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THE UNITED STATES
STRATEGIC BOMBING SURVEY

Report on the Survey 12.54

THE WAR AGAINST
JAPANESE TRANSPORTATION
1941-1945

Transportation Division

May 1947

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JAN 21 1948

This report was written primarily for the use of the U. S. Strategic Bombing Survey in the preparation of further reports of a more comprehensive nature. Any conclusions or opinions expressed in this report must be considered as limited to the specific material covered and as subject to further interpretation in the light of further studies conducted by the Survey.

FOREWORD

The United States Strategic Bombing Survey was established by the Secretary of War on 3 November 1944, pursuant to a directive from the late President Roosevelt. Its mission was to conduct an impartial and expert study of the effects of our aerial attack on Germany, to be used in connection with air attacks on Japan and to establish a basis for evaluating the importance and potentialities of air power as an instrument of military strategy for planning the future development of the United States armed forces and for determining future economic policies with respect to the national defense. A summary report and some 200 supporting reports containing the findings of the Survey in Germany have been published.

On 15 August 1945, President Truman requested that the Survey conduct a similar study of the effects of all types of air attack in the war against Japan, submitting reports in duplicate to the Secretary of War and to the Secretary of the Navy. The officers of the Survey during its Japanese phase were:

Franklin D'Olier, *Chairman*.
Paul H. Nitze, Henry C. Alexander, *Vice Chairmen*.
Harry L. Bowman,
J. Kenneth Galbraith,
Rensis Likert,
Frank A. McNamee, Jr.,
Fred Searls, Jr.,
Monroe E. Spaght,
Dr. Lewis R. Thompson,
Theodore P. Wright, *Directors*.
Walter Wilds, *Secretary*.

The Survey's complement provided for 300 civilians, 350 officers, and 500 enlisted men. The

military segment of the organization was drawn from the Army to the extent of 60 percent, and from the Navy to the extent of 40 percent. Both the Army and the Navy gave the Survey all possible assistance in furnishing men, supplies, transport, and information. The Survey operated from headquarters established in Tokyo early in September 1945, with subheadquarters in Nagoya, Osaka, Hiroshima, and Nagasaki, and with mobile teams operating in other parts of Japan, the islands of the Pacific, and the Asiatic mainland.

It was possible to reconstruct much of war-time Japanese military planning and execution, engagement by engagement, and campaign by campaign, and to secure reasonably accurate statistics on Japan's economy and war production, plant by plant, and industry by industry. In addition, studies were conducted on Japan's over-all strategic plans and the background of her entry into the war, the internal discussions and negotiations leading to her acceptance of unconditional surrender, the course of health and morale among the civilian population, the effectiveness of the Japanese civilian defense organization, and the effects of the atomic bombs. Separate reports will be issued covering each phase of the study.

The Survey interrogated more than 700 Japanese military, government, and industrial officials. It also recovered and translated many documents which not only have been useful to the Survey, but also will furnish data valuable for other studies. Arrangements have been made to turn over the Survey's files to the Central Intelligence Group, through which they will be available for further examination and distribution.

PREFACE

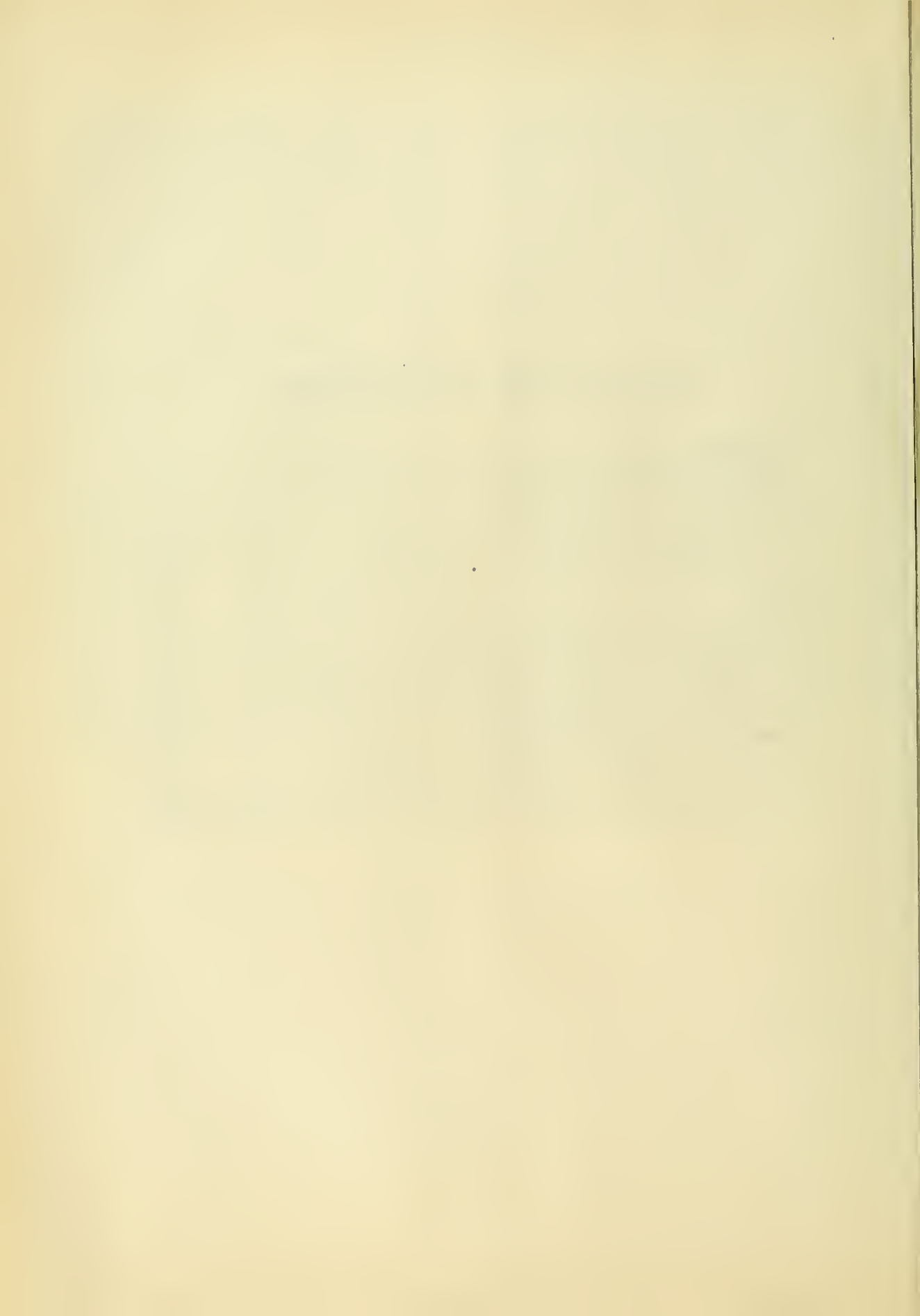
The study of the history of Japanese merchant shipping presented problems of very considerable difficulty, largely because of the confusion and inadequacies of Japanese records. Most of the Division's work was necessarily devoted to culling out material of sufficient quantity and validity to provide a reasonably accurate description of this phase of the Japanese war effort.

Statistics regarding the sinking of Japanese merchant shipping are based on information collected in Japan. About fifty different lists, reports, and other pieces of information were obtained from Japanese Army, Navy, and civilian sources in Tokyo and elsewhere in the empire. Some of this information purported to cover the whole question of the fate of their merchant marine; some dealt with only certain sections of the problem, geographically, chronologically, or in accordance with other limits. Not one of these lists is believed to be complete or accurate within the limits it is alleged to cover. However, the source material represents a sufficiently broad cross section of informed persons to give a comprehensive picture of what happened to the Japanese merchant marine. All of these pieces of information have been compared, checked, evaluated, ship by ship, and substantiated wherever practicable by comparison with attack data from United States sources.

The governing policy in making this tabulation of Japanese merchant ship losses has been to develop an over-all picture of events sufficiently complete and accurate to justify general conclusions on the subject. It is believed that this has been done. It is believed that the statistics in this report cover the fate of at least 95 percent of the merchant tonnage under control of the Japanese and that within that coverage the figures are at least 95 percent accurate. Because of the lack of time and the comparative unreliability of the data available, no attempt has been made to survey, ship by ship, the losses of shipping under 500 gross tons burden. However, it is believed that this small shipping played a relatively unimportant part in the workings of Japan's war economy. (The order of importance of steel shipping under 500 tons is shown in the fact that it constituted only 3 percent of the steel merchant tonnage available to Japan on Pearl Harbor day, and that during the war less than one-half of one percent of the steel tonnage constructed in Japan was less than 500 tons). Full information on individual ship sinkings will be available by reference to reports of the joint Army and Navy assessment committee, not yet completed, whose findings represent a careful appraisal of all available data and are mutually agreed to by all the services.

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JAPAN
AND
VICINITY

CHAPTER I

SUMMARY AND CONCLUSIONS

No major power in the world was more dependent upon ocean shipping than Japan. Her entire economy in peace, and even more so in war, depended upon shipping to provide the basic materials for industry and to fill out the supply of staples required to feed and clothe her population. The munitions industries were largely founded upon the basic iron and steel, aluminum, and chemical industries, all of which relied heavily upon imported raw materials—iron ore, coking coal, scrap and pig iron, alumina, phosphorite, etc. Although some basic industrial raw materials were available in the home islands, they were largely of inferior grade and inadequate output. In fuel alone, Japan was reasonably self-sufficient for ordinary industrial and domestic purposes because of her large coal reserves and developed output. But coal of coking quality was lacking and the all-important oil to power her Navy, merchant marine, and air force had largely to be imported.

As a maritime nation with a large domestic and foreign trade, as a great naval power, and as an aspirant to conquest, Japan had developed a large and modern merchant marine. With the active interest of the government, the merchant fleet had been built up to 4½ million tons in 1937 and was carrying some 54 percent of the nation's foreign commerce, in addition to the entire volume of its large domestic and colonial trade. Even so, Japan was short of shipping; at the end of 1938 only three-tenths of one percent of her merchant fleet was laid up as compared with 3 percent of England's and 10 percent of the United States merchant fleet. Active shipbuilding in the modernization and expansion of this fleet had given her a sizable and competent shipbuilding industry. The fleet of large ocean-going vessels was supplemented by numerous smaller craft ubiquitously engaged in the coasting trades between and around the home islands. But as her shipping was highly developed and her principal heavy industry located to employ fuel and raw materials received by water, the railroad mileage was small and the rail system was generally of

limited capacity. Only two main lines extended the length of Honshu, keeping for the most part close to the coastal margin. Only the line from Tokyo southwest to the great ports of the Inland Sea and the Shimonoseki ferries was developed for heavy traffic. The few lateral lines crossing the backbone of Honshu were of most limited capacity and of minor importance. On Hokkaido and Kyushu the system was one of gathering lines feeding into the ports and ferries. Only after the war began was direct physical rail connection secured between Kyushu and Honshu by construction of the Kanmon tunnels. In normal times the rail system had a large predominance of passenger business and its freight traffic was chiefly of the short-haul variety largely ancillary to the coastwise and ocean movement. The highway system was primitive and no important improved intercity highways existed. Intercity truck and bus transportation was completely undeveloped.

The disposition of fuel and other natural resources in the home islands concentrated the sources of bulky domestic traffic at the two ends of the main island chain, i. e. on Kyushu and Hokkaido, whereas the principal population and industrialization was along the southeast coast of Honshu from Tokyo southwestward to the great ports of the Inland Sea. Coastwise shipping and the two limited-capacity main railroads were the life lines of the basic domestic movement, particularly of fuel and foodstuffs. These life lines proved to be exceedingly vulnerable.

The series of events following closely upon Pearl Harbor culminated in a vast expansion of territory under the control of Japan, a wide scattering of her armed forces in the field, and the imposition of formidable problems of supply by ocean vessel. Simultaneously the country faced the problem of exploiting at once the resources of conquered territory, all separated by ocean hauls from the main islands, in order to take the place of the prewar import trade and reestablish the raw materials and food bases for the Japanese war economy. But Japan had been gradually deprived of the use of foreign

shipping prior to Pearl Harbor and had taken only 823,000 tons in her conquests. The Japanese shipping situation was, therefore, tight at the very beginning of the war, and it was necessary to press the utilization of the merchant fleet to the maximum. The fleet of ocean-going steel ships, because of a vigorous construction program, had expanded by this time to some 6,000,000 tons, (of ships over 500 tons) but nearly 4,100,000 of these were assigned to the military in separate Army and Navy pools leaving but 1,900,000 tons in the civilian shipping pool. The rapid expansion of conquest and the development of reverses at the periphery prevented the expected return of vessels from the military pools to civilian use. The three pools continued to be separately operated. An effort was made to have vessels in the military pools load strategic materials on the return voyage to home waters, but this was generally unsuccessful and the amazing spectacle of ships moving in ballast in opposite directions in the face of a severe shortage of shipping continued virtually throughout the war. Shipping was an early target for Allied offensive power. Even during the retreats through the Philippines, Malaya, and the Indies, significant damage was done by Allied air power and the submarines soon began to harass Japanese shipping lanes from Tokyo to Singapore, albeit in weak force and scattered fashion. Nevertheless, despite all of Japan's shipbuilding efforts and despite the weakness of available Allied offensive forces early in the war, the balance of shipping available to Japan began to decline as early as April 1942.

The Japanese were peculiarly and astonishingly unprepared to convoy and protect their merchant marine against attack whether by sea or air. Merchant vessels were not armed at the outset and guns were not available to arm more than a portion of them. Those in the Navy pool were first equipped, the Army attempted to use field guns on deck, and dummy wooden guns were used in some of the civilian fleet as a deception. Few vessels were available for convoy service and many of these were small short-range craft of limited utility. Lacking the means to convoy, the Japanese nevertheless sent out unprotected vessels in groups and lost heavily as a result. Strenuous efforts were made to build up the convoying fleet, exposed routes

were consolidated with others that could be better protected, and finally all important routes were being operated on the convoy system. This of course reduced the carrying capacity of the fleet, for many convoy routes were roundabout, vessels lost time awaiting the formation of convoys, fast ships were held down to the speed of slower craft, and many a vessel wasted time awaiting the refueling of short-range escort craft protecting the convoy. Yet the system was always of limited effectiveness because of the shortage of escorts and their lack of proper detecting and other equipment. Moreover a more effective convoying effort might not have reduced the vulnerability of merchant shipping to air attack.

Air activity against shipping began to increase after our capture of Henderson field on Guadalcanal as the United States effort passed to the offensive and available forces, as well as the exposure of the enemy, increased. The shipping used in the attempted reinforcement of the Solomons was largely sunk and the air forces based on New Guinea commenced a steady attrition of near-by shipping. Submarine activity expanded and this period of growing effectiveness of our effort was punctuated by the smashing carrier aircraft blow at Truk in February 1944, when 186,000 tons of shipping, bottled up by the presence of submarines, were sunk in a two-day raid. By this time the submarine force had so greatly expanded that no route was secure from its attack. No ship was safe south of Honshu. In the 16 months from September 1943 to the end of 1944, our submarines sent 3,000,000 tons of enemy merchant shipping to the bottom.

