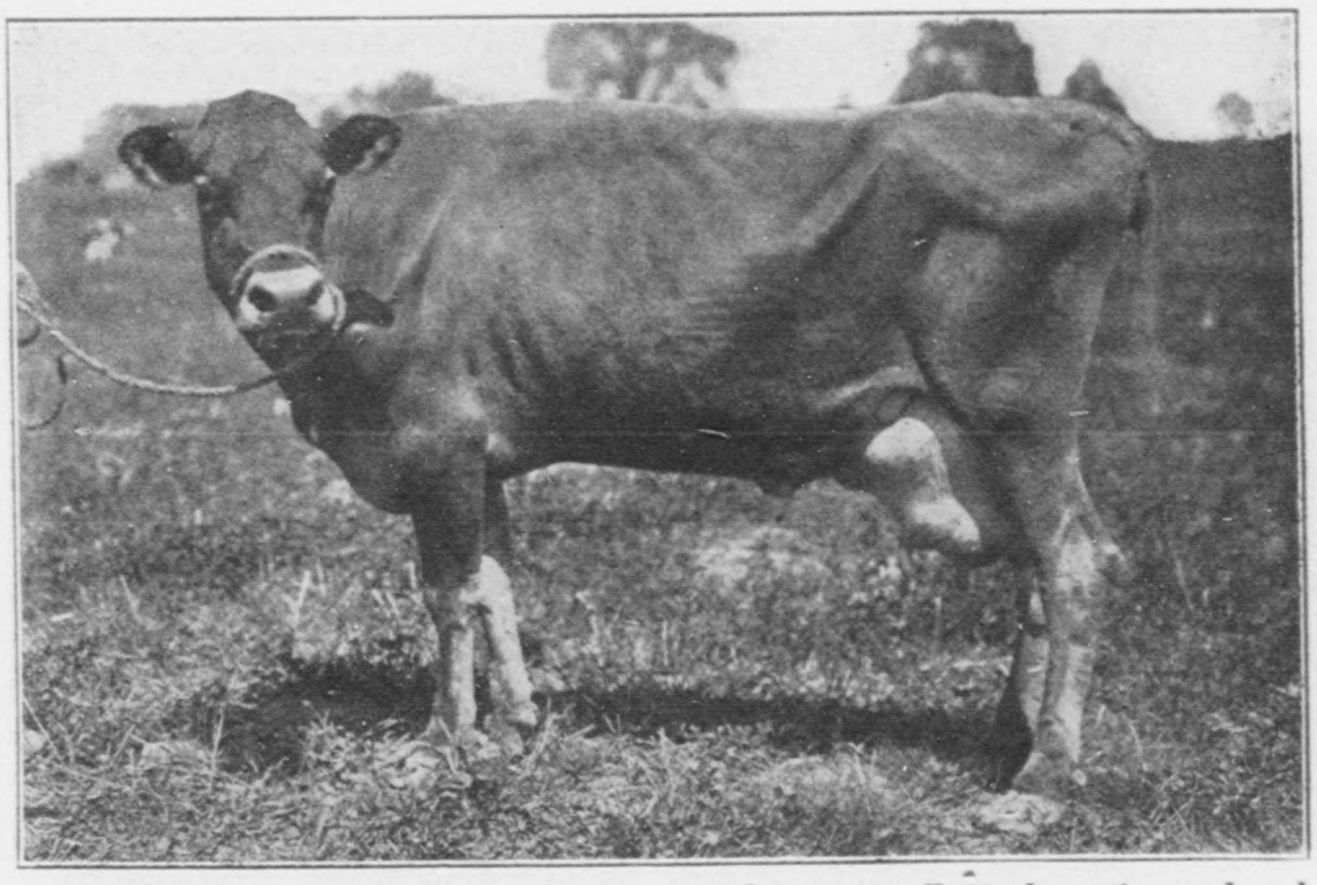

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(lactose) than normal. Owing to these deficiencies such milk is inferior in nutritive quality as well as bacteriological quality.

TESTING FOR MASTITIS

Testing for mastitis can best be carried out cooperatively by the dairyman, veterinarian, and laboratory worker. The history and data obtained by each are valuable in properly determining the status of each lactating cow. The part of each will be briefly discussed.

1. **The Dairyman** – It is essential that the dairyman be interested in the health of his herd before he undertakes this work. He must be mastitis-conscious and willing to apply certain sanitary pro-