The three months of the Philippine campaign in late 1944 threw the administration of the Japanese merchant marine into confusion. Gradual losses over a prolonged period were accentuated and so great was the reduction in tonnage by this time that the old methods of organization and operation became impractical. Carrier aircraft struck heavy blows immediately prior to the Leyte landings and during the early Japanese efforts to reinforce the Philippines. Concentrations of submarines around Luzon were active and effective. The attempted reinforcement was frustrated and, in three months, the Japanese merchant marine lost more than 1,300,000 tons of ships, or more

than one-third of its remaining fleet. Notwithstanding intensified air activity, and particularly the effective strikes of carrier air, 55 percent of the ship tonnage lost during this period was sunk by submarines.

As 1945 began, the thin remaining life line of the Japanese Empire was a trickle of ships moving from Formosa along the South China coast to Indo-China and on to Malaya and the Indies. Although the effort to run the gauntlet of Allied attacks was great, a few ships got through. For the most part the Japanese were still secure in navigation of the Sea of Japan and the Yellow Sea. As far as possible, inter-island and import trade was routed to use the shortest sea haul by shifting as soon as possible to rail. Much of the coastwise traffic was moving all rail. The railroads were loaded close to capacity but the decline in domestic inter-island traffic roughly paralleled the decline in coastwise shipping capacity, thus avoiding the overburdening of rail lines. On the continent, too, the railroads of North China and Korea were being used to shorten ship hauls as much as possible. Within six months the remaining sea transport was reduced to chaos.

In mid-January carrier fleets undertook concentrated sweeps in the South China Sea sinking 10 percent of Japan's remaining merchant fleet. In March came the Okinawa campaign and the discontinuance of further attempts to operate convoys between Japan and Singapore. Only the expected imminent occupation of Formosa or Okinawa accomplished this objective, for Japan's needs for imports from the south were so great that even the huge losses from combined submarine and air activity could not deter her from the attempt to force some shipments through. The occupation of Iwo and Okinawa contracted Japan's sea sphere to the Sea of Japan, the Tsushima Straits, and the Yellow Sea with a tenuous connection to Shanghai and the Yangtze. March saw also the beginning of the heavy city raids by B-29s which had no significant effect upon shipping or upon the railroads, though the traffic upon the latter was somewhat reduced because of the general paralysis of industry and commercial activity in the affected cities.

Finally on 27 March the highly successful mine-laying campaign of the B-29s commenced, completing the paralysis of shipping.

The Shimonoseki Straits were effectively mined, imposing a virtual blockade upon movement through this vital shipping gateway. Eventually all important Japanese and Korean seaports on the Japan Sea and Korean Straits had been mined. Over 670,000 tons of shipping were sunk or disabled for the duration of the war by mines and the remainder of the fleet was rendered largely ineffective. Concurrently every part of Japan's sea lanes came within reach of active land-based aircraft. In July a carrier strike against Hokkaido and the Tsugaru Straits accounted for much tonnage and virtually stopped the important movement via the rail ferries to Honshu. As early as May sinkings and serious damages were at the rate of 11 percent a month, steel shipbuilding was but 30 percent of the peak and falling rapidly, wood shipbuilding was down to 12 percent and fuel available for the boats in service was but 10-20 percent of former quantities. The repair problem was serious with half a million tons of damaged shipping in the yards and much additional damaged tonnage unable to reach repair yards because of the mine blockade. By July the disintegration was complete.

At the time of surrender Japan had but 1,800,000 gross tons of shipping afloat, 1,650,000 of which were in the Inner Zone. Only 650,000 tons of steel ships were serviceable within the Inner Zone, or 12 percent of the fleet with which she began the war. These ships had been confined almost entirely to the trade between Hokkaido, Korea, and the Japan Sea ports of Honshu. Shipbuilding was almost at a standstill and in August total seaborne traffic in steel ships was only 312,000 tons or 7.8 percent of the peak movement of October 1942. The Allied striking agents responsible for this remarkable result, and their respective shares in vessel sinkings are illustrated in Figure 1. This chart is not to be interpreted too literally for it is subject to a margin of error arising from inadequacy of data which may be on the order of 5 percent. Moreover, it refers only to sinkings and in no way measures interdiction nor the inefficiencies in shipping utilization, for example, where effective land-based patrol forced rerouting of convoys and compelled shipping to move over more circuitous courses.

The economic repercussions of the shipping shortage began early and became drastic,

THE DESTRUCTION OF THE JAPANESE MERCHANT MARINE
BY VARIOUS ATTACKING AGENTS
(SHIPS OVER 500 GROSS TONS ONLY)

GROSS TONS

(FIGURES FOR 1945 INCLUDE SHIPS DAMAGED AND PUT OUT OF ACTION FOR THE DURATION))

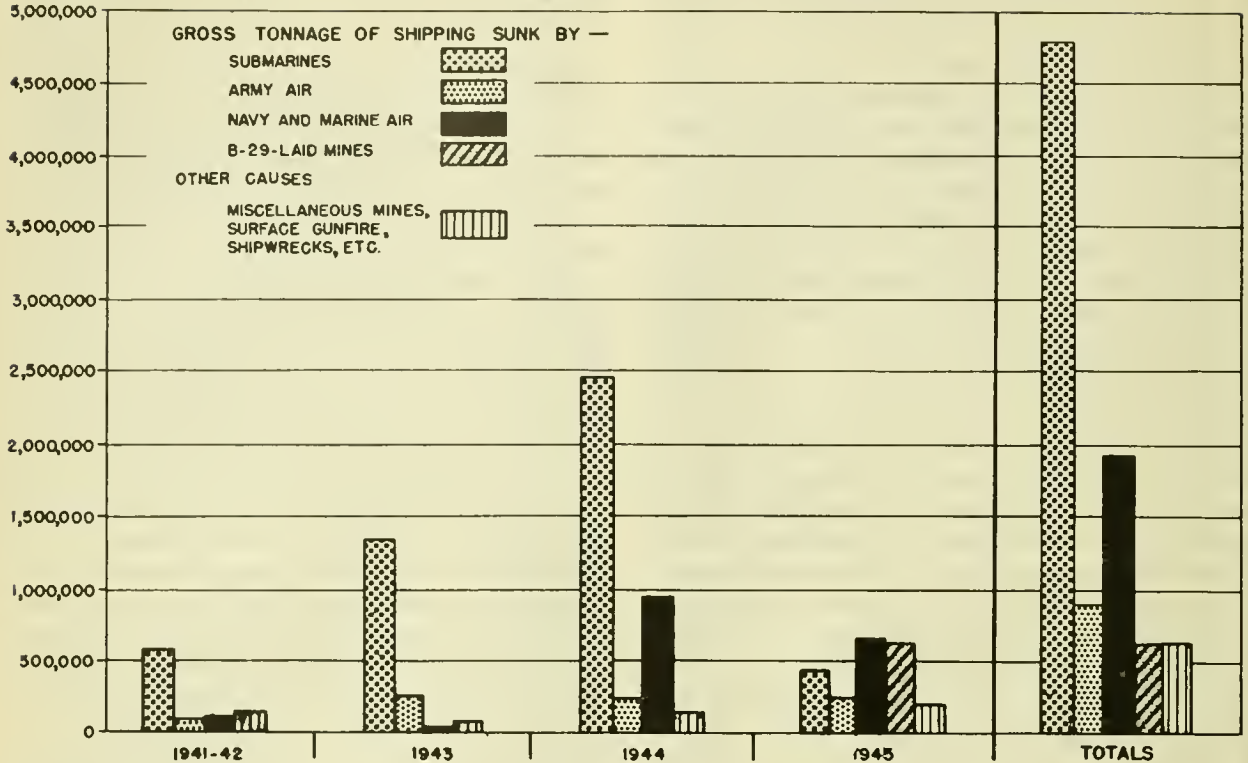


FIGURE 1.

threatening the very life of the nation. Virtually all industry suffered in some degree from the loss of vital imports, many of them early in the war. Imports of 16 major commodities for which data are available fell from 20 million metric tons in 1941 to 10 million in 1944 and but 2.7 million in the first six months of 1945. Figure 2 shows the relationship between shipping available in the civilian pool, total freight handled by these ships and total imports of the 16 major commodities. The total value of all imports showed an almost steady decline despite the decline in value of the yen in 1943. Iron and steel as an industry basic to all war-time industry enjoyed top priority throughout most of the war period. But its dependence upon imported coal and ore made it vulnerable to the shipping attack, and all efforts to protect it by shortening hauls, stockpiling, and greater use of domestic coal and ores failed to prevent a decline in output after 1943. Thus ingot steel output fell from its peak of 700,000 tons in De-

cember 1943 to but 300,000 tons in June 1945 when its stocks were largely exhausted and the prospect of further import disappeared.

The decline of iron ore imports from other sources compelled an effort to step up shipments down the Yangtze from the Tayeh mines. This movement reached its peak in mid-1943. At about this time the attacks of the Fourteenth AF against river traffic on the upper Yangtze, stopping daylight operation of big ships above Nanking, reversed the trend of Yangtze traffic, eliminated within approximately 3 months all the gain which the Japanese had secured from this source, and ended any hope of continued substantial imports from this source. Thereafter, the continued attacks of Fourteenth AF aircraft, augmented by China-based B-29s, by bombing and mining in the river and in the port of Shanghai caused increasing ship losses and contributed, together with the general shortage of shipping and the consequent efforts to develop nearer sources of

JAPANESE MERCHANT SHIPPING AVAILABLE FOR CIVILIAN USE AND ITS PERFORMANCE DURING THE WAR

- (A)** MERCHANT SHIPPING (EXCLUDING TANKERS) IN SERVICEABLE CONDITION & AVAILABLE FOR CIVILIAN USE. (IN GROSS TONS).

(C) TOTAL TONNAGE MOVED IN CIVILIAN SHIPS. (IN METRIC TONS).

(B) TOTAL GROSS TONNAGE OF ALL SERVICEABLE CARGO SHIPS IN THE INNER ZONE AFTER CONSOLIDATION OF SHIPPING.

(D) TOTAL IMPORTS INTO JAPAN OF 16 MAJOR BULK COMMODITIES: COAL, IRON ORE, BAUXITE, STEEL, SCRAP IRON, LEAD, TIN, ZINC, PHOSPHORITE & PHOSPHATE, DOLOMITE, MAGNESITE, SALT, SOYBEAN CAKE, SOYBEANS, RICE & PADDY, OTHER GRAINS & FLOURS, AND RAW RUBBER. (IN METRIC TONS).

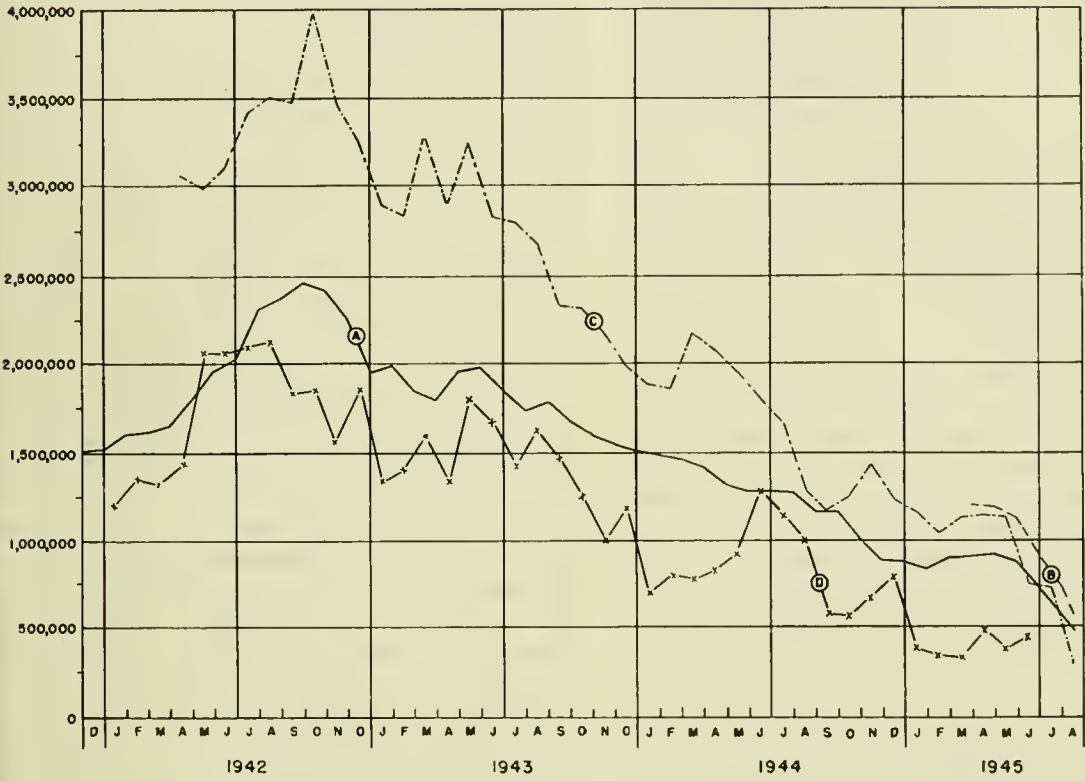


FIGURE 2.

ore in North China and Korea, to the steady decline in importance of the Tayeh ore. Access to one of the most significant sources of iron ore supply had been effectively denied.

Although tanker sinkings were insignificant until the carrier strike at Truk early in 1944 and did not rise consistently above new construction until August 1944, oil imports passed their peak after August 1943 and behaved erratically but moved generally downward, thereafter. The advent of the convoy system with its great sacrifice of efficiency, the loss of Navy tankers at Truk, the increasing tanker sinkings in the fall of 1944, and the gradual constriction of the route to the East Indies and Malaya brought a fall in oil imports which produced a desperate shortage of the vital fuel. Strenuous efforts to force the movement produced peaks of short duration, but after July 1944 the tanker tonnage devoted to import declined precipitously and by April 1945 the movement ceased. The effect on Japan was immediate. Stocks had long since been depleted and consumption was on a hand to mouth basis. Even the oil supply for the shipping industry, rated second only to aviation fuel, began to dry up and a considerable tonnage, particularly of the smaller vessels, was laid up for lack of it.

In most of the important industries not only quantity but quality had to be sacrificed. Local raw materials, often of astonishingly poor quality, were exploited in the attempt to substitute for the loss of import capacity. The use of secondary scrap was pushed. Even direct munitions suffered in quality when the ferro-alloys became well-nigh unobtainable and when aluminum output had declined 76 percent in a single year from the virtual stoppage of bauxite import.

Finally the nation was sorely pressed for food. Local production had declined, partly from the loss of manpower and partly from the shortage of imported fertilizers. Fishing declined precipitously to less than half its prewar volume from a variety of causes—requisition of fishing vessels by the Navy, the increased hazards and reduced areas open to the boats, the shortage of fuel, the shortage of hemp for fishnets, etc. Never wholly self-sufficient in food supplies, Japan, even on a reduced ration, was still compelled to import large quantities of the staple grains. The position became so acute

that in April 1945, it was decided to devote virtually all of the small remaining shipping capacity to the import of food and salt, sacrificing the trickle of industrial raw materials that had still been flowing in. In short Japan was, in the spring of 1945, virtually isolated. The raw materials basis of her economy had been cut off. She could look forward only to gradual starvation and increasing impotence.

Japan still had, however, a functioning railroad system which was physically intact. Undermaintenance had set in, to be sure, but it had not yet affected the smooth operation of the system and had caused little decline in its peak capacity. The few scattered attacks upon rail facilities and the great raids upon the cities had been mere pinpricks as far as the railroad system was concerned. A few traffic interruptions of very temporary duration had occurred. Line and yard capacity was essentially unimpaired. Only the loading, unloading, and collection and delivery systems in some of the cities subjected to the great fire raids had been disrupted. But in those locations the need for such facilities had contemporaneously declined as traffic demands fell with the burning of industrial and commercial plant and the exodus of population. The railroads were still capable of serving. Even the atom bomb attacks had but temporary and minor effects upon railroad facilities and service. Only the carrier strike against the ferries from Hokkaido was a significant blow against the railroad system as a functioning unit. Interdiction of the railroad system, had it been undertaken, would have deprived Japan of all significant transportation and left the nation industrially and militarily almost completely immobile.

CONCLUSIONS

The war against shipping was perhaps the most decisive single factor in the collapse of the Japanese economy and the logistic support of Japanese military and naval power. Submarines accounted for the majority of vessel sinkings and the greater part of the reduction in tonnage which brought about the collapse of the shipping services. Although submarines were never available in sufficient numbers to enforce a blockade, they were able steadily to reduce the tonnage afloat and to impose in-

creasing inefficiencies upon the operation of the remaining tonnage.

The marked effectiveness of the submarine operations was due to a variety of favorable circumstances. The complete failure of the Japanese to anticipate heavy submarine attacks and to guard against them presented an open and inviting field for such attacks. Belated efforts to organize a convoy system were poorly planned and executed, resulting in the very marked sacrifice of performance. Technical antisubmarine equipment was poor. Efforts to arm merchant vessels for protection against submarines were belated and inadequate. Meanwhile, excellent intelligence enabled our submarines to find targets with increasing success and efficiency. Finally the development of effective cooperation between the submarines and the air arm permitted the results of continual air patrol and search to be translated into effective submarine attack, where such attack was the most appropriate method to employ. It must be understood, however, that particularly as the sea lanes contracted and more effective escort was supplied, the task of the submarine became hazardous and losses were considerable.

Early in the war combat vessels were the priority target. Commercial shipping followed and, when there was a choice between dry-cargo vessels and tankers, submarines were expected to prefer the tankers. But not until 1944 were submarines specifically directed to seek out tankers for destruction. Had submarines concentrated more effectively in the areas where tankers were in predominant use after mid-1942, oil imports probably could have been reduced sooner and the collapse of the fleet, the air arm, merchant shipping and all other activities dependent upon oil fuel hastened. With the lag required to shift the emphasis of shipbuilding to tankers, Japan could never have caught up even temporarily with the rate of sinkings that might have been produced by such preference. And the fuel shortage might have been acute at the end of 1943 rather than a year later (Appendix A).

Carrier-borne air attacks, when directed against large concentrations of merchant shipping, were by far the most devastating attacks of all. They were, however, sporadic and not part of a continuing program to neutralize enemy shipping lanes. In general the responsi-

bilities of carrier air were presumed to lie elsewhere and to relate more directly to naval operations. Even the raid on Truk was designed more to seek out and destroy naval units than to sink merchantmen. However, when carrier air went into an area Japanese shipping there was completely disorganized and outbound movement virtually ceased for a time. Its range from the carriers was limited, apparently from 200 to 300 miles from the take-off point, but its bases were mobile and the strong carrier task forces seem to have been able to operate with relative impunity in the later stages of the war. The concentrations of shipping against which they operated so effectively were, of course, in part produced by the activities of other arms. It is possible that, subject to the limitations imposed by the threat of Japanese counteraction with a portion of their fleet and carrier forces still intact, carrier air might have been directed earlier and more heavily against Japanese merchant shipping. And since shipping was the most important single key to the logistic basis of the Japanese military and naval machine, such a policy should have been enormously profitable. For example, had carrier task forces been able to cruise south of Java and Sumatra in the latter part of 1943, carrier aircraft could have caused devastation to Jap shipping in the Java Sea and Singapore areas where large tonnages, particularly of tankers, were concentrated. Likewise a heavy blow by carrier air against shipping in the Inland Sea during the summer of 1944 would have netted tremendous results. Either or both of these raids would have seriously reduced the Japanese merchant fleet and, in consequence, Japan's war-making potential.

Land-based aircraft, both Army and Navy, were able to and did undertake extensive and sustained armed search of shipping lanes. They not only disposed of tonnage by their own action, but provided information of value to other agencies in cooperative endeavors, including the submarine forces. They were operating against increasingly dispersed and smaller targets. Their contribution to sinkings of large vessels was smaller than those of other principals.

Army land-based air committed to the interdiction of such Japanese shipping as was involved in providing logistic support for the perimeter garrison forces was highly effective.

The destruction of considerable tonnage in Rabaul harbor and the successful interdiction of this important port is an outstanding example. In direct support of our offensive operations, enemy shipping along the lines of advance, including barges and all types of smaller craft, were attacked and destroyed.

Since such operations comprised the predominant employment of Army air against shipping, the principal reason for its failure to sink larger numbers of large ships is apparent. Other military objectives are said to have precluded the assigning of more than a small effort (1.5 percent of combat sorties) to antishipping strikes. It is difficult to avoid a feeling that a full realization of the importance of merchant shipping as a target did not figure adequately in the appraisal of relative target priorities. Certainly the war against shipping would have been expedited had Army land-based air been available for steady concentration against this target, but the wisdom of such employment at the expense of other military objectives cannot be assessed by this Division.

Land-based air was generally limited in its coverage by the range of its aircraft and the position of its bases in relation to the important economic shipping lanes. Its capabilities steadily increased throughout the war and as our forces advanced through the Philippines toward Japan, land-based air forces brought these vital lanes under increasingly heavy attack. At the cost of increased length of run and vessel turnaround time, the Japanese progressively rerouted their dwindling shipping until it became impossible longer to escape the depredations of air attack.

Considering the entire war, relatively few large ships were sunk by land-based aircraft further than 600 miles from their bases, but by the time our forces had undertaken sustained offensive action, armed search and strike missions were continuous over double that range. The Japanese upon interrogation generally professed to discount the menace of land-based air when based more than 600 miles distant from lines of supply, nor did they discontinue shipping operations over such routes because of the presence of land-based air more than 600 miles distant, although diversions were made wherever possible to avoid the closer approach to air.

The willingness to commit shipping in the

face of severe losses reflects the desperate need of the Japanese for strategic imports regardless of cost and the aura of unreality that surrounded Japanese shipping planning. As a result of these desperate measures taken by the Japanese, complete interdiction of major shipping lanes was not achieved by the limited land-based air committed to this objective, although a measure of interdiction was achieved and profitable reductions of Japanese shipping resulted.

Among the most significant contributions of Army air in the strategic war against merchant shipping was the mine-laying campaign conducted by the B-29s. Prior to March 1945, mine-laying by aircraft and submarine was limited and not an important factor in the progress of the war except in some local situations. Sinkings were few and no important blockade effect was secured except in the Yantze. The B-29 mine-laying campaign was, however, a very successful effort. Four desired effects were accomplished simultaneously, viz:

- (1) The tonnage of merchant shipping in operating condition was greatly reduced;
- (2) The use of ports previously protected from submarine blockade was rendered decidedly dangerous and the Shimonoseki Straits, the most important shipping crossroads in Japan, became virtually impassable;
- (3) Access to repair yards was denied to much damaged tonnage and all repair facilities were congested beyond their capacity;
- (4) The administration of shipping was thrown into hopeless confusion.

It is believed that this campaign, begun earlier and laid on with greater weight, would have reduced effective shipping nearly to the vanishing point. It would thus have produced a condition of crisis in Japan sooner than actually occurred. Recognition of its potentialities by the planners at a much earlier date would have been required to establish the necessary priority, to train crews, and to secure the production and shipment of the necessary supply of mines in order that the campaign might have commenced as soon as possible after the B-29s were based within range.

Failure to attack the railroad system as soon

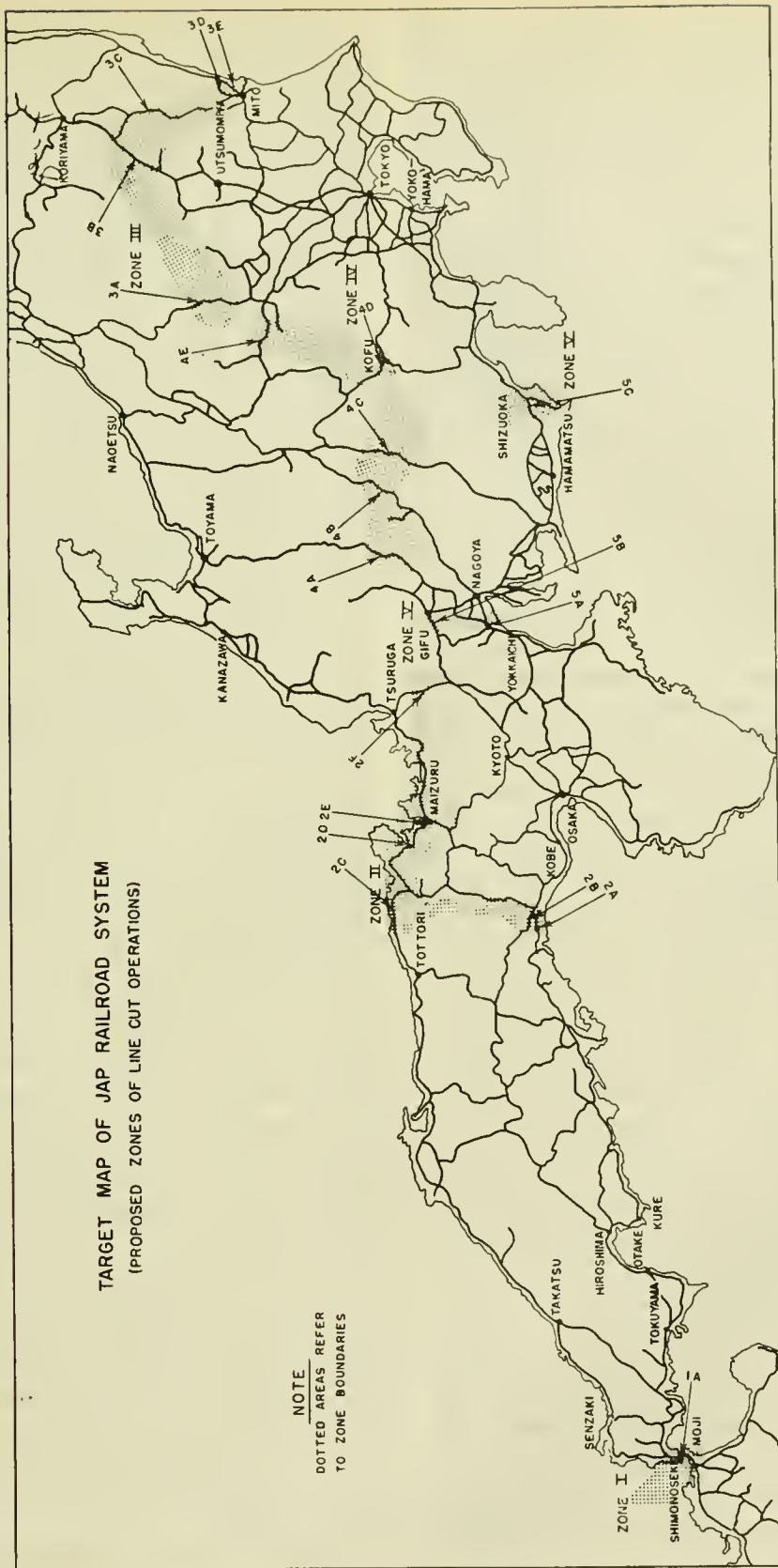


FIGURE 3.

as the force was available resulted in the loss of a major opportunity. With her shipping so seriously reduced, Japan depended almost entirely upon her railroad system for transportation. The disposition and supply of her forces to resist invasion must rely upon the railroads; the remaining industry must rely almost wholly upon Japanese sources of fuel and raw material which could be transported only by rail; and the distribution of food and elementary necessities of life could not be accomplished without the rails. The Japanese railroad system was, moreover, one of the most vulnerable of any size to be found anywhere. With its through movement confined almost entirely to the two main lines the length of Honshu, and the supply of bulk traffic to these lines bottlenecked at the Kanmon tunnel on the south and the Hakodate and Aomori ferries in the north, opportunities for diversion and rerouting were almost nil. Moreover the bulk of the traffic had become long-haul with the virtual demise of coastwise shipping and traffic must use one or another of these main lines for a substantial portion of their length. Any serious interruption of either line and especially of the high capacity Sanyo line, west of Kobe, would have seriously reduced the major flow of traffic from Kyushu northeast to the industrial cities and the loss of both lines would have paralyzed the flow. The less important movement southwest from the northern tip of Honshu could have been similarly paralyzed by the cutting of both lines, for it was largely through business. The main line between Tokyo and the Kanmon was particularly open to attack because at many points it hugged the coast and its approximate location could be picked up by radar by reference to coastal features even under conditions of low visibility. All lines had many structures, such as bridges, tunnels, cuts, fills, and retaining walls which would have been desirable targets for carrier-borne dive bombers or similar aircraft under visual conditions. The Kanmon tunnels themselves, keys to the most important coal and steel movement, were most vulnerable. They were easy to pick up by radar and required only destruction of tunnel mouths and approaches for effective neutralization. The Honshu rail system, although it used some low-grade Honshu coal, could not be fully worked without considerable quantities of Kyushu and Hokkaido coal.

A program, therefore, involving the successful destruction of the Kanmon and the contemporary destruction of the rail ferries from Hokkaido (as was actually done quite effectively by a carrier task force at a late date) followed by half a dozen well-chosen line cuts on the main routes would have disposed effectively of the Japanese rail system as an economic asset. The system had only extremely limited recuperative powers. Neither plans nor materials were in hand for replacing any major structures. Not even bridge timber had been assembled as a precaution against such attack. And the material required could not be obtained from the mills except after considerable lapse of time. The objective of the program would be to stop the flow over the main routes. Its accomplishment would require very little physical destruction. Recuperation need not worry the attacker, for no quick reaction was possible. Had it begun, however, force was at hand to bring it promptly to an end.