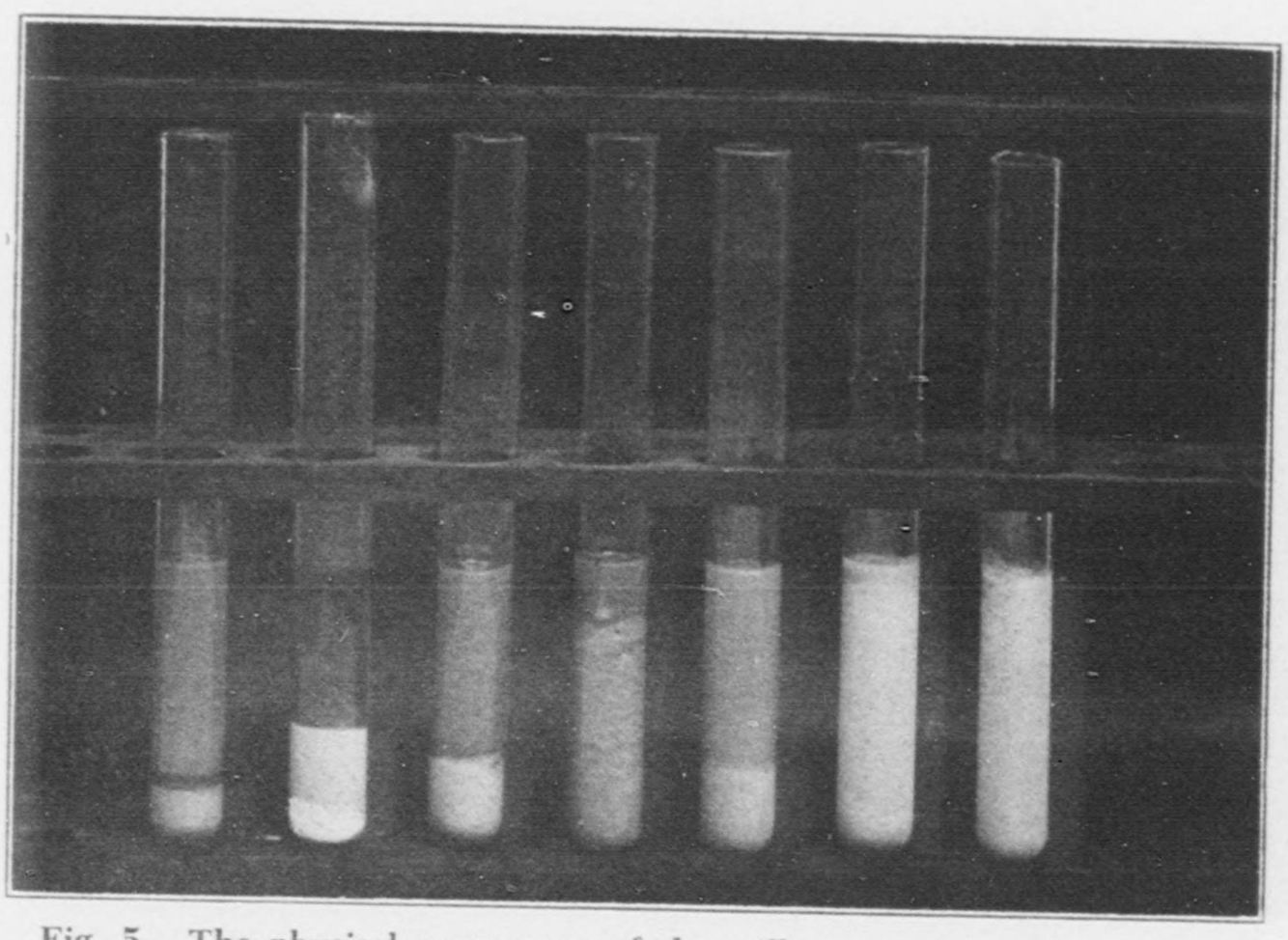

Fig. 5. The physical appearance of the milk secreted is not an accurate indicator of the presence or absence of mastitis. If abnormal milk, such as illustrated above, is secreted and an injury of the udder is not responsible, it suggests mastitis infection. All of these milk samples, including the normal appearing milk on the extreme right, were obtained from infected cows. This normal appearing milk contained many streptococci and pus cells. It is this abnormal milk that should interest the dairyman sufficiently to check more accurately on the herd condition. A physical examination of the udder and laboratory examination of the milk from each cow should be made as a basis for a proper diagnosis. See Fig. 8a for the appearance of milk at extreme right under the microscope.

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cedures that may be recommended by the veterinarian. A strip cup should be used to detect flakiness of milk. At each milking the first two or three streams of milk from each quarter should be collected in a cup with a wire or black cloth covering, thereby making it possible to detect the flakiness which frequently is present in milk from an infected udder; this abnormal milk should be withheld from the herd milk sent to the milk plant. A record should be kept of these results so that they may be referred to in obtaining a history of the physical condition of the milk produced by each cow. A strip cup may be purchased from various dairy supply houses or can be made by using a rubber band to hold a black cloth over the top of a tin cup.

Fig. 6. A careful physical examination of the udder is an important step in the diagnosis of mastitis and in selecting the infected cows suitable for udder infusion treatment.

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2. **The Veterinarian** should make a physical examination of the udder of each cow (Fig. 6). The physical examination of the udder determines the presence or absence of scar tissue. The scar tissue develops at the expense of, or replaces, the secreting tissue, for which reason cows with badly scarred udders are usually not profitable cows to have in a herd. The presence of scar tissue in the udder, and blind and swollen quarters are indicative of infectious mastitis. Instances have been noted where such alterations were the results of injury to the udder and, conversely, many cows may be affected with infectious mastitis that has not progressed to the point of being detected by physical examination of the udder or milk. For those reasons an additional laboratory examination of the milk is desirable if infectious mastitis is to be controlled in the herd. If a laboratory check-up is made, it is desirable to have the veterinarian properly collect and identify the milk samples.

THE PROPER COLLECTION OF MILK SAMPLES FOR TEST

Milk samples must be properly collected and handled if the test results are to be of any value. Only milk samples from lactating cows can be tested with any degree of accuracy. Directions for properly collecting samples for test (Fig. 7) can be obtained from the laboratory when milk sample vials are obtained.

3. **The Laboratory** testing consists in incubating the properly collected milk samples so that the bacteria will increase in number if present, and then examining the milk with the microscope for their presence and pus cells (Fig. 8). Because of the easy spread of the infection to other cows of the herd, repeated testing is desirable in a program of mastitis control.

THE FREQUENCY OF TESTING COWS FOR MASTITIS

The number of times that the herd should be tested will depend on the individual dairy herd. A suggested plan is to test at monthly intervals for 3 months, every other month for about 8 months and at about 90-day intervals thereafter. The tendency is to allow too great an interval of time between tests. This is unfortunate for not all cows of the herd are lactating at any one time and only milk from lactating cows can be tested with any degree of accuracy. If in-