It appears that force was at hand within range of the desirable targets by mid-April 1945. Reconnaissance could have been secured during the previous months. One hundred dispatched sorties by B-29s with 800 tons of Azon bombs should have been sufficient for a complete program of line cuts, including the approaches to the Kanmon tunnel, designed to cut all significant main rail routes. The program would require also the cooperation of a carrier raid against the Hokkaido ferries of similar magnitude and effectiveness to the one actually employed, but it would have been preferable to accomplish it at an earlier date. Alternatively this operation against Japanese rail lines could have been accomplished with 650 B-29 sorties carrying 5,200 tons of ordinary general-purpose bombs or 1,740 carrier-based sorties carrying 1,300 tons. A combination of the two types of attack might prove to be the most efficient. A similar or somewhat greater effort monthly might have been required to maintain the interdiction. Figure 3 indicates a possible plan of areas within which the necessary cuts might have been spotted and the order of importance of the several zones. It also spots the points included in calculating these force requirements. A table of force requirements (Figure 4) follows the map.

Such a decimation of the rail system could

have seriously impeded military dispositions essential for defense against invasion. It could have paralyzed all economic traffic by rail, not only by cutting the main routes, but also by depriving the separated segments of the coal needed even for local operations. Even the low quality fuel available on Honshu could not have been distributed where needed, and stocks in the hands of most divisions of the railroad were sufficient for but a few days operation. The restoration of the railroads would have become the primary task of the day, but would have been slow and confused because of the complete lack of preparation to cope with such a situation. Meanwhile Japan would have been paralyzed and might have been ripe for surrender sooner than was actually the case. It is difficult to realize the profound and ramifying effects of a nearly complete transportation tie-up. Such a prolonged interruption of transport has not occurred in the modern world. Judgment, therefore, differs as to the significance of the effects which would have been produced upon the people and upon the government and the rapidity with which such effects would have been felt.

Had an invasion still appeared necessary, and had some local railroad operation been restored for military purposes, the air forces available could have plastered the entire limited rail system during the several weeks immediately before the landings.

The employment of forces against oil targets in accordance with the effective plan was largely a duplication, from the economic point of view, of results already assured by the success of the shipping attack. The urban area attacks, while duplicated in the same sense, accelerated the economic decline and produced morale and political repercussions of a type which would have been secured more slowly by the continuing strangulation of shipping. The weakest point in Japan's economic structure and the one which was already most nearly disposed of was her transportation. A combination of accelerated and intensified assault against shipping by the naval and air arms, coupled with the type of railroad attack discussed above, should have been ample to complete the destruction of the nation's war-making potential.

FIGURE 4.—Force requirements—B-29 and carrier-based A/C

Target No.—type	Altitude of attack for B-29s	Dispatched tonnage to cause interdiction			Estimated recovery period	Tonnage per month to maintain interdiction		
		B-29s using—		Carrier-based		B-29s using—		Carrier-based
		Azon	GP				Azon		GP
Zone I					Month			
1a Kanmon tunnel	20,000	16	220	48	1	16	220	48
Zone II								
2a 300-ft. girder bridge ¹	10,000	84	480	87	$\frac{2}{3}$	126	720	130
2b 300-ft. girder bridge ¹	10,000	84	480	87	$\frac{2}{3}$	126	720	130
2c 300-ft. girder bridge	10,000	48	280	50	$\frac{2}{3}$	72	420	75
2d 300-ft. girder bridge	10,000	48	280	50	$\frac{2}{3}$	72	420	75
2e 300-ft. girder bridge	10,000	48	280	50	$\frac{2}{3}$	72	420	75
2f approach to 100-ft. bridge	10,000	2	24	8	(²)	16	192	64
Total Zone II		314	1,824	332		484	2,892	549
Zone III								
3a 500-ft. girder bridge	10,000	30	176	70	1	30	176	70
3b 500-ft. girder bridge	10,000	30	176	70	1	30	176	70
3c 500-ft. girder bridge	10,000	30	176	70	1	30	176	70
3d 300-ft. girder bridge	15,000	73	408	50	$\frac{2}{3}$	110	614	75
3e 300-ft. girder bridge	15,000	73	408	50	$\frac{2}{3}$	110	614	75
Total Zone III		236	1,344	310		310	1,756	360
Zone IV								
4a 300-ft. girder bridge	10,000	48	280	100	$\frac{2}{3}$	72	420	150
4b 300-ft. girder bridge	10,000	48	280	100	$\frac{2}{3}$	72	420	150
4c approach to 100-ft. bridge	10,000	2	24	16	(²)	16	192	128
4d approach to 100-ft. bridge	10,000	2	24	16	(²)	16	192	128
4e 300-ft. girder bridge	10,000	48	280	100	$\frac{2}{3}$	72	420	150
Total Zone IV		148	888	332		248	1,644	706
Zone V								
5a 1,000-ft. truss bridge ¹	20,000	46	496	70	1	46	496	70
5b 1,000-ft. truss bridge ¹	15,000	17	192	40	1	17	192	40
5c 1,500-ft. truss bridge ¹	15,000	23	256	70	1	23	256	70
Total Zone V		86	944	180		86	944	180
Total tonnage		800	5,220	1,202		1,144	7,456	1,843
Total sorties		100	653	1,740		143	933	2,460

¹Two parallel single-track bridges, on a double-track line.

²Three to four days.

been ample to complete the destruction of the nation's war-making potential.

It is possible that the social and political effects of the transportation attack would have been as effective in forcing a Japanese surrender as were the methods actually employed. But this is a matter of conjecture. In any event it appears that the railroad attacks could have been well complemented by the city raids and that both types of attack were operationally

feasible. The two types of effort conducted together might well have advanced the date of surrender.

Our failure to adopt such a plan appears to have been due to a faulty assessment of the Japanese position, a failure to realize the full effects that had been secured by the massacre of shipping, and failure to recognize the vulnerability of the rail system or the effectiveness of its neutralization in paralyzing the Japanese economy and military potential.

CHAPTER II

TRANSPORTATION IN THE PEACETIME ECONOMY OF JAPAN

Importance of Overseas Shipments

Few countries in the world are more dependent on shipping than Japan. The simple fact that she is an island community where local demands far exceed local production, implies continuous overseas shipment for the maintenance of her economic life. In addition the multiple island character of the country requires that most of the domestic trade be waterborne. Dependence on the outside world is accentuated by the extremely limited productivity of the land and the unbalanced ratio existing between resources and population.

The area of the islands comprising Japan proper is 147,611 square miles. Fully 85 percent, however, is in rugged forested mountains and is relatively unproductive. In natural resources Japan is the poorest of the great powers. In the products of forests and of the sea, Japan has perhaps adequate resources for a balanced economy, but in most of the agricultural, animal, and mineral products there are severe shortages.

Before the war Japan normally depended on imports (including those from the colonies) for 20 percent of her total food supply on the basis of caloric intake. Almost all of the sugar, and more than half of the salt, soy beans, and corn came from overseas. In addition, it was necessary to ship in enormous quantities of rice (about 20 percent of the total consumption) and large percentages of the wheat and millet requirements.

A relatively high degree of industrialization added to the demand for overseas products. Approximately one-third of the raw materials of industry were imported. Included in this category were 100 percent of the cotton, wool, rubber, phosphorite, sodium nitrate, potash, bauxite and magnesite needs. In addition, over half of the iron ore, coking coal, ferro-alloys, scrap iron, petroleum, pulp, oils and fats, hides and skins, industrial salt, lead, tin, jute and

hemp requirements represented inward shipments. Substantial quantities of the paper, lumber, coal, soda ash, ammonium sulphate, pig iron, copper and zinc requirements were also imported (Figure 5).

Although shipping space for large quantities is not involved, the further dependence of industrial Japan on overseas materials is illustrated by her almost complete dependence on foreign sources for such essentials as antimony, nickel, quicksilver, mica, asbestos, shellac and resin, quinine, and tanning materials. In fact complete self-sufficiency in the raw materials of industry is found only in raw silk, sulphur, fish oil, and a few minor products.

Likewise important was the dependence on overseas export trade in Japan's peacetime economy, although the manufactured export goods were far less demanding on shipping space than the bulky incoming raw materials of industry. Many of the exports, however, represented reshipment of imported materials. This was true of the largest single export, cotton goods, and many of the lesser ones, such as flour, refined sugar, rubber goods, metal manufactures, paper and rayon. Of the major exports, only silk and pottery were manufactured from domestic raw materials and had not required water transportation at some period in their production.

FIGURE 5.—*Sources of raw materials, 1937*
(percent of total)

Product	Japan Proper	Colonies included	Manchuria and Kwantung	Foreign
Petroleum.....	18	0		82
Coal.....	90	6		4
Iron ore.....	11	14		75
Pig iron.....	67	10		23
Bauxite.....				100
Magnesite.....		100		
Cotton.....		1		99
Wool.....				100
Pulp.....	32	3		65
Rubber.....				100
Phosphorite.....		9		91
Ammonium sulphate.....	75	12		13
Salt.....	25	28		47
Soybeans.....	25	75		
Wheat.....	70	3		27
Corn.....	24	2		74
Sugar.....	12	73		15

Japan's foreign trade figures normally loom large among those of the world. Imports and exports have shown a general upward trend since the country was opened to foreign commerce in 1854. By 1937 the total trade had reached 6,958,596,000 yen (about \$2,000,000,-000), an all-time high up to that year and a figure that has since been exceeded only in 1940 (Figures 6 and 7). This total gave Japan sixth place in world exports and fifth place in imports for the year. Imports accounted for 3,783,177,000 and exports for 3,175,418,000 of the total leaving an excess of imports over exports of 607,759,000 yen. This slightly unfavorable trade balance was the usual situation in Japanese foreign trade until 1938.

FIGURE 6.—*Foreign trade of Japan—1900–43*
(In 1,000 yen)

Year	Exports	Imports	Total
1900	204,429	287,261	491,690
1901	252,349	255,816	508,165
1902	258,303	271,731	530,034
1903	289,502	317,135	606,637
1904	319,260	371,360	690,620
1905	321,533	488,538	810,071
1906	423,754	418,784	842,538
1907	432,412	494,467	926,879
1908	378,245	436,257	814,502
1909	413,112	394,198	807,310
1910	458,428	464,233	922,661
1911	447,433	513,805	961,238
1912	526,981	618,992	1,145,973
1913	632,460	729,431	1,361,891
1914	591,101	595,735	1,186,836
1915	703,306	532,449	1,235,755
1916	1,127,468	756,427	1,883,895
1917	1,603,005	1,035,811	2,638,816
1918	1,962,100	1,668,143	3,630,243
1919	2,098,872	2,173,459	4,272,331
1920	1,948,394	2,336,174	4,284,568
1921	1,252,837	1,614,154	2,866,991
1922	1,637,451	1,890,308	3,527,759
1923	1,447,750	1,982,230	3,429,980
1924	1,807,034	2,453,402	4,260,436
1925	2,305,589	2,572,657	4,878,246
1926	2,004,727	2,377,484	4,382,211
1927	1,992,317	2,179,153	4,171,470
1928	1,971,955	2,196,314	4,168,269
1929	2,148,618	2,216,240	4,364,858
1930	1,469,852	1,546,070	3,015,922
1931	1,146,981	1,235,675	2,382,656
1932	1,409,992	1,431,461	2,841,453
1933	1,861,045	1,917,219	3,778,264
1934	2,171,924	2,282,601	4,454,525
1935	2,499,072	2,472,235	4,971,307
1936	2,692,976	2,763,681	5,456,657
1937	3,175,418	3,783,177	6,958,595
1938	2,689,000	2,663,440	5,352,440
1939	3,576,370	2,917,666	6,494,036
1940	3,655,850	3,452,725	7,108,575
1941	2,650,865	2,898,565	5,549,430
1942	1,792,547	1,751,637	3,544,184
1943	1,627,350	1,924,350	3,551,700

Total tonnage for 1937 was 39,923,000, surpassing that of any previous year, and a figure that has not since been equalled (Figures 7 and 8). Of this total, 23,954,000 tons, or 54 percent were carried in Japanese vessels, the remaining 46 percent in foreign vessels, of various flags, principally British, American, German and

FIGURE 7.—*Foreign trade indices¹ (1923–100)*

	Value Index			Volume Index		
	Exports	Imports	Total	Exports	Imports	Total
1929	109.0	100.9	104.7	111.2	104.8	107.8
1930	74.5	70.4	72.4	102.6	92.1	97.0
1931	58.2	56.3	57.2	105.8	102.2	103.9
1932	71.5	65.2	68.2	125.0	100.9	112.3
1933	94.4	87.3	90.6	138.1	104.6	120.5
1934	110.1	103.9	106.9	163.4	111.6	136.1
1935	126.7	112.6	119.3	185.3	116.9	149.2
1936	136.6	125.8	130.9	202.5	128.4	163.5
1937	161.0	172.3	166.9	210.7	136.5	171.6
1938	136.2	121.7	128.6	174.3	101.1	135.2

¹Source: The Orient Yearbook, 1942, p. 321.

FIGURE 8.—*Distribution of Japanese foreign transport in domestic and foreign shipping, 1937–41¹*
(In 1,000 tons)

Year	In Foreign Vessels		In Japanese Vessels		Total	
		Percent		Percent		Percent
1937	15,969	40	23,954	60	39,923	100
1938	13,750	42	18,989	58	32,739	100
1939	11,619	40	17,289	60	28,908	100
1940	13,652	38	22,273	62	35,925	100
1941	10,411	35	19,334	65	29,745	100

¹Source: Ariyoshi Shipping Control Association.

Norwegian. Foreign vessels chartered by Japan averaged 391,826 gross tons per month during 1937.

Character of Foreign Trade

As expected of an industrial country, Japan's prewar imports consisted largely of raw materials and semi-finished goods. In first place were the raw materials for her textile industries, followed by the raw materials for her metallurgical industries, the two groups together accounting for more than one-half of the value of the imports each year. Other important items were mineral fuels, fertilizer, wool and rubber. Raw cotton was the largest single item, usually representing from 25 to 35 percent of the total annual import value. Smaller amounts of finished manufactured goods, principally machinery and parts, and vehicles, were imported each year (Figure 9).

Japan received goods from all parts of the world, but predominantly from Asia and North America. As shown in Figure 10, about 70 percent of each year's total was normally supplied by the two continents. The United States was the largest single source of materials, 30.7 percent of total foreign imports originating there in 1936. The other leading sources were India, Manchuria, Australia, China, Germany and the

Netherlands Indies (Figure 11).

In contrast to the raw-material nature of most of Japan's imports, exports consisted largely of manufactured and semi-finished goods. Outstanding were the textile and clothing products, with some metal manufactures, processed foods, pottery, glassware, toys, and wood products. Occupying first place in value were cotton piece goods, followed by raw silk, these two leading items accounting for 32.5 percent of the annual value of exports (Figure 12).