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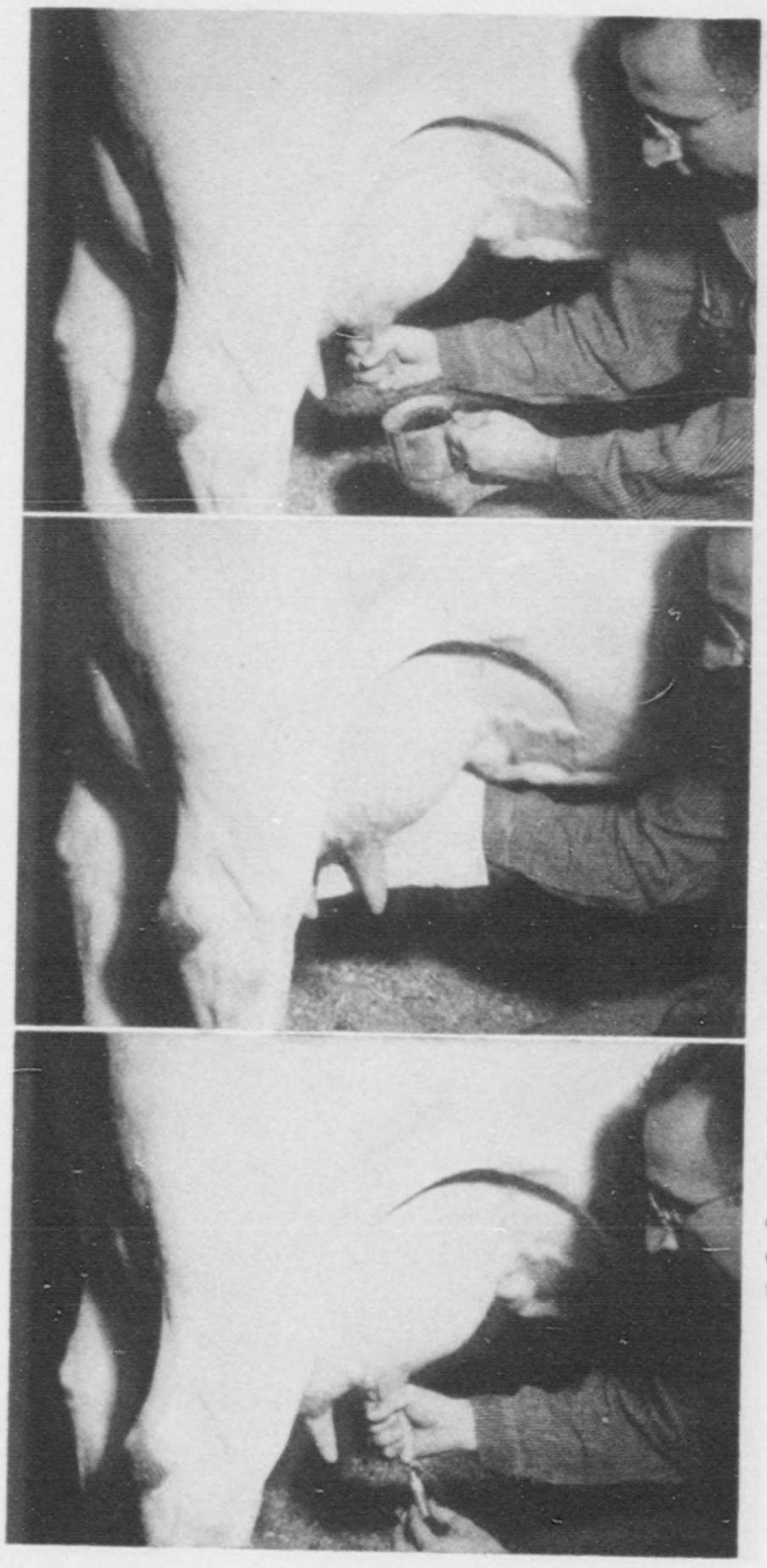

Fig. 7 The proper collection of milk samples for infectious mastitis test.

A. Remove the foremilk from each quarter, to flush out the teat canal, by milking into a strip cup for observation of its physical character and to prevent contamination of the floor.

B. Wash udder and teats with an effective udder disinfectant. Special attention must be given to disinfecting the end of each teat.

C. After preparation as described in A and B, a sample is collected by milking directly into a sterile vial (note the manner of holding the cork between the index and second fingers to prevent contamination). This test is used in selecting the cows for treatment and to check for recovery after treatment.

fection does gain entrance to the herd, it may spread and do much damage before its presence is detected.

Mastitis vials, containing the differential preservative, for use in submitting milk samples for test can be obtained from the Animal

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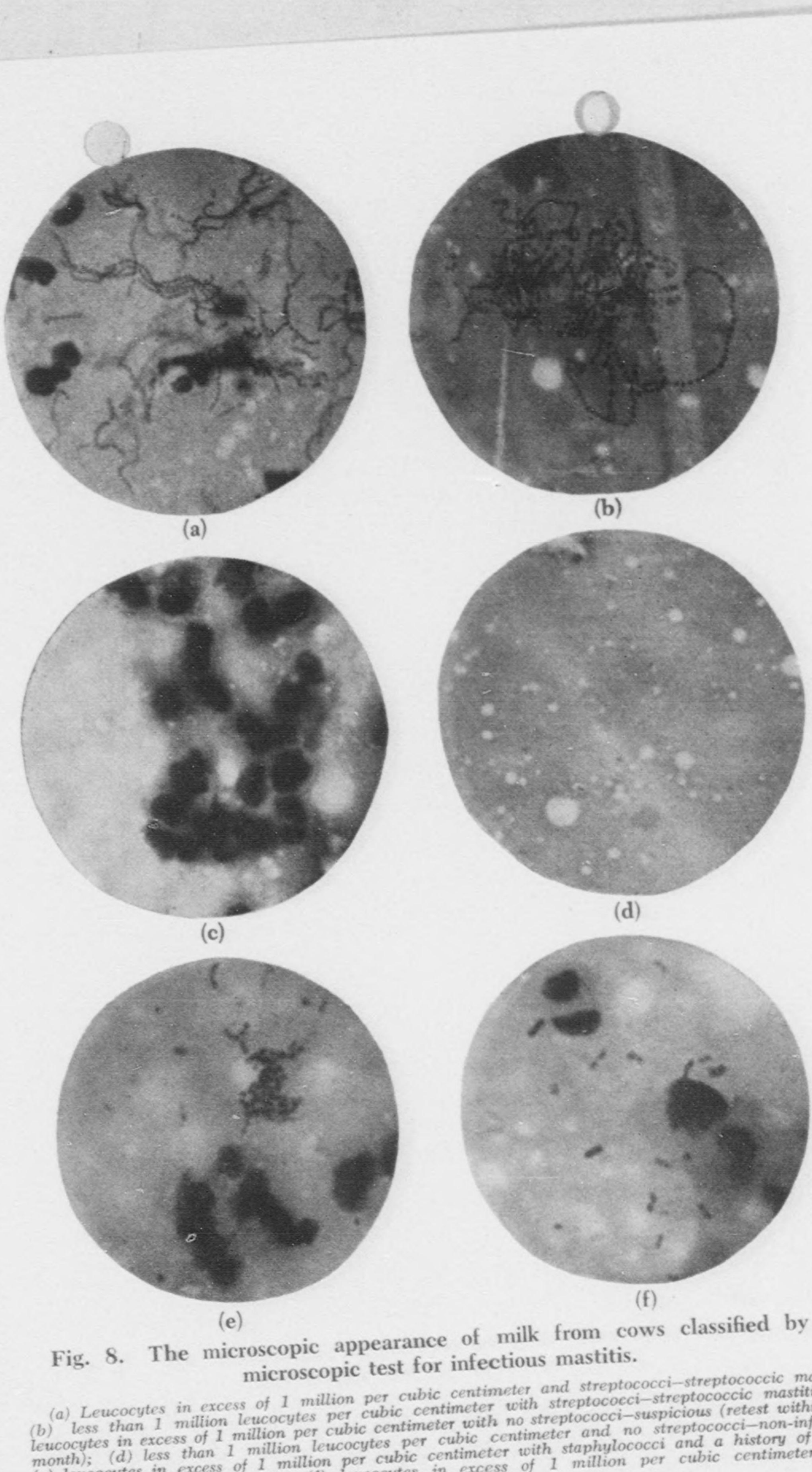

Fig. 8. The microscopic appearance of milk from cows classified by the microscopic test for infectious mastitis.