FIGURE 9.—*Japanese import trade, 1936*
COMMODITIES

Product	Value 1936 (1,000 yen)	Percent of total	Percent from principal countries of origin
Total Imports	2,763,681	100.0	
Raw cotton	850,451	30.77	United States, 43.8; British India, 37; Egypt, 4.3; China 2.7.
Raw wool	200,898	7.27	Australia, 73.4; New Zealand 9.1; Union of South Africa, 8.7.
Mineral oils	182,769	6.62	United States, 63.5; Netherlands Indies, 28.9.
Machinery and parts	91,184	3.29	United States, 57.9; Germany, 26.9; Great Britain, 17.8.
Beans and peas	82,601	2.98	Manchuria and Kwantung, 88.8; China, 5.6.
Scrap iron	80,866	2.92	United States, 65.9; India, 8.8.
Crude rubber	72,957	2.63	Straits Settlements, 32.4; Netherlands Indies, 31.3; French Indo China, 22.9.
Lumber	55,548	2.00	United States, 57.9; Canada, 11.2.
Coal	51,056	1.84	Manchuria and Kwantung, 52.5; China, 24.4; French Indo China, 22.9.
Other iron and steel	48,865	1.76	United States, 31.5; Germany, 17.0; Belgium-Luxemburg, 10.0; Great Britain, 9.7.
Pulp for rayon	44,056	1.59	United States, 50.8; Norway, 30.8; Finland, 9.9.
Oil yielding seeds	42,896	1.55	Manchuria and Kwantung, 52.5; China, 31.9.
Pig iron	42,064	1.51	India, 34.6; Manchuria and Kwantung, 34.8; Soviet Russia, 15.8.
Iron ore (1934)	40,043	1.44	Straits Settlements, 43.8; China, 32.9; Australia, 5.7.
Automobiles and parts	37,036	1.33	United States, 94.3; Great Britain, 1.8.
Copper	36,221	1.31	United States, 97.1.
Oil cake	35,790	1.29	Manchuria, 65.5; Kwantung, 15.2; China, 13.6.
Ammonium sulphate	33,930	1.22	Kwantung, 36.2; Manchuria, 9.7.
Hides and skins	30,420	1.10	China, 10.0; United States, 9.4; Argentina, 13.2; Australia, 11.3.
Lead	27,189	.98	Canada, 43.8; India, 14.0.
Pulp for paper	23,050	.83	United States, 40.0; Sweden, 19.0; Norway, 18.0; Canada, 13.0.
Phosphorite	22,393	.81	Egypt, 32.5; United States, 25.2; Straits Settlements, 13.6.
Sugar	20,928	.75	Netherlands Indies, 94.2.
Corn	20,526	.74	Argentina, 60.7; Netherlands Indies, 34.5.
Manila hemp	20,017	.72	Philippine Islands, 100.0.
Salt	17,761	.64	Egypt, 48.0; China, 17.1; Kwantung, 16.5; Manchuria, 11.2; Netherlands Indies, 7.2.
Zinc	16,428	.59	Canada, 34.9; Australia, 21.3; United States, 18.2.
Aluminum	13,229	.47	Canada, 66.3; Switzerland, 15.0; United States, 6.0.
All others	522,509	18.90	

FIGURE 10.—*Sources of Japanese foreign imports, 1929 and 1936*

Area	1929, percent of total	1936, percent of total
Asia	37.6	38.4
Europe	20.0	12.0
North America	32.6	33.3
(United States)	(29.5)	(30.7)
Central and South America	.7	4.9
Africa	1.9	3.9
Oceania	6.2	7.6
	99.0	100.1

FIGURE 11.—*Japanese import trade, 1936*
SOURCES

Country	Value, 1936 (1,000 yen)	Percent of total	Principal products
Total foreign	2,763,681	100.0	
United States	847,000	30.7	Cotton, oil, scrap iron, copper, wood and timber, steel, machinery and tools, motor cars and parts, pulp.
India	372,000	13.5	Cotton, pig iron, jute, lead.
Manchuria	205,567	7.4	Beans and peas, oil cake, coal, pig iron, oil seeds, salt.
Australia	182,000	6.6	Wool, wheat, beef tallow, hides and leather, zinc.
China	154,838	5.6	Cotton, oilseeds, ores, coal.
Germany	115,500	4.1	Machinery and tools, iron and steel, sulphate of ammonia, potassium sulphate, synthetic dye-stuffs.
Netherlands Indies	113,546	4.1	Oil, rubber, sugar.
Canada	73,179	2.6	Wheat, wood and timber, pulp, paper, lead, aluminum, zinc.
Great Britain	72,942	2.6	Machinery and tools, iron and steel, caustic soda and soda ash, woolsens and worsteds, nickel, cotton yarn.
Brazil	47,352	1.7	Cotton.
Egypt	45,737	1.7	Cotton, salt, phosphorite.
Straits Settlements	41,174	1.5	Rubber, tin.
British Malaya	39,125	1.4	Iron ore, rubber.
Philippine Islands	36,266	1.3	Hemp, wood, and timber.
Kwantung L.T.	33,848	1.2	Beans and peas, oil cake, salt.
Argentina	29,989	1.1	Wheat, linseed, hides and skins, quebracho, corn.
East Africa	29,865	1.1	Cotton, soda ash, salt.
Sweden	23,109	0.8	Chemicals, pulp, paper, steel products, machinery, and tools.
Union of South Africa	22,561	0.8	Wool, tanning materials.
New Zealand	21,973	0.8	Wool.
French Indo-China	20,155	0.7	Coal, rubber.
France	19,898	0.7	Chemicals and pharmaceuticals, iron and steel, machinery and tools.
All others	216,057	7.81	

As was true of imports, the exports of Japan likewise involved contact with all parts of the world, but with emphasis on Asia and North America. The United States was the destination of the largest share, receiving 22.1 percent of the total value shipped to foreign countries in 1936. Other important receiving countries were Kwantung province, India, China, Manchuria, Great Britain, and Netherlands Indies (Figure 13).

Character of Colonial Trade

Japan's colonies, Korea, Formosa, and the mandated islands of the Pacific, with a total

FIGURE 12.—*Japan's export trade, 1936*

COMMODITIES

Product	Value, 1936 (1,000 yen)	Percent of total	Percent to leading countries of destination
Total exports	2,692,976	100.0	
Cotton piece goods	483,591	17.95	Manchuria and Kwantung, 15.6; India, 15.0; Netherlands Indies, 11.5; African countries, 17.7; South American countries, 6.9; China, 1.6.
Raw silk	392,809	14.58	United States, 85.0; France, 8.5.
Rayon piece goods	149,170	5.53	India, 17.6; Australia, 12.3; Manchuria and Kwantung, 15.0; African Countries, 10.7.
Machinery and parts	82,154	3.05	Manchuria and Kwantung, 57.9; China, 20.6; Soviet Russia, 9.8.
Tinned and bottled foodstuffs	71,077	2.63	Great Britain, 45.6; United States, 21.7; Manchuria and Kwantung, 3.6.
Silk piece goods	68,027	2.52	India, 19.4; Great Britain, 11.8; African countries, 12.8; United States, 11.1; Straits Settlements, 5.0.
Knitted articles	49,988	1.85	United States, 13.6; Philippine Islands, 11.0; Great Britain, 10.4; Netherlands Indies, 8.9.
Woolen piece goods	45,956	1.70	Manchuria and Kwantung, 31.1; African countries, 20.8; India, 11.4.
Potteries	43,548	1.61	United States, 35.9; India, 8.5; Manchuria and Kwantung, 7.0; Netherlands Indies, 5.5; Australia, 5.3.
Iron manufactures	40,302	1.49	Manchuria and Kwantung, 28.3; India, 10.7; Netherlands Indies, 10.4; Straits Settlements, 5.3; Philippine Islands, 5.2.
Toys	36,459	1.35	United States, 37.5; Great Britain, 16.2; India, 7.6; Australia, 5.9.
All others	1,229,895	45.67	

population of thirty million, accounted for 24.5 percent of Japan's imports and received 24.8 percent of her exports in 1936 (Figure 14). Korea was by far the most important in 1936; shipments to Japan totalled 518,047,000 yen. Only the United States exceeded this total as a source of Japanese imports. Korea, only partially industrialized, remained a source of raw materials for Japanese industry. About three-fourths of all exports to Japan normally consisted of rice, fish products, minerals, and textile raw materials. The colony was important as being a major source of magnesite, the principal external source of rice and a source of certain strategic minerals such as mica, graphite, tungsten, fluorspar, and molybdenum. Exports to Korea were valued at 647,918,000 yen in 1936, a total greater than that of any other country, colonial or foreign. A great variety of commodities entered this trade, the largest being textiles, machinery, and metal manufactures.

Shipments from Formosa to Japan totalled 358,895,000 yen in 1936. Only the United States,

Korea, and India supplied larger values. More than 95 percent consisted of foodstuffs, principally sugar and rice. Japan depended on Formosa for 80 percent of her sugar and 38 percent of her normal rice imports. Japanese exports to Formosa reached a 1936 total of 243,832,000 yen, exceeded only by the values of

FIGURE 13.—*Japan's export trade, 1936*

Country	Value 1936 (1,000 yen)	Per- cent of total	Principal products
Total exports	2,693,882	100.0	
United States	594,251	22.1	Raw silk, silk piece goods, knitted articles, tinned and bottled foodstuffs, potteries, toys, glassware, tea, vegetable oils, isinglass, insecticide, camphor, menthol.
Kwantung	347,165	12.9	Cotton piece goods, rayon piece goods, iron manufactures, machinery and parts, tinned and bottled foodstuffs, potteries, sugar, flour, tires, woolens, paper, timber.
India	259,108	9.6	Cotton piece goods, rayon piece goods, silk piece goods, woolen piece goods, iron mfrs., potteries, toys, raw silk, cotton yarns, knitted articles, glassware, clothing, camphor.
China	159,691	5.9	Cotton piece goods, flour, machinery and parts, paper, sugar, tires.
Manchuria	150,859	5.6	Cotton piece goods, rayon, paper, woolen piece goods, iron mfrs., machinery and parts, tinned and bottled foodstuffs, potteries.
Great Britain	147,309	5.5	Silk piece goods, knitted articles, tinned and bottled foodstuffs, toys, raw silk, beans.
Netherlands Indies	129,495	4.8	Knitted articles, iron mfrs., potteries, cotton piece goods, rayon, cotton yarns, glassware.
Australia	68,763	2.6	Rayon piece goods, potteries, toys, silk, cotton piece goods.
Straits Settlements	58,770	2.2	Silk piece goods, iron mfrs., cotton piece goods, rayon, coal.
Hong Kong	58,445	2.2	Cotton piece goods, rayon, paper, coal.
Philippine Islands	51,840	1.9	Knitted articles, iron manufactures, glassware.
France	43,475	1.6	Raw silk.
Siam	43,028	1.6	Cotton piece goods.
Union of South Africa	41,534	1.5	Cotton piece goods, rayon, silk piece goods, woolens, potteries, knitted articles.
Egypt	40,907	1.5	Cotton piece goods, rayon, silk piece goods, woolens.
Germany	35,054	1.3	Cotton piece goods, silk piece goods, beans, isinglass, fish oil.
East Africa	30,602	1.1	Cotton piece goods, rayon, silk piece goods, woolens.
Argentina	22,712	0.8	Cotton piece goods.
French Morocco	20,512	0.8	Cotton piece goods, rayon, silk piece goods, woolens.
All others	390,362	14.5	

exports to Korea, the United States, and Kwantung province. The trade was highly diversified with foodstuffs, textiles, fertilizers, and metal manufactures leading.

Perhaps of more significance is the trade with northeastern Asia, including Manchuria, not classified by the Japanese as a colony. Fig-

FIGURE 14.—*Sources of Japanese receipts from overseas (including colonial)*

Area	Value 1929 (1,000 yen)	Percent of total	Value 1936 (1,000 yen)	Percent of total
Foreign	2,194,930	79.8	2,764,000	75.57
Asia	832,811	30.0	1,060,000	28.98
Europe	442,515	16.0	331,000	9.05
North America	722,787	26.3	921,000	25.18
(United States)	(654,058)	(23.5)	(847,000)	(23.16)
Central and South America	15,825	0.6	134,000	3.66
Africa	42,537	1.5	108,000	2.96
Oceania	138,455	5.0	210,000	5.74
Colonial	556,800	20.2	893,442	24.43
Korea	309,900	11.2	518,047	14.17
Formosa	238,700	8.7	358,895	9.81
Mandated Islands	8,200	.30	16,500	.45
Total	2,751,730	100.0	3,657,442	100.0

¹ 1934.

ure 15, showing the percentages of overseas shipments of several commodities originating in Japanese-controlled areas including Manchuria, illustrates the importance of these areas as sources of raw materials, especially foodstuffs, fertilizers, and the raw materials of the steel industry. The "yen bloc" of Japanese-controlled areas was almost self-sufficient in food, and essentially so in coal and pig iron.

In recapitulation, the dependence of Japan on overseas sources and hence on shipping, is further emphasized by considering simultaneously the contributions of foreign and colonial sources to total supply of materials. Figure 5, listing most of the principal raw materials and foodstuffs that involve substantial tonnages, and hence space requirements, shows the percentage of each produced in Japan proper, the percentage originating in colonial areas and the percentage originating in foreign countries. The overwhelming dependence on overseas sources for bulk foodstuffs and the raw materials of industry is at once apparent.

Character of Domestic Waterborne Traffic

Probably no country has a larger share of its domestic traffic carried by water than does Japan. The population is distributed on four major and hundreds of smaller islands. Except for that share which utilizes the railroad tunnel between Honshu and Kyushu, and the railroad ferries between Honshu and Hokkaido and Honshu and Shikoku, all inter-island traffic is by sea. Some of the bulky raw materials, especially coal, are found principally in the north and south islands, whereas the chief industrial areas are on the central island of Honshu, requiring bulk shipments from the extremes to-

FIGURE 15.—*Sources of Japanese imports of selected products (percent of total receipts) 1937*

Product	Korea	Formosa	Mandated Islands	Manchuria and Kwantung	Total colonial	Foreign (less Manchuria)	Total
Rice	60.45	37.66			98.11	1.87	100
Soybeans	21.04	1.01		77.95	100		100
Wheat	3.28			6.39	9.67	90.30	100
Sugar		80.28	4.00		84.28	15.67	100
Salt		5.58		31.72	37.30	62.66	100
Bean cake	9.46			89.90	99.36	.63	100
Ammonium sulphate	20.13			34.31	54.44	45.55	100
Phosphorite			9.31		9.31	90.69	100
Iron ore	8.81			7.18	15.99	83.97	100
Coal	9.90	3.73		43.68	57.31	42.67	100
Pig iron	12.00			19.00	31.00	69.00	100
Cotton	.96				0.96	99.03	100

ward the center. Even the intra-island trade consists in large part of coastwise shipping. The large population and industrial centers are on the coast. (Many of the industrial plants have selected tidewater sites.) Likewise many of the natural resources are located on or near the coast, facilitating movement by sea. Since overland transport is difficult, because of terrain, and since both the producing and consuming centers are on tidewater, there is little to encourage growth of rail traffic between the two.

Much of the bulky materials of low value, such as sand and building materials, which in most countries would be carried for the most part by land, was carried in Japan largely by water. This factor aided in swelling the total tonnage figures, which before the war were equal to three and one-half tons per person, a figure greater than that for goods transported by land. In spite of the low value of much of the tonnage, total value of domestic waterborne commerce reached a significant figure. In 1926 it was more than double the value of foreign commerce which for the year totalled 4,422,212,000 yen. Only four ports, Yokohama, Kobe, Yokkaichi, and Shimizu, handled foreign trade with value exceeding that of their domestic trade in 1936.

It is generally considered that the tonnage of Japan's prewar domestic commerce was normally about four times that of her foreign commerce. Applying this ratio to 1937 figures, and assuming the 1926 value ratio to be also applicable in 1937, it can be calculated that domestic trade for that year involved about 160,000,000 tons with a value of about 14,000,000,000 yen.

By far the most important item was coal carried from Kyushu to Honshu and from Hokkaido to Honshu (Figures 51 and 52). From northern Kyushu ports it flowed eastward to Inland Sea ports, principally Osaka, and to Nagoya, Shimizu and Tokyo Bay ports. Hokkaido coal was shipped from Hakodate, Muroran, and Kushiro to Tokyo Bay ports, and from Otaru and Rumoe to the Japan Sea ports of Honshu, principally Fushiki. Significant amounts of coking coal from Karafuto were shipped to Hokkaido and Honshu.

Karafuto was the source of other bulk products, principally fish meal, pulp, and paper, that were shipped south to Honshu. Hokkaido ports shipped, in addition to coal, large amounts of paper, pulp, lumber, metal products and foodstuffs, nearly all destined for Honshu ports. Specific items included steel ingots, lead and zinc, copper, manganese and chromite ores, and sulphur. Hokkaido was the principal Japanese source of wheat, beet sugar, and dairy products. Large quantities of beans, about 1,000,000 tons of potatoes, and several hundred tons of fresh and canned fish products were also shipped each year.

Shikoku's contributions to domestic trade included cereals, salt, non-ferrous metals, especially copper, ferrous concentrates, fertilizer, and limestone. Kyushu, in addition to coal, shipped pig iron, rolled steel products, coke, cement, refined metals, chemical products, soda, and cereals. Okinawa was the source of all the cane sugar produced in Japan proper, most of which was shipped north to the main islands.

Originating on Honshu and shipped largely intra-island, were coal, soda, and fertilizer shipped to Ube, cereals from Japan Sea ports to west coast population centers, oil from Niigata and Funakawa to east coast industrial centers, iron and steel from Hirohata and Kamaiishi and limestone from Yoshizu.

Although many ports were involved in the handling of the foreign and domestic trade described above, the bulk of it passed through relatively few. Of the 44 open ports in Japan proper and Karafuto, 18 were comparatively important in foreign trade. And of these, Kobe, Yokohama, and Osaka handled 82.8 percent of the total foreign trade of 1937 (Figure 16). The coastwise trade was more widely distributed, but Osaka and Tokyo were outstanding in

volume handled.

Inland waterway traffic was negligible, being confined almost entirely to the networks of river channels and canals found in the delta cities, principally Tokyo and Osaka. Here barges and sampans performed a delivery service.

Transition to a War Economy: Changes in the Pattern of Imports

The demands of the China war and the preparation for more serious war necessarily resulted in a change in the character of Japan's overseas trade, gradual at first, but rapid in later years. On the import side there was less emphasis on non-essential foods, luxury items, textile raw materials, and other items for home consumption and export. Imports of raw cotton, wool, pulp, and wheat in 1940 were only one half as great as those in 1936. There were similar declines in the imports of other raw materials, a large part of which was normally processed in Japan and reshipped overseas. Corresponding declines in the exports of these commodities were apparent after the depletion of stockpiles.

Offsetting these declines were increased demands for machinery, especially machine tools, motor vehicles, bearings, ores and metals, and petroleum. Gearing for war meant that the iron and steel industry, when confronted with the huge demands of shipbuilding, production of artillery, armored vehicles, aircraft, ammunition, industrial equipment, and machinery,

FIGURE 16.—*Exports and imports by principal ports, 1937¹*
[Million yen]

Port	Exports	Imports	Total
Kobe	1,107.6	1,119.5	2,227.1
Yokohama	800.0	1,047.6	1,847.6
Osaka	853.1	835.2	1,688.3
Moji	69.9	233.9	303.8
Nagoya	147.9	148.3	296.2
Wakamatsu	18.0	118.1	136.1
Yokkaichi	13.8	94.7	108.5
Shimizu	38.3	26.9	65.2
Hakodate	33.5	2.7	36.2
Nagasaki	10.7	24.3	35.0
Niigata	2.3	14.1	16.4
Total (incl. others)	3,175.4	3,783.2	6,958.6

¹ Source: Orient Yearbook, 1942, p. 347.

faced three critical shortages in the necessary raw materials: iron ore, coking coal and ferrous-alloys. Aluminum, vital to the aircraft industry and necessary in electrical transmission and communication, and magnesium, used in

aircraft manufacture and in flares and incendiaries, both required large amounts of imported raw materials. Salt, in addition to its uses as a food and as a food preservative, was the basis for many chemicals which in turn were essential for the rapidly expanding industries of petroleum refining, aluminum production, and the manufacture of explosives. The domestic petroleum industry was able to fill only one-tenth of the needs for aviation gasoline, fuel oil for the imperial fleet, and motor gasoline and lubricants essential for motorized warfare.

These increases in demands for overseas products met a succession of restrictions of source areas beginning with the outbreak of the European war in 1939. This event alone meant the loss of most German products and many of those originating in other belligerent countries. In 1940 the United States and countries engaged in the European war imposed export embargoes on many commodities needed in Japan. Among the more serious losses experienced were petroleum from the United States, copper from the United States, pig iron from the United States and India, scrap iron from the United States, non-ferrous metals from Canada and rubber from British Malaya. Japan's import trade changed accordingly.

In July 1941 Japanese credits were frozen in American, British, French and Dutch areas resulting in the further loss of important commodities including United States cotton, lumber and pulp, Australian wool and iron ore, Canadian lumber and pulp, Malayan iron ore and Indo-Chinese coal.

The declaration of war on the United Nations meant the virtual restriction of Japan's foreign trade area to Northeastern Asia, a situation enduring, however, only until the conquest of areas to the south. In possible anticipation of such a contingency, every effort had been made to increase the productivity and versatility of this area. As early as the spring of 1939, Japan announced a plan of becoming self-sufficient within the "yen bloc" by 1942 in iron and steel, light metals, zinc, coal, soda, sulphate of ammonia and pulp.

Self-Sufficiency Through the "Co-Prosperity Sphere"

During the conquest and occupation of the southern area, plans for economic self-sufficiency within the Greater East Asia Co-Pros-

perity Sphere commanded much attention. The Co-Prosperity Sphere was considered to include Japan, Manchukuo, China, French Indo-China and Siam, the countries within the sphere in early 1942. In addition, the Netherlands East Indies, the Philippines, Malaya, and Hong Kong were countries "expected to participate in the sphere." On the basis of average trade figures for the period 1935-37, only 30 percent of the export trade of the 8 countries, was confined to the sphere, the remaining 70 percent being destined for third countries. About 39 percent of the imports of the 8 countries originated in the sphere, 61 percent arriving from third countries.

It was considered easily possible to attain self-sufficiency in food-stuffs. Rice, the principal commodity, was produced with a slight surplus. There were still greater degrees of self-sufficiency in beans, sugar and many miscellaneous foodstuffs. Of the principal commodities, only wheat showed a deficiency (Figure 17).

FIGURE 17.—*Self-sufficiency rate of selected commodities in Greater East Asia Co-Prosperity Sphere¹*
(Based on average conditions 1935-37)

Commodity	Rate of self-sufficiency (percent)
Rice	101.8
Wheat	93.6
Beans	123.7
Sugar	170.1
Cotton	46.5
Wool	17.4
Iron ores	100.0
Pig iron	82.3
Steel	88.2
Copper	45.0
Lead	10.1
Tin	1,361.1
Zinc	47.7
Coal	100.6
Machinery	82.7
Rubber	2,285.6

¹ Source: Orient yearbook, 1942, p. 359.

The situation in fibres was less satisfactory. China, the only major producer of cotton, fell far short of filling the needs. The situation was still worse in wool, with China and Manchukuo producing only about one-sixth of the requirements, and in jute, practically all of which had come from India. There was a shortage of rayon pulp. Only in silk was there surplus and it was planned to make greater use of silk to overcome other fibre deficiencies.

In the important metallurgical industries there was an adequate supply of iron ore and coal but a shortage of pig iron, scrap iron and steel requiring annual importation from third countries of 660,000 metric tons of pig, 630,000 metric tons of scrap, and 660,000 metric tons of steel. The aluminum industry was in a situation similar to that of the iron and steel industry with an ample supply of raw materials, but with need for expanding refining facilities. There was self-sufficiency in tungsten, antimony and magnesite. Annual production of tin was 13 times greater than the requirement, but the ratio of self-sufficiency in copper, lead, zinc and nickel was very low.

Petroleum supplies within the sphere were not as abundant as coal, and self-sufficiency in mineral oils was dependent on increased production in the Netherlands East Indies and in the Japanese synthetic industry.

In summary, the evaluation of potential self-sufficiency in the Co-Prosperity Sphere concluded that there would be little to worry about in foodstuffs, difficulty in meeting fibre and non-ferrous metal requirements, and serious

problems in disposing of certain agricultural surpluses, namely rubber, beans and sugar.

Conquest of Southeastern Asia and the East Indies gave Japan control of the bulk of the world's supplies of rubber, tin, antimony, jute and quinine, as well as vast supplies of petroleum, iron ore, coal, phosphorite, bauxite, sugar, corn, and rice. This storehouse of raw materials, supplementing the materials and manufacturing capacity of the Inner Zone, gave Japan a position of strength in the waging of war as long as sea transport to the south remained unmolested.

During that period Japan drew heavily on this area for bulk raw materials and many critical items required in smaller quantities. The general order of priority was as follows: rice, bauxite, rubber, iron ore, tin, lead, tanbark, turpentine, resin, cowhide. On the basis of tonnage the principal commodities were petroleum from the Netherlands Indies, bauxite from Malaya and the Netherlands Indies, rice from Indo-China and Siam, iron ore from Malaya and the Philippines, and coal from Indo-China (Figure 18).

FIGURE 18 (1).—Japanese imports of coal, 1940–45

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries	6,535,000	93.2	6,109,000	94.6	5,967,000	93.4	5,035,000	97.2	2,635,000	100.0	548,000	100.0
Manchukuo	872,000	12.4	650,000	10.1	631,000	9.9	426,000	8.2	512,000	19.4	201,000	36.7
China	3,819,000	54.4	4,128,000	63.8	4,362,000	68.3	3,923,000	75.7	1,863,000	70.7	270,000	49.3
Formosa	284,000	4.1	94,000	1.5	134,000	2.1	30,000	0.6				
Korea	1,560,000	22.3	1,237,000	19.2	840,000	13.1	657,000	12.7	260,000	9.9	77,000	14.0
Total, southern area	431,000	6.1	350,000	5.4	421,000	6.6	145,000	2.8				
French Indo-China	431,000	6.1	350,000	5.4	421,000	6.6	145,000	2.8				
Total, other	45,000	0.6										
Grand total	7,011,000	99.9	6,459,000	100.0	6,388,000	100.0	5,181,000	100.0	2,635,000	100.0	548,000	100.0

Source: Coal Control Association, Shipping Control Association, Ministry of Commerce and Industry, Transport Ministry.

FIGURE 18 (2).—*Japanese imports of iron ore, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner-zone countries.....	1,944,000	32.0	3,359,000	53.3	4,485,000	95.4	4,027,000	93.7	2,057,000	95.5	314,000	92.0
China.....	1,400,000	23.1	2,500,000	39.7	3,615,000	76.9	3,725,000	86.7	1,457,000	67.6	75,000	22.0
Manchukuo.....	55,000	0.9	50,000	0.8	93,000	2.0	3,000	0.1	17,000	0.8	3,000	0.8
Formosa.....	69,000	1.1	51,000	0.8	32,000	0.7	57,000	1.3				
Korea.....	420,000	6.9	758,000	12.0	745,000	15.8	242,000	5.6	583,000	27.1	236,000	69.2
Total, southern area.....	3,288,000	54.1	2,136,000	33.9	215,000	4.6	271,000	6.3	96,000	4.5	27,000	8.0
Philippines.....	1,209,000	19.9	1,910,000	14.4	55,000	1.2	85,000	2.0	49,000	2.3		
Malaya.....	2,032,000	33.4	1,182,000	18.8	97,000	2.0	173,000	4.0	47,000	2.2	27,000	8.0
French Indo-China.....	47,000	0.8	44,000	0.7	55,000	1.2	13,000	0.3				
Siam.....					8,000	0.2						
Total, other.....	841,000	13.9	814,000	12.8								
Grand total.....	6,073,000	100.0	6,309,000	100.0	4,700,000	100.0	4,298,000	100.0	2,153,000	100.0	341,000	100.0

¹ Basic Materials Division sources give these figures as about 615,000 and 455,000 tons, respectively, for the comparable fiscal years; part of the difference is explained by the fact that the above figures are for calendar years but the figures remain at substantial variance.

² Basic Materials Division sources give these figures as 101,000 and

3,058,000 tons, respectively, for the 1941 fiscal year. Most of the difference is explained by the difference in year as most of the imports from India and other sources were stopped early in 1941.

Source: Iron and Steel Control Association, Shipping Control Association, Transport Ministry, Ministry of Commerce and Industry.

FIGURE 18 (3).—*Japanese imports of bauxite, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, southern area countries.....	¹ 275,000	100.0	¹ 150,000	100.0	305,000	100.0	909,000	100.0	376,000	100.0	15,500	100.0
Netherland East Indies.....					211,000	69.2	803,000	88.3	357,000	94.9	15,500	100.0
Palau.....					94,000	30.8	106,000	11.7	19,000	5.1		
Grand total.....	275,000	100.0	150,000	100.0	305,000	100.0	909,000	100.0	376,000	100.0	15,500	100.0

¹ No breakdown available on prewar imports.

Source: Shipping Control Association, Transport Ministry, Ministry of Commerce and Industry.