(a) Leucocytes in excess of 1 million per cubic centimeter and streptococci—streptococcic mastitis; (b) less than 1 million leucocytes per cubic centimeter with streptococci—streptococcic mastitis; (c) leucocytes in excess of 1 million per cubic centimeter with no streptococci—suspicious (retest within one month); (d) less than 1 million leucocytes per cubic centimeter and no streptococci—non-infected; (e) leucocytes in excess of 1 million per cubic centimeter with staphylococci and a history of acute mastitis—staphylococcic mastitis; (f) leucocytes in excess of 1 million per cubic centimeter with Escherichia coli and a history of acute mastitis—coli mastitis.

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Pathology Department, Michigan State College. A small charge is made for each vial, and an additional amount is charged for each sample when the milk is submitted for test.

RECOMMENDATIONS FOR THE PREVENTION AND CONTROL OF MASTITIS

Consult your local veterinarian early – The specific conditions existent on each dairy farm require expert knowledge for the proper application of preventive and control methods of handling the dairy herd. The treatment to be administered to the infected cow depends upon her condition; therefore, we urge every dairyman to consult his local veterinarian early.

The available scientific data, substantiated by field trials, indicate that the successful program for the prevention and control of bovine mastitis must include the following items in the order presented. **Any effort to alter this order is doomed to failure.**

A. **Good, sanitary milking procedures**

1. Arrange cattle into healthy, suspicious and infected groups, and milk the cows in that order.
2. Discard the foremilk into a strip cup just before disinfecting the udder. Withhold from the supply any abnormal milk and properly dispose of it by disinfection.
3. Wipe the udder of each cow just one minute before milking. Use a clean cloth moistened in a chlorine solution (200 p. p. m. of available chlorine and preferably as warm as the hand can stand) or other suitable udder disinfectant. This practice results in clean disinfected hands. Allow the cloth to remain in the disinfectant between cows.
4. Exclude from the milking of cows, those persons with "running sores" on their hands or with sore throats.
5. Before milking each cow by machine, dip the teat cups into a full pail of water and then a full pail of chlorine solution. The valve in the head of the long tube machines must be left open so that the air can escape and the antiseptic solution can reach all parts of the interior of the teat cups. The pur-

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pose of the water is to remove the milk solids so that the chlorine in the second pail can effectively sanitize the teat cups. If only one pail of chlorine is used it should be replaced with clean solution as soon as the disinfectant becomes milky.

6. Milk each cow **rapidly** and **completely** at each **regular** milking period; this promotes udder health. Irregular and incomplete milking result in non-infectious mastitis in some cows and thereby becomes a predisposing factor to infectious mastitis.

B. **Good herd management procedures**

1. All injuries, especially those occurring in the udder and teats, must be properly treated to prevent subsequent infection.

2. Stable cows in properly constructed stalls or stanchions (each of sufficient length and width and separated by an adequate guard or partition) with plenty of clean bedding to prevent udder and teat injuries.

3. Upon removal of infected cows from the herd, their stalls must **be thoroughly cleaned.** This should include the mechanical removal of all bedding, etc., and the thorough scrubbing with a lye solution or the application of superphosphate or lime to the floor.

4. Keep the barn dry and permit plenty of sunshine to enter.

5. Procedures must be practiced in raising heifer calves to prevent udder injury and to prevent the sucking that breaks the seal on the teats if the calves are to be used as good replacement cows.

6. The source of replacement cows in order of preference is

   (a) Home-raised heifers, (b) Purchase of bred heifers, and

   (c) Purchase of mature milking cows – test all replacement cows before purchase or buy them subject to such test and isolate them until tested.

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C. **Early and accurate diagnosis**

1. A careful physical examination of each cow's udder reveals the amount of scar tissue present. Non-infectious as well as infectious mastitis may cause this tissue change. Infected udders containing marked areas of scar tissue do not respond to the known udder infusion treatments, therefore, such cows should be eliminated from the herd by slaughter.

2. The microscopic test (the examination under the microscope of properly collected milk samples after incubation at 37°C. for approximately 24 hours) should be made of the milk of each lactating cow of the herd to determine the presence or absence of udder infection.

D. **Elimination by slaughter, or complete segregation from the herd of infected cows with badly damaged udders**

1. These cows will not respond to the udder infusion treatments.

2. This confines or eliminates the sources of spread of infection in the herd.

E. **Early and proper treatment**

1. When cows in the early stages of udder infection are treated by udder infusions, a high percentage, but not all of the cases, become free of infection.

2. Udder infusions are of value only where infection is the cause of the mastitis and they must necessarily be accompanied by sanitary milking procedures and farm sanitation; otherwise, the recovered case becomes re-exposed and re-infection may occur.

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POLICY DECLARATIONS ON Transportation

Transportation and
Communication Department

CHAMBER OF COMMERCE
OF THE UNITED STATES

June, 1948
Washington 6, D. C.

RETURN

TO MAJ NIBLOCK

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. 775013

PREFACE

THIS BOOKLET contains policies of the Chamber of Commerce of the United States in the field of transportation. They were developed by the Chamber's Transportation and Communication Department Committee, International Transport Committee and Urban Transportation Committee.

These policies, dealing with many of our postwar domestic, foreign and local transportation problems, are aimed towards development of a sound national transportation system, privately owned and operated, and capable of serving the best interests of shippers, carriers and the general public and available to meet national security needs.

HAROLD F. HAMMOND, *Manager*
Transportation and Communication Department

Policies developed by other Chamber committees, where applicable to transportation, are included and so indicated.

June, 1948

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Transportation

Transportation—In General

National Transportation Policy. The national transportation policy stated in the Interstate Commerce Act should be broadened and strengthened so as to embody the principle that the Interstate Commerce Commission in its administration of the Act is to allow "revenues sufficient to enable the carriers, under honest, efficient and economical management to provide" the service needed by the public; and the strengthened policy should be considered by Congress in new legislation affecting transportation, be made applicable to all governmental agencies as to all matters within their jurisdiction affecting carriers and transportation, and be applied to all carriers and agencies of transportation.

Regulation of all interstate and international transportation for hire should ultimately be by a single regulatory body; air transport and international ocean transportation should be under separate bodies for reasonable development periods; and all such regulatory bodies, permanent or temporary, should report direct to Congress.