FIGURE 18 (4).—*Japanese imports of iron and steel, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries.....	621,000	100.0	921,000	100.0	993,000	100.0	977,000	100.0	1,097,000	100.0	170,000	100.0
Manchukuo.....	450,000	72.5	780,000	84.7	830,000	83.6	542,000	55.5	782,000	71.3	80,000	47.1
Kwantung.....	1,000	0.1	1,000	0.1	1,000	0.1	14,000	1.4	2,000	0.2	2,000	1.2
Korea.....	170,000	27.4	140,000	15.2	130,000	13.1	270,000	27.6	250,000	22.8	50,000	29.4
China.....					32,000	3.2	151,000	15.5	63,000	5.7	38,000	22.3
Grand total.....	621,000	100.0	921,000	100.0	993,000	100.0	977,000	100.0	1,097,000	100.0	170,000	100.0

Source: Iron and Steel Control Association, Transport Ministry, Ministry of Commerce and Industry.

FIGURE 18 (5).—*Japanese imports of scrap iron, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries	17,000	0.8	16,000	6.5	38,000	76.0	19,000	44.2	18,000	85.7	12,000	100.0
Manchukuo.....	10,000	0.5	10,000	4.1	10,000	20.0	8,000	18.6	5,000	23.8	2,000	16.7
Kwantung					1,000	2.0	1,000	2.3	1,000	4.8		
China					25,000	50.0	10,000	23.3	12,000	57.1	10,000	83.3
Formosa.....	7,000	0.3	6,000	2.4	2,000	4.0						
Total, southern area countries.....	75,000	3.5	49,000	19.9	9,000	18.0	16,000	37.2				
Hong Kong.....	13,000	0.6					5,000	11.6				
Netherland East Indies.....	62,000	2.9	49,000	19.9	9,000	18.0	11,000	25.6				
Total, other	2,012,000	95.6	181,000	73.6	3,000	6.0	8,000	18.6	3,000	14.3		
Grand total.....	2,104,000	100.0	246,000	100.0	50,000	100.0	43,000	100.0	21,000	100.0	12,000	100.0

Source: Iron and Steel Control Association, Ministry of Commerce and Industry, Transport Ministry.

FIGURE 18 (6).—*Japanese imports of lead, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries.....	8,080	8.1	8,670	10.0	8,720	79.4	16,190	65.9	16,590	98.7	4,000	100.0
Manchukuo.....	80	0.1	650	0.7	570	5.2	2,920	11.9	1,180	7.0		
Kwantung					150	1.4	240	1.0				
Korea	8,000	8.0	8,000	9.2	8,000	72.8	13,000	52.9	14,000	83.3	4,000	100.0
China			20	0.1			30	0.1	1,410	8.4		
Total, southern area countries.....	7,880	7.8	9,270	10.7	2,270	20.6	8,390	34.1	220	1.3		
Singapore.....	510	0.5					8,390	34.1	220	1.3		
Burma.....	7,370	7.3	9,270	10.7	2,270	20.6						
Total, others	84,140	84.1	68,590	79.3								
Grand total.....	100,100	100.0	86,530	100.0	10,990	100.0	24,580	100.0	16,810	100.0	4,000	100.0

Source: Light Metals Control Association, Transport Ministry, Ministry of Commerce and Industry.

FIGURE 18 (7).—*Japanese imports of tin, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, southern area countries.....	10,500	100.0	5,500	100.0	3,800	100.0	26,800	100.0	23,500	100.0	3,600	100.0
Netherland East Indies and Malaya.....	10,500	100.0	5,500	100.0	3,800	100.0	26,800	100.0	23,500	100.0	3,600	100.0
Grand total.....	10,500	100.0	5,500	100.0	3,800	100.0	26,800	100.0	23,500	100.0	3,600	100.0

Source: Light Metals Control Association, Transport Ministry, Shipping Control Association, Ministry of Commerce and Industry.

FIGURE 18 (8).—*Japanese imports of zinc, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries.....			1,600	20.2	5,100	60.0	6,500	65.0	5,500	90.2	2,500	100.0
Korea.....			1,600	20.2	5,100	60.0	6,500	65.0	5,400	88.5	2,500	100.0
China.....									100	1.7		
Total, southern area countries.....	800	3.4	3,000	38.0	3,300	38.8	3,000	30.0	600	9.8		
French Indo-China.....	800	3.4	3,000	38.0	3,300	38.8	3,000	30.0	600	9.8		
Total, other.....	22,700	96.6	3,300	41.8	100	1.2	500	5.0				
Grand total.....	23,500	100.0	7,900	100.0	8,500	100.0	10,000	100.0	6,100	100.0	2,500	100.0

Source: Light Metals Control Association, Shipping Control Association, Transport Ministry, Ministry of Commerce and Industry.

FIGURE 18 (9).—*Japanese imports of phosphorite and phosphate, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries.....	16,700	2.4	54,900	13.8	56,000	16.4	55,900	23.6	66,100	73.8	23,000	100.0
China.....	16,700	2.4	54,900	13.8	56,000	16.4	55,900	23.6	63,300	70.7	20,000	87.0
Manchukuo.....									2,800	3.1	3,000	13.0
Total, southern area.....	117,900	16.6	80,000	20.2	285,600	83.5	180,800	76.4	23,500	26.2		
Straits Settlements.....	82,900	11.7	47,600	12.0			3,500	1.5	2,000	2.2		
French Indo-China.....	20,000	2.8	22,400	5.7	55,000	16.1	48,300	20.4	4,500	5.0		
Malaya.....	15,000	2.1	10,000	2.5			4,100	1.7	4,000	4.5		
Pacific islands.....					230,600	67.4	124,900	52.8	13,000	14.5		
Total, other.....	575,800	81.0	261,600	66.0	500	0.1						
Grand total.....	710,400	100.0	396,500	100.0	342,100	100.0	236,700	100.0	89,600	100.0	23,000	100.0

Source: Chemical Industry Control Association, Shipping Control Association, Ministry of Commerce and Industry, Transport Ministry.

FIGURE 18 (10).—*Japanese imports of dolomite and magnesite, 1490-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent	Metric tons	Per-cent
Total, inner zone countries.....	409,600	100.0	506,300	100.0	468,700	100.0	437,500	100.0	287,100	100.0	65,900	100.0
Manchukuo.....	247,300	60.4	189,000	37.3	191,700	40.9	189,900	43.4	112,500	39.2	39,500	59.9
Kwantung.....	130,300	31.8	244,300	48.3	202,000	43.1	172,600	39.5	119,600	41.7	9,400	14.3
Korea.....	32,000	7.8	73,000	14.4	75,000	16.0	75,000	17.1	55,000	19.1	17,000	25.8
Grand total.....	409,600	100.0	506,300	100.0	468,700	100.0	437,500	100.0	287,100	100.0	65,900	100.0

Source: Chemical Industry Control Association, Ministry of Commerce and Industry, Shipping Control Association, Transport Ministry.

FIGURE 18 (11).—*Japanese imports of salt, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent
Total, inner zone countries.....	1,269,800	73.5	1,341,600	93.2	1,476,600	98.5	1,394,100	97.8	989,300	99.9	386,900	100.0
Manchukuo.....	40,600	2.4	119,900	8.3	89,000	6.0	115,900	8.1	91,300	9.2	29,300	7.6
Kwantung.....	501,300	29.0	389,900	27.1	313,400	20.9	354,900	24.9	333,300	33.7	158,800	41.0
China.....	674,200	39.0	779,400	54.2	969,000	64.6	799,500	56.1	496,600	50.1	195,800	50.6
Formosa.....	53,700	3.1	52,400	3.6	105,200	7.0	123,800	8.7	68,100	8.7	3,000	0.8
Total, southern area.....	19,600	1.1	27,000	1.9	6,900	0.5	31,000	2.2	400	0.1		
Philippines.....							31,000	2.2	400	0.1		
French Indo-China.....	19,600	1.1	27,000	1.9	6,900	0.5						
Total, others.....	438,900	25.4	70,300	4.9	16,300	1.0						
Grand total.....	1,728,300	100.0	1,438,900	100.0	1,499,800	100.0	1,425,100	100.0	989,700	100.0	386,900	100.0

Source: Shipping Control Association, Transport Ministry, Ministry of Agriculture and Forestry.

FIGURE 18 (12).—*Japanese imports of soybean cake, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent
Total, inner zone countries.....	333,900	100.0	337,700	100.0	449,500	100.0	304,500	100.0	384,700	100.0	163,400	100.0
Manchukuo.....	317,000	94.9	305,600	90.5	341,900	76.1	258,700	85.0	367,900	95.6	160,300	98.0
Kwantung.....	600	0.2	7,000	2.1	56,600	12.6	17,400	5.7	7,700	2.0	1,600	1.0
China.....	16,300	4.9	25,100	7.4	51,000	11.3	28,400	9.3	9,100	2.4	1,600	1.0
Grand total.....	333,900	100.0	337,700	100.0	449,500	100.0	304,500	100.0	384,700	100.0	163,400	100.0

Source: Ministry of Agriculture and Forestry, Shipping Control Association.

FIGURE 18 (13).—*Japanese imports of soybeans, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent
Total, inner zone countries.....	642,900	99.1	572,400	100.0	698,800	100.0	590,600	100.0	667,000	91.5	606,900	100.0
Manchukuo.....	464,600	71.6	492,800	86.1	614,200	87.9	524,700	88.8	628,900	86.3	596,100	98.2
Kwantung.....	2,800	0.4	1,200	0.2	1,000	0.1	600	0.1	600	0.1		
China.....	14,200	2.2	20,600	3.6	33,600	4.8	23,400	4.0	4,000	0.5		
Formosa.....	1,300	0.2	3,600	0.6								
Korea.....	160,000	24.7	54,200	9.5	50,000	7.2	41,900	7.1	33,500	4.6	10,800	1.8
Total, southern area.....									60,000	8.2		
French Indo-China.....									60,000	8.2		
Total, other.....	5,600	0.9							1,800	0.3		
Grand total.....	648,500	100.0	572,400	100.0	698,800	100.0	590,600	100.0	728,800	100.0	606,900	100.0

Source: Ministry of Agriculture and Forestry, Shipping Control Association.

FIGURE 18 (14).—*Japanese imports of rice and paddy, 1490-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent
Total, inner-zone countries...	445,100	26.3	791,800	35.5	1,101,500	41.9	279,200	24.6	709,300	90.6	151,000	99.9
Formosa	385,100	22.7	271,800	12.2	261,500	9.9	207,200	18.3	149,800	19.1	9,000	6.0
Korea	60,000	3.6	520,000	23.3	840,000	32.0	72,000	6.3	559,500	71.5	142,000	93.9
Total, southern area	1,144,200	67.5	1,435,500	64.3	1,527,700	58.1	856,600	75.4	73,900	9.4	200	0.1
French Indo-China	439,300	25.9	562,600	25.2	973,100	37.0	662,100	58.3	38,400	4.9		
Burma	420,900	24.8	437,500	19.6	46,600	1.8	18,000	1.6				
Siam	284,000	16.8	435,400	19.5	508,000	19.3	176,500	15.5	35,500	4.5	200	0.1
Total, other.....	104,700	6.2	5,400	0.2								
Grand total.....	1,694,000	100.0	2,232,700	100.0	2,629,200	100.0	1,135,800	100.0	783,200	100.0	151,200	100.0

Source: Ministry of Agriculture and Forestry, Shipping Control Association.

FIGURE 18 (15).—*Japanese imports of other grains and flours, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent
Total, inner zone countries.....	43,800	16.3	53,000	20.0	676,100	82.1	111,000	14.8	151,800	30.0	231,400	100.0
Formosa	500	0.2	1,000	0.4	1,000	0.1	300	0.1	100	0.1		
Korea	3,300	1.2	1,000	0.4	600,000	72.9	25,200	3.3	25,200	4.1	15,000	6.5
China			1,000	0.4	2,300	0.3	5,000	0.7	4,500	0.9	3,000	1.3
Manchukuo	40,000	14.9	50,000	18.8	72,800	8.8	80,500	10.7	122,000	24.0	213,400	92.2
Total, Southern area countries	225,500	83.7	214,400	80.0	147,200	17.9	639,100	85.2	355,000	70.0		
French Indo-China.....	148,600	55.2	135,200	50.5	124,900	15.2	634,100	84.5	355,000	70.0		
Netherland East Indies.....	76,900	28.5	79,200	29.5	22,300	2.7	5,000	0.7				
Grand total	269,300	100.0	267,400	100.0	823,300	100.0	750,100	100.0	506,800	100.0	231,400	100.0

Source: Ministry of Agriculture and Forestry, Shipping Control Association.

FIGURE 18 (16).—*Japanese imports of raw rubber, 1940-45*

Country of origin	Quantity											
	1940		1941		1942		1943		1944		1945	
	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent	Metric tons	Per cent
Total, southern area.....	27,500	100.0	67,600	100.0	29,700	94.6	40,100	95.2	28,100	89.2	16,500	92.2
Malaya.....	14,300	52.0	1,400	2.1	14,000	44.6	25,000	59.4	17,200	54.6	16,500	92.2
Siam	2,700	9.8	23,800	35.2								
Netherland East Indies.....	10,500	38.2	20,500	30.3	12,300	38.2	15,000	35.6	6,500	20.6		
French Indo-China.....			21,900	32.4	3,400	10.8	100	0.2	4,400	14.0		
Total, other.....					1,700	5.4	2,000	4.8	3,400	10.8	1,400	7.8
Grand total.....	¹ 27,500	100.0	¹ 67,600	100.0	31,400	100.0	42,100	100.0	31,500	100.0	17,900	100.0

¹ No information on imports from sources outside Asia.

Source: Rubber Control Association, Shipping Control Association, Greater East Asia Ministry.

CHAPTER III

PREWAR TRANSPORTATION FACILITIES

History of the Merchant Fleet

Japan was historically a maritime nation, but during the two centuries prior to the arrival of Commodore Perry the isolationism of the Shoguns had stifled ocean navigation. It was not until the Meiji Restoration after the middle of the nineteenth century that Japan took part in world trade. Her first efforts to acquire a merchant marine were guided by foreign experts. Progress was slow. By 1870 Japan had a merchant marine of only 25,000 tons.¹ In the ensuing 40 years Japan's rapid progress from maritime infancy to sixth place among the maritime powers of the world with a merchant fleet of 1,100,000 tons, carrying 40 percent of her own trade in her own bottoms, was a history of the dependence of Japanese imperial ambitions on shipping (Figure 19).

The conquest of Formosa in 1874, the Sino-Japanese war in 1894, and the Russo-Japanese war in 1904, each in its time, gave the Japanese shipping industry a tremendous boost, as, like all nations, Japan learned that in war she must depend on her own merchant shipping, and conversely must have merchant shipping as a prerequisite to war.

The world shipping slump preceding World War I reduced the natural demand for Japanese shipping, but by this time the Japanese government had learned its lesson and began a program of fostering the merchant marine which continued until the recent war. In 1909 a

selective subsidy program designed to increase the number of new and larger ships in world trade was inaugurated.