The Interstate Commerce Commission should use every effort to separate its judicial and administrative functions, delegate details and expedite decisions; through elimination of politics in appointments and reappointments, provision for retirement compensation and appropriate salaries, effort should be made to obtain members of the highest possible qualifications; and like policies should be applied with regard to the Civil Aero-

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nautics Board and the United States Maritime Commission.

Carriers should be clearly empowered to enter into agreements as to rates or service, subject to safeguards imposed by the regulatory body, and agreements approved by that body should be relieved from the operation of the antitrust laws.

Regulatory agencies should continue to be given wide latitude in applying the rate provisions of the Interstate Commerce Act; differential rates should be left wholly within their jurisdiction; and to the extent that below-cost competitive rates are designed to injure competing carriers or stifle competition, or have that natural effect, they should be prohibited.

The principle of voluntary consolidation of railroads, subject to approval of the Commission, should be preserved; railroad management should proceed with the development of consolidation plans and businessmen should lend full encouragement thereto.

Congress should take any necessary action to permit operators of one form of transportation service to operate other forms within reasonable territorial limits upon making an adequate showing to the appropriate regulatory authorities that it would be in the public interest and would not unduly restrain competition; and to encourage operators of different forms of transportation, under proper safeguards in the public interest, to coordinate their services through contractual arrangements.

Legislation should be adopted to establish a formula for allocation among the states for tax purposes of equipment and plant of interstate air lines; the Interstate Commerce Commission after investigation should develop a similar formula for carriers under its jurisdiction; as a measure of assistance to transportation companies facing heavy deferred-maintenance expenditures as a result of

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the war, the carry-back provisions of the revenue laws should be extended through 1947; legislation should be adopted to avoid penalizing through lowered capital bases carriers changing to the depreciation system of accounting; and there should be no diversion of special user taxes from the purposes for which they were imposed.

Government aid to any form of domestic transportation should be limited to an early developmental period and be gradually withdrawn as the industry becomes established on a basis of its own.

State or local regulation not essential to the safeguarding of life or property, including public highways, should not be permitted to interfere with interstate transportation.

Organized relationships comparable in purpose to those of railroad shippers' advisory boards should be established between other forms of transportation and their patrons; organized cooperation should be arranged among carriers of different forms of transportation with regard to matters contemplated under the Bulwinkle Bill, H. R. 2536, and other matters of a non-competitive character; chambers of commerce should ordinarily deal with transportation problems through general transportation committees with representation of all forms of transportation and non-carrier interests rather than through separate committees for the different forms; and all carriers should examine their own competitive practices to see that they do not have non-economic effects detrimental to their own net revenues. (1946)

Carrier Agreements. The welfare of transportation companies and of the shipping and traveling public calls for early removal of the present uncertainty regarding the legality of long-established conference procedures respecting rates and services. There should be prompt action on pending legislation which, subject to safeguards speci-

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fied therein and such others as may be imposed by the Interstate Commerce Commission, would relieve from the operation of the antitrust laws conference agreements approved by that body. (1947)

Interference with Railroad Management. Legislation, federal or state, which would limit lengths of trains, prescribe so-called full crews, establish a six-hour basic work day in transportation, or otherwise interfere with the proper functions of management, is not warranted by any economic or safety considerations. Proposals of this character should be vigorously resisted and existing laws in several states should be repealed. (1946)

Transport Conservation. Termination of the war has not resulted in material diminution of the demands upon domestic transportation facilities. The adequate and rapid movement of freight involves the economic welfare of the nation and primary effort should be made to expedite the manufacture of additional freight hauling facilities and the rehabilitation of those now in use. Meanwhile, there is imperative need for active and continued cooperation of the regulatory authorities, carriers, and users of transportation to get the maximum possible service from the inadequate available supply of facilities. Shippers and consignees should load and unload cars promptly and fully, with arrangements where feasible for six-day loading and unloading operations. Carriers should make every effort to speed up their service. (1947)

Federal Barge Lines. The continued operation of the government-owned barge lines by the Inland Waterways Corporation conflicts with sound policies repeatedly enunciated by the Chamber. It represents unfair and uneconomic competition, conducted at great expense to the public, with privately operated barge lines and other com-

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peting forms of transportation. Therefore, the operation of government-owned barge lines should be discontinued at an early date either by liquidation or outright sale of the facilities as a whole or in units. In the meantime, no funds should be appropriated or applied for expansion. modernization or recapitalization of the Inland Waterways Corporation. (1948)

Department of Transportation. The Interstate Commerce Commission, the United States Maritime Commission and the Civil Aeronautics Board are constituted by statute as arms of Congress to bring about continuity of policy in their respective fields. Political influences are minimized by the requirement that not more than a bare majority of the members of any of these bodies may be of the same political party. Those bodies should not be subjected to domination or even to controlling influence of the Executive Branch of the government through establishment of a Department of Transportation which would always be subject to sudden and sweeping changes of policy. (1948)

Protection of Domestic Transport. The long established policy of the United States to reserve our domestic commerce for U. S. flag carriers, in respect both to air transport and coastwise water-borne commerce, should be preserved. (1948)

Vinson-Trammell Act. Considering the radically changed conditions in the aircraft and shipbuilding industries since the enactment of the Vinson-Trammell Act in 1934, we endorse the proposal of interested government agencies that those provisions which require specified percentages of aircraft and naval vessels procured by the government to be built in government facilities should be repealed. Likewise, due to the expensive procedure re-

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quired in allocating costs and the existence of ample protection under other provisions of law for government purchases through negotiated contracts. we endorse the proposal similarly made that profit limitations of the Act on contracts for aircraft and naval vessels also be repealed.

(1948)

Highways

(ADOPTED 1947)

Specific highway programs should be based on comprehensive surveys giving adequate consideration to an overall plan, to the economic benefits of each highway and to the proper relationship of the entire program to the whole public budget. Each state within its jurisdiction should be primarily responsible for the development of programs applicable to highways of general use and for the construction and maintenance of such highways. Lesser political units should be primarily responsible for those of local use, but state highway departments should have general supervision over expenditures of state-raised revenues applied to local systems.

The costs of building and maintaining highways should be paid by the interests they serve in proportion to benefits. Highway users should pay the major part of the costs of highways of general use, including main thoroughfares in urban areas, in addition to paying their fair share of the general costs of government. Local roads and streets should be financed from general revenues or property assessments, augmented by a share of user revenues proportional to use. Contributions by highway users to the cost of building and maintaining highway systems should be through special taxes or fees based on logical standards reasonably commensurate with the value of the use; and no part of the proceeds of these special user levies should be diverted from highway purposes. Bond issues

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should not be employed for highways, unless an adequate program is impossible from current highway revenues.

The function of the federal government in highway development, except for direct responsibilities for highways on the public domain, should be primarily one of coordination in the interests of interstate commerce with due regard to military use. All federal aid for highways should be administered by a single federal agency working exclusively with the state highway departments. Allotments of federal aid among the states should, among other factors, give adequate consideration to traffic volume and needs. Federal aid should be required to be matched in not less than equal amounts by state funds, with exceptions when reasonably necessary in states containing large areas of the public domain. Acquisition of right of way should be recognized as a responsibility of the states under the federal-aid system. Acquisition by the states for highway purposes of reasonable amounts of adjoining land and property to avoid damage claims or to establish and protect freeways and parkways should be encouraged.

Public authorities should encourage the provision of private off-street parking facilities for hire on a stable basis, without the threat of unfair competition from free or below-cost facilities provided or operated at public expense. There should be a continuous postwar program for the elimination of railroad-highway grade crossings which are dangerous or which delay a substantial volume of traffic, any assessments for construction costs levied therefor against railroads, or obligations imposed upon them for subsequent maintenance or taxes, to give adequate recognition to the growth of highway use and to the relatively small benefits derived therefrom by the railroads under present conditions. Costs of construction and maintenance of grade-crossing protection should be simi-

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larly allocated according to benefits. Safety, not only through suitable highway construction, reconstruction and maintenance, but also through protective devices, adequate administration, law enforcement exclusively by state and local authorities, and education of highway users, should be a prime requirement in all highway programs.

Urban Transportation

(ADOPTED 1948)

Planning. Urban planning should make provision for all needed forms of passenger and freight transportation. Business and civic groups should take an active interest in the proper development and application of such plans.

Street Systems and Urban Expressways. A basic requisite of an urban transportation plan should be a street system consisting of a proper balance in the location, design and use of neighborhood streets, secondary streets and major thoroughfares having adequate capacity to handle efficiently the traffic of the community. As traffic demand justifies, urban expressways with limited access and a minimum of intersections should become a part of the major thoroughfare network of the urban street plan and should be designed for use by all types of vehicles.

The major part of the costs of building and maintaining main thoroughfares and expressways in urban areas should be paid for through reasonable motor vehicle and motor fuel taxes. Lesser streets should be financed from general revenues or property assessments augmented by a share of user revenues reasonably proportional to use.

Traffic Control and Administration. As an initial step toward meeting the growing volume of urban traffic, every effort should be made to increase the efficiency,

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capacity and safety of the existing street system through proper application of proven traffic engineering and enforcement techniques.

Public authorities should regulate or prohibit curb parking to the degree necessary to prevent undue interference with moving passenger and freight traffic and with essential curb loading and unloading of passengers and freight. Such regulations should be rigidly enforced.

Responsibility for traffic engineering administration should be clearly defined and centralized in a single agency. Cities should have a citizen's traffic committee and, where desirable in large cities, an official commission to coordinate the traffic activities of city departments.

Off-Street Parking. Where there is substantial demand for off-street parking facilities, public authorities should be required to encourage their provision on a stable basis by assisting the commercial parking industry to obtain traffic and parking facts bearing on the location, design and operation of parking facilities, and giving assurance against unfair competition from free or below-cost facilities provided or operated at public expense. New and remodeled business structures and industrial establishments generating large parking demands should be encouraged to make provision for the parking needs of their occupants. Where desirable, a parking agency should be established to carry out the foregoing functions.

Parking lots operated for public use should be regulated by the community but not as to parking fees.

Truck Loading. Street parking regulations should recognize that practically every building, including residences, requires frequent or occasional service by trucks, and should make such service feasible.

Official curb loading zones should be provided and trucks should be encouraged to load and unload when

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they will create minimum interference to traffic flow.

Tenants and landlords, where necessary, should be required to establish joint truck loading facilities or arrangements. Joint terminals for consolidating less than truck load deliveries should be encouraged. Where volume justifies, off-street truck loading facilities should be required for new buildings and also for existing buildings where economically feasible. Development of adequate truck loading facilities should be made a responsibility of the proper municipal authority. All interested transportation and business groups should work with municipal officials to reduce traffic congestion without disrupting the flow of freight.

Public Transit. Every effort should be made to facilitate and encourage greater use of local transit.

Efficient service can be best attained through private operation, with the capitalization, fares and service under the regulation of a state utility commission or a properly designed official agency within the metropolitan area having jurisdiction over all types of local passenger carriers.

Since efficient and improved public transit is dependent upon its ability to attract investment capital, transit should be given a more favorable business climate in which to operate and should have relief from special and burdensome assessments.

Further use should be made of limited stops, turn-back service, express service and other methods of improving transit service and expediting transit operations, including application of staggered working hours for business and industrial employees. Unwarranted route extensions and other unprofitable services affecting the financial stability of the transit carriers should be discouraged.

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Taxicabs. Taxicabs should be regulated as common carriers, preferably by the same official agency that regulates other types of local carriers and should be reasonably restricted both as to their activities and number; they should be required to provide proof of financial responsibility; charges to the public, in large cities, should be determined by taximeters; they should be encouraged to establish fixed stands and to install two-way radio communications where desirable.

Traffic Safety. The elements of a traffic safety program of a community should be those recently developed and approved by the President's Highway Safety Conference. The several states should be urged to adopt proven safety practices and to enforce vigorously such practices.

Every community should have an active traffic safety organization which should provide public support to strengthen the traffic functions of the public officials. Businessmen and their organizations should give sustained support to the street and highway traffic safety program.

Aviation

(ADOPTED 1947)

Airports. The national interest in the provision of an adequate nationwide airport system justifies reasonable federal aid for this purpose. The Federal Airport Act of 1946 lays the basis for such participation. Funds provided under that Act should be restricted to the federal share of costs of grading, drainage, runway construction, lighting and other safety features, and state or local jurisdictions should be required to provide land, buildings and maintenance. Administrative and financial responsibility for airport work should be concentrated in single agencies in federal, state and local jurisdictions. There should be airport planning surveys in each state to be conducted

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in cooperation with the federal agency on the one hand and local airport authorities on the other. Privately owned and operated airports constitute approximately one-half of the total number of existing airports and governmentally financed projects which would result in destructive competition therewith should not be undertaken. Reasonable user charges should be required at all publicly owned airports and such airports should as soon as practicable be put on a self-sustaining basis.

(ADOPTED 1948)

Civil Aviation. Scheduled and irregular common carriers by air should be subject to regulation only by the Federal Government as to rates, service and safety. For irregular common carriers engaging in carriage of passengers, directly or by charter, the inspection standards, pilot qualifications and other safety requirements should be similar to those for other common carriers by air. Financial responsibility to cover any liability for personal injury or property damage should be required.

To provide an adequate basis for their experimental operation certifications of local service air lines should be made for five-year periods.

Contract air carriers should be made subject to regulation by the Civil Aeronautics Board as to rates, service and safety.

Maintenance of government civil aircraft, and to the extent feasible, of aircraft of the Armed Services should be contracted to the civilian aircraft maintenance industry to assure that the latter will be available as an effective auxiliary to the military establishment.

As a means of developing widespread aviation experience, private flying should be encouraged through the development of an adequate system of airfields, encourage-

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ment of widespread aviation education and simplification of regulatory requirements.

A continuing program of aviation research on an adequate scale to meet the needs of national defense should be provided for by the government to supplement such work by the aviation industry, educational institutions and other private research agencies. The best results will be obtained through the allocation of the work to private agencies to be carried on under supervision and coordination by the National Advisory Committee for Aeronautics with guidance and support of the Research and Development Board. The federal government, with the cooperation of the Air Force, air transport operators and aircraft manufacturers, should assume a primary role in the development of such types of transport aircraft as may be required in the interest of the national defense.

Plans incorporating the recommendations of all users, and principally those of the armed forces, for modernizing and developing the airways should be carried out by the federal government in the interest of national defense.

Air transport, now in process of expansion, requires continuation for the time being of regulation separate from that for other forms of transportation. Such effective action as may be necessary should be taken to determine and express a unified government viewpoint on aviation matters. In the present condition of aviation development the states should concentrate efforts on airport matters and other promotional work in the interest of aviation and should limit their regulating activities to cooperation with the federal government in the enforcement of the federal safety regulations.

International Transport

There is urgent need for adequate and efficient international transport throughout the world, both for the

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movement of relief and other emergency supplies and personnel and for early reestablishment of world trade, a major factor in restoring many war-depressed peoples to a self-sustaining basis. Encouraging progress has been made, especially where opportunity has been open for resumption and expansion of commercial services. (1946)

Restoration of Commercial Services. With large numbers of transport planes now available for international air lines, suitable for temporary use although in many instances not ideal for permanent employment, and with vast quantities of ocean shipping of similar description becoming available for commercial use since the passage of the Ship Sales Bill, rapid establishment of adequate air and shipping services in private operation is most desirable. We endorse the announced policies of our government to facilitate this by every practicable means, including the chartering of government-owned vessels to citizens to replace privately-owned vessels temporarily retained in government service or vessels which have been purchased or are under construction for private account, delivery of which has not been effected. We urge that preference be given to privately-owned vessels and such chartered ships in the allocation of cargoes controlled by the War Shipping Administration. We strongly oppose the imposition of restrictions directly or indirectly, other than by operating subsidy or other appropriate agreements, on the employment of privately-owned tonnage and tonnage chartered to private owners. Provision should be made for the promptest possible decisions by our governmental authorities, both in disposal of ships and planes and in action upon applications involved in the establishment of international sea and air transport lines. (1946)

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Regulation. The principles of the Merchant Marine Act, 1936, and the Civil Aeronautics Act, 1938, providing for a regime of regulated competition in each of these fields are sound. We believe also that, in the interest of quick adjustment of the supply of service to the demand and the maintenance of flexibility to meet the changing requirements of international commerce, the determination of rates for both sea and air services should be handled through the time-proven system of conferences established by the carriers of all nationalities engaged in each trade, governmental supervision being limited to approval of the conference agreements but not attempting to pass upon the actual rates. (1946)

Support for American Services. Recognition should be given by our government in its administration of the Merchant Marine and Civil Aeronautics Acts to the importance of maintaining vigorous shipbuilding and airplane building industries in order to insure both the continuity of progress in the arts of ship and plane building and the availability of such organizations and facilities in the event of another national emergency. Special immediate attention should be given to rounding out the American merchant fleet to provide the types of vessels in which it is now deficient, notably passenger, refrigerator and medium draft cargo vessels. Ships of these types still in military or naval use should be made available for urgently needed commercial service, even though it may involve utilization of somewhat less suitable tonnage for certain military and naval purposes. American exporters, importers and travellers should lend support to American sea and air transport lines by their patronage. (1946)

Trade and Travel Barriers. Many governmental actions, regulations and restrictions, in force in the United

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States and elsewhere, are hampering the fullest development and use of international sea and air transport. The efforts of international authorities, the International Chamber of Commerce and other organizations to obtain simplification of the requirements for the issuance of passports, visas, customs rules, public health and quarantine regulations as related to ships, aircraft, passengers, cargo and air-transport spare parts, supplies and personnel in international trade should be actively supported. Our government should take the lead in putting such simplifications into effect. (1948)

Industry Representation. In international conferences dealing with sea and air transport we consider it highly important that our government continue its policy, applied at the Chicago conference and in the recent London conference for liquidation of the United Maritime Authority, that representatives of our shipping and air transport industries be included in our governmental representation. (1946)

Demobilization. The liquidation of the United Maritime Authority and the restriction of its successor allied shipping pool to relief and UNRRA needs are proper steps. Similarly the Army and Navy transport services should be reduced as rapidly as practicable and maximum dependence be placed on commercial shipping. Likewise the Army and Navy air transport services should be reduced to the minimum necessary, with due account of the possibility of utilizing commercial airlines to meet military and naval transport requirements. (1946)

International Air Transport. Our international air transport is a vital link in the nation's transportation network; an indispensable element in the national defense;

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a servant of foreign trade. Therefore, a first consideration in the civil air policy of the United States government should be to provide permanently for U. S.-flag international air transportation on a scale commensurate with its importance to the national interest as well as the great volume of traffic which the United States has developed and continues to contribute to world transport by air. Provisions for the operation of United States and foreign flag airlines to and from our territory should be consistent with this policy. If necessary to insure desired development and maintenance of services, adequate support should be given to our international airlines on the basis of existing law or otherwise. As an essential part of this program we should maintain a vigorous aircraft industry, with the necessary plant, tools and experienced personnel, and with adequate provision for research, design and production. (1947)

As the basis for extending the development of U. S. flag international air transport, the existing pattern of bilateral agreements should, at least for the present, be followed in obtaining operating rights in foreign countries. (1948)

Steps should be taken to clarify the apparent inconsistencies in the Civil Aeronautics Act relating to issuance of foreign air carrier permits and effective opportunity should be provided for all interests concerned to be heard before agreements are entered into which affect the issuance of such permits. (1948)

Since the existing conference system provides the most practical method of making rates for international air transport, extension of government control over such rates should not be authorized unless more need therefor becomes evident and the conference system should be adhered to with only that degree of government supervision provided by existing authority of the Civil Aeronautics Board to pass upon conference agreements. (1948)

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International Air Navigation Facilities. The United States should cooperate in the improvement of air navigation, communication and ground facilities throughout the world wherever necessary as an important part of any program of economic rehabilitation and international trade promotion. (1948)

Foreign Aircraft Earnings—Reciprocal Tax Exemption. The Internal Revenue Code should be amended to extend to the earnings of aircraft under foreign registry the reciprocal income-tax exemption now granted for earnings of ships under foreign flags, and, where necessary, intergovernmental agreements should be made to provide such reciprocal exemption, thus aiding the growth of our airborne foreign commerce by relieving our carriers of burdensome foreign taxes and the complications of diverse and unfamiliar administrative provisions of foreign tax laws.

Merchant Marine. There should be a strong, consistent national policy with respect to the American merchant marine, implemented by vigorous administration of that policy. (1947)

While between the World Wars progress was made in building up a merchant fleet which was immediately available and rendered valuable service in our armed efforts, the recent experience clearly demonstrates that we must have a higher degree of security and independence in the field of ocean transportation. (1947)

Continuation of the policies for shipping in foreign trade embodied in the Merchant Marine Act of 1936 and other existing merchant marine acts, based on private ownership and operation with government regulation and support, is equitable and desirable from both national and international viewpoints. There should be broad public understanding of the fact that subsidies provided

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thereunder do not give advantage to American shipping over that of other nations but only seek to equalize American with lower foreign construction and operating costs where they exist. (1947)

In the light of the greater international commitments and responsibilities thrust upon us by the war, we should consider the adequacy of the established trades, strengthen and expand the prewar services, and create such additional routes and add such tonnage or services as may be necessary to meet foreign competition which has rapidly mobilized itself in the first full year of peace. (1947)

Every effort should be made to assure adequate provision of passenger vessels and other special types suitable for conversion to troop transports and naval service in time of emergency, the need for which was so clearly demonstrated during the war. (1947)

Recognition should be given by our government in its administration of the Navy and merchant marine to the importance of maintaining a vigorous shipbuilding industry to insure both the continuity of progress in the art of shipbuilding and the availability of organizations and facilities in the event of another national emergency. (1947)

We approve the proposal for appointment of a special board by the President to make a broad survey of our shipbuilding problem from the viewpoint of the national need, including a determination of the essential minimum volume of shipbuilding and methods for maintaining it in the light of merchant marine and naval requirements. (1947)

There should be consistent and effective implementation of the national shipping policy based on private ownership and operation with government regulation and support as provided for in the Merchant Marine Act of 1936; and, to assist in rounding out our existing mer-

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chant fleet with passenger and other special type vessels needed in the interest of our national security and foreign trade, the construction subsidy provided in that Act should be the expected average difference between American and foreign building costs over the useful life of the vessel, estimated at 50 per cent of the American cost. (1948)

Port Facilities. Public authorities and business organizations should promote the development of port improvement programs both in the United States and in other parts of the world, and such programs should be recognized as one of the important needs to be met in connection with international efforts for economic reconstruction. In the interests of national defense attention should be given to the development of strategically essential United States ports. (1948)

Policy Declarations Originating in other Chamber Committees

Repeal of Railroad Social Security System. Existing legislation creating the composite social security program for railroad employees—comprising retirement benefit, survivors' benefits, unemployment benefits, sickness benefits, and maternity benefits—is discriminatory and otherwise inconsistent with sound social security principles. Such legislation should be repealed, with suitable transitional provisions to protect the rights already acquired by individuals under it. Railroad employees should then be included within the coverage of appropriate general social security programs. —*Social Security*

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Excise Taxes. Excise taxes equitably devised and nondiscriminatory as between competing industries should continue to be an important feature of the revenue system. Such taxes at low rates upon articles of wide use, but not of first necessity, are needed to supplement the income taxes. The war increases in excises, the tax upon property and passenger transportation, and levies of a nuisance type should be repealed. *—Finance*

Foreign Travel. Congress and the appropriate agencies of the Government, in order that persons may travel with the greatest possible freedom, should give consideration and study to the:

1. Laws and travel regulations of our country controlling the entry of foreign persons into this country for temporary visits and persons passing through the United States en route to other countries.
2. Laws and travel regulations of foreign countries applicable to American citizens desiring to visit those countries temporarily or passing through those countries en route to their destination.

To encourage foreign countries to liberalize their existing laws and regulations, the United States should initiate as great a degree of liberalization in its policies as is consistent with its national interests. Our Government should endeavor to arrange bilateral agreements with friendly nations so that

1. Our citizens holding U. S. passports, who present proof that their proposed visit to a foreign country is for a limited time, should receive visas promptly from any consul of the country to be visited, without the necessity of producing photographs, police, or other unnecessary certificates, or personally calling on the consul, and
2. Our consuls in foreign countries with whom such agreements are made be authorized and instructed to furnish visas promptly to foreign citizens desiring to visit the U. S., under the same terms.

—Foreign Commerce

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Personal Injuries. Strong support should be given to programs designed to reduce the loss of life and limb through automobile accidents. It is unnecessary for the motor vehicle accident rate to climb to new heights, particularly after the improvements during the war years. Careful driving campaigns, improved traffic control devices, highways designed for safe operation of vehicles, and enforced traffic laws should all contribute to the desired end. (1946)

Financial Responsibility Laws

Many states have adopted legislation to assure to their citizens greater financial responsibility of motorists. The primary consideration in such legislation should be the reduction of the number and the severity of accidents. The basic principles of the so-called automobile financial or safety responsibility laws should be supported. Strict enforcement of such laws, coupled with a well-rounded program of traffic safety education and highway engineering, is the best solution to the problem. The creation of state automobile insurance funds is opposed. (1946)

Marine Insurance

The Chamber continues to oppose the government's engaging in any phase of business which can be successfully undertaken and conducted by private enterprise, and it, therefore, opposes the writing of marine insurance by the government excepting in times of emergency, and then only to the extent that such insurance is not available in the private market. (1946)

Extension of Marine Policy

The Chamber of Commerce of the United States urges the principle that marine insurance be permitted to cover goods while they remain in their original package and

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until that package is broken up for distribution through the distributing agencies in the countries importing the said goods and that this marine insurance facility be available to shippers without the necessity of the insurance company being licensed in the country of destination of the goods shipped. (1946)

—*Insurance*