FIGURE 19.—History of the Japanese Merchant Marine
(In gross tons as registered in Japan and the Japanese Empire)

Year	Japan proper (all ships over 20 GRT)		Tankers over 1,000 GRT	Japanese Empire (all steel ships over 100 GRT)			Year
	Steel Ships	Wooden Ships		Steamers	Motor-ships	Total	
1870	24,997	2,611					1870
1882	64,313	51,684					1882
1892	157,147	34,163					1892
1897	426,624	27,412					1897
1902	605,122	329,839					1902
1904						668,360	1904
1905						870,839	1905
1906						996,553	1906
1907	1,109,444	357,257				1,068,757	1907
1908						1,140,177	1908
1909						1,150,858	1909
1910						1,146,977	1910
1911						1,200,975	1911
1912	1,430,329	441,039				1,344,991	1912
1913						1,500,014	1913
1914						1,708,386	1914
1915						1,826,068	1915
1916	1,696,631	585,593				1,847,453	1916
1917						2,059,001	1917
1918						2,299,405	1918
1919						2,325,266	1919
1920						2,995,878	1920
1921	3,167,737	960,947				3,354,806	1921
1922						3,586,918	1922
1923						3,604,147	1923
1924						3,842,707	1924
1925						3,919,807	1925
1926	3,607,038	873,468				3,967,617	1926
1927						4,033,304	1927
1928						4,139,815	1928
1929			76,911	3,958,317	228,335	4,186,652	1929
1930	3,907,908	896,272	101,114	3,910,613	406,191	4,316,804	1930
1931			120,110	3,763,925	512,416	4,276,341	1931
1932	3,874,619	867,658	122,337	3,684,637	570,377	4,255,014	1932
1933	3,780,197	862,846	125,043	3,649,213	608,946	4,258,159	1933
1934	3,811,773	874,935	134,250	3,365,132	707,575	4,072,707	1934
1935	3,862,942	900,792	150,191	3,253,644	832,006	4,085,650	1935
1936	4,034,284	930,322	188,480	3,247,949	967,741	4,215,690	1936
1937	4,421,648	965,961	222,792	3,361,694	1,113,416	4,475,110	1937
1938	4,973,336	984,599	345,849	3,721,628	1,285,084	5,000,712	1938
						5,629,845	1939

(¹) Many vessels were used in fishing and inter-island trade in Japan before the Restoration, but they were not "European-style" ships. These small vessels were a Japanese variety of the Oriental junk and were built of wood. As new steel ships were built, after the European manner, they were called "kisen", literally "steam vessel". Later on, with the advent of the internal combustion engine, the older, wooden, Japanese-style vessels began to be equipped with power, and were called "kihansen", literally "powered sailing vessel". In more recent years, the sail was not always provided, but the term "kihansen" was retained to distinguish these "Japanese-style" vessels, usually but not always built of wood, and seldom exceeding 250 gross tons burden, from the more modern "European-style" kisen, usually but not always built of steel, sometimes as small as 50 tons, but usually over 500 tons. At the same time the term "kisen," originally meaning steamship only, came to include all "European-style" ships, whether propelled by steam or Diesel. This unique Japanese distinction is preserved herein by using the words "kisen" and "kihansen" to distinguish between steel, European-style ships and wooden Japanese-style ships wherever confusion might exist. The word "ships", when used alone, refers to kisen of over 500 gross tons.

Gross tonnage is a measure of a ship's size, and is calculated as the number of hundred-cubic-foot units of space covered by the main deck. Wherever not otherwise specified herein, tonnages given are gross tonnages.

World War I increased the demand for Japanese shipping beyond all precedent, and as the German and British fleets disappeared from Asiatic waters, Japan began her program of absorbing all the maritime commerce of East Asia. Shipbuilding increased tenfold during the war years to a maximum capacity of one-half million tons a year, and the Japanese merchant marine doubled in size. At the end of the war she was carrying not only her domestic trade, but 80 percent of her foreign trade in her own ships.

In the decade of the twenties Japan's merchant fleet only increased an average of 130,000 tons a year. Government support of shipping

continued. As a result of mergers NYK became one of the world's greatest shipping companies. In 1930 the size of the fleet crested at 4,300,000 tons and thereafter receded slightly under the pressure of the world depression. During 1931 and 1932 the stress of world events produced profound changes in Japanese shipping policies. Political repercussions of the Manchuria Incident, the uncertainty of world trade, the gold embargo, and fluctuations in foreign exchange, culminated in the depreciation of the yen, long steady at 49 cents, to 29 cents in 1935. As freights were paid in foreign currency, Japanese shipping gained tremendously; for the same reason, Japanese exports increased 75 percent by volume. In this favorable market the Japanese merchant marine, shocked into a temporary recession in 1931, began the upturn in 1933.

New government subsidies designed to encourage the scrapping of old ships and the building of fast new motorships greatly improved the quality and carrying capacity of the Japanese fleet in the succeeding years, although the gross tonnage did not increase much (Figure 20). With the great need for shipping resulting from the ambitious industrial program in Manchuria, Japan was able to keep her own ships busy and had to rely on foreign ships for the carriage of nearly half of her foreign trade.

History of the Railroad

Railway construction in Japan was initiated in the year 1869 when the Japanese government proposed construction of a trunk line between Tokyo and Kobe with branches to Yokohama and Tsuruga, a Japanese seaport north of Kyoto.

Since the state treasury was unable to finance this proposed construction, an English offer to furnish the required funds was accepted, and a

FIGURE 20. — *Annual construction of four main categories of steel merchant ships in Japanese shipyards, 1931-41*
(In gross tons)

Year	Passenger	Passenger Cargo	Cargo	Tankers	Total
1931	1,038	302	67,384	29,366	98,090
1932	4,558	18,094	15,955	236	38,843
1933	937	13,599	46,627		61,163
1934	7,112	15,800	93,839	19,283	136,034
1935	3,071	20,482	98,389	17,972	139,914
1936	2,472	35,622	126,031	56,739	220,864
1937	1,475	63,853	271,696	36,877	373,901
1938	1,781	11,223	294,235	42,540	349,779
1939		49,790	214,145	56,531	320,466
1940	3,500	82,194	194,418	13,500	293,612
1941		40,397	156,596	13,380	210,373
Total	25,944	351,356	1,579,315	286,424	2,243,039

Japanese loan was placed on the London market. With the arrival of a British engineer corps, work was begun on the Shimbashi-Yokohama section in March 1870 and on the Kobe-Osaka section in November 1870. The gauge adopted for these lines was 1.067 meters (3 feet, 6 inches), which later became the standard gauge of the Japanese railways.

Following this early construction the government encouraged further railway building by subsidy. As a result of this encouragement, private railways were built in rapid succession. But, in spite of this governmental assistance, by 1893 the entire length of the Japanese railways totalled only 2,574 kilometers, while the demand for the speedy development of railways was as urgent as ever in view of the industrial progress of the country.

It soon became obvious that, because most of the contemplated lines were in remote districts with little prospect of immediate profit, there was little appeal to private enterprise. These circumstances showed both the government and the public the advisability of state acquisition of private lines, an opinion which was further strengthened by the financial failure of some of the private companies about the turn of the century. In 1907, therefore, the government acquired the bulk of the private railways. Immediately after nationalization, state railways were organized under a railway bureau which was directly responsible to the cabinet and in May 1920 the government railways, including all main trunk lines, were organized under a ministry with representation in the cabinet by the minister of railways (now minister of transportation). Under this administration the system expanded until in 1945 approximately 12,000 miles of line were operated, including 14,000 miles of first and additional main track and 5,800 miles of sidings and yard track.

Physical Description of the Railroad System

With the exception of a narrow coastal strip, the Japanese terrain is almost entirely mountainous. These mountains, which form the backbone of the country, extend longitudinally from the northern extremity of Hokkaido, south through Honshu and Kyushu. Because of the rugged nature of the terrain, the main trunk lines parallel the coastline for the most part while secondary lines traverse the mountain chains to connect east and west coast main

lines. Numerous tunnels, bridges, retaining walls, and steep grades are necessary.

Through railway traffic was carried on between the Japanese home islands of Hokkaido and Honshu and Kyushu and Honshu via railroad ferry. Each of the four main industrial areas of Tokyo, Nagoya, Osaka-Kobe-Kyoto, and Moji-Shimonoseki has an extremely well developed railway net within its immediate environs. Beyond these urban areas however, the railway facilities rapidly decline to two, or at most three, trunk lines connecting these main manufacturing centers with each other and their principal sources of supply (Figure 21).

Most of the railroads in Japan are single-tracked and steam operated. The notable exception to this is the Tokaido main line and its extension to Shimonoseki, the Sanyo main line. This entire route is double tracked and the sections between Tokyo and Numazu, a distance of 78 miles, and between Kyoto and Akashi (which is west of Kobe), a distance of 52 miles, are electrified. While it may seem a paradox that there is such emphasis on steam power, in a country so abundantly supplied with hydroelectric power, it must be understood that the Army in Japan had not permitted extensive electrification of the railway system out of fear of increasing the vulnerability of the system to attacks and breakdowns.

Normal Rail Traffic

The Japanese railroads before the war carried about one-third of the tonnage of the country's domestic trade. As described above, the geographical situation tended to encourage water transport at the expense of the develop-

ment of land transport. As a result Japan's railroads were unique among the systems of the world for their dependence on passenger traffic. Revenue from passenger traffic and passenger train mileage consistently exceeded revenue from freight and freight train mileage.

Freight consisted predominantly of bulk raw materials carried largely on short hauls. Freight arrived in the larger ports by vessel and was moved by rail to industries located in the interior. None of the traffic required long hauls by rail. Railroad facilities were concentrated in the large ports, and industries located a distance from the ports were fed by short rail hauls from the docks, storage yards, and warehouses, contiguous to the unloading piers. Agricultural and forest products of the interior were rail-hauled short distances to the nearby coastal ports. Mineral products constituted about one-half of the total tonnage; coal alone about 38 percent. The 19 items listed in Figure 22 include about three-fourths of the tonnage. The principal commodities fall into the following classes:

(1) Local raw materials transported from production areas to consuming or processing centers: coal, metal ores, limestone, pulp, lumber, charcoal, and firewood. This class represents by far the largest share of materials carried by rail.

(2) Imported materials transported to consuming areas: mineral fertilizers and coal.

(3) Foodstuffs: agricultural products of the interior transported to coastal cities—rice, other grains, potatoes and soybeans, and fish from seaports to interior consuming centers.

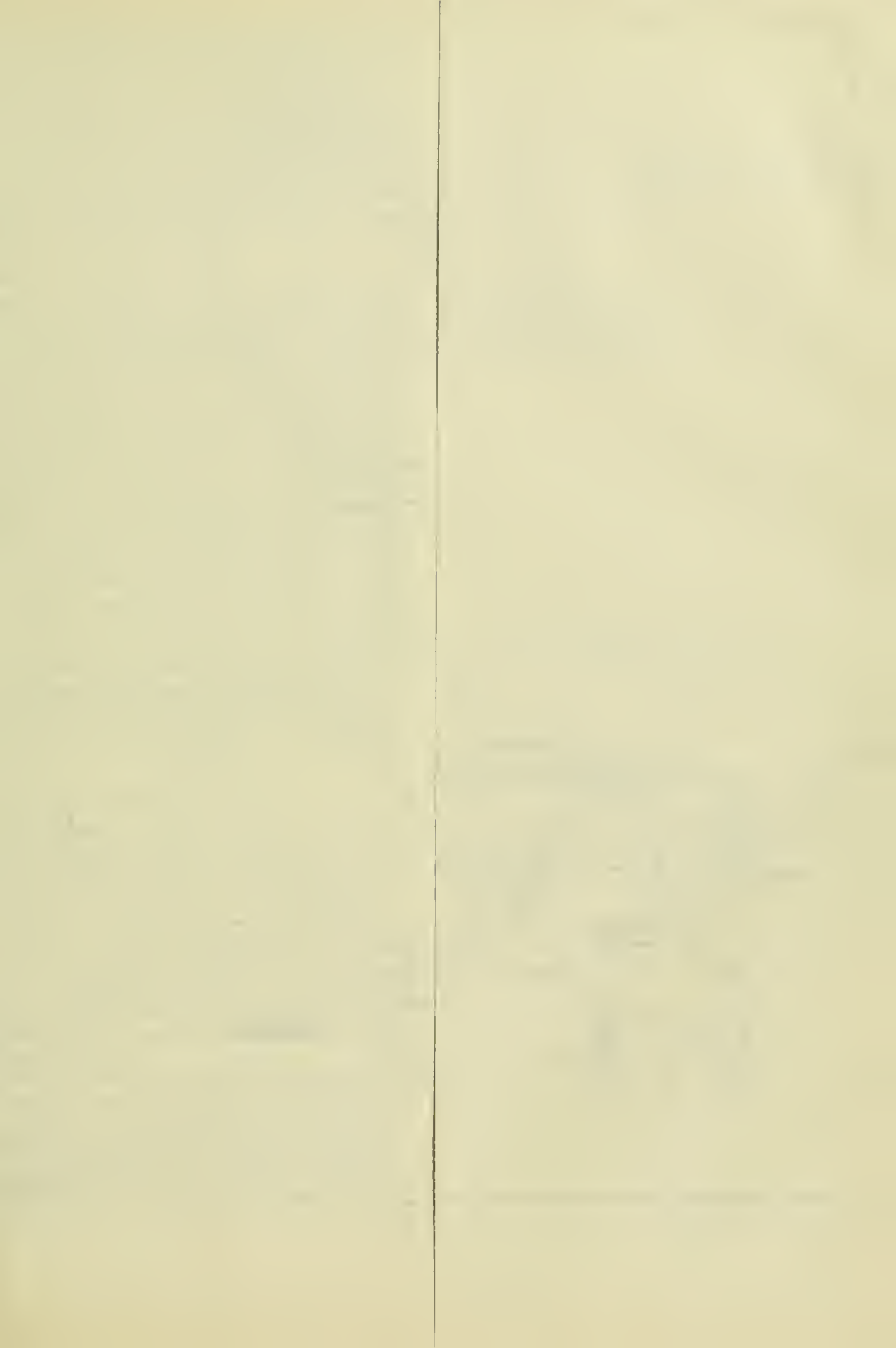
FIGURE 22.—*Tonnage of the principal commodities carried on the Japanese Railroads*
(Figures are in 1000 metric tons. Fiscal years are shown).

Commodities	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945 (1st quarter only)
Rice	3,547.5	3,540.7	3,950.3	4,373.1	3,593.0	3,934.8	4,393.0	4,593.8	4,230.7	916.9
Grain	984.6	1,189.4	1,341.2	1,698.5	1,537.2	1,197.5	1,538.8	1,276.7	1,497.0	261.0
Soybeans	360.1	258.0	282.9	357.4	300.1	214.7	513.2	772.2	967.9	507.1
Potatoes	410.4	420.0	481.3	585.2	650.1	830.0	1,020.8	1,235.3	1,230.5	175.2
Lumber	8,008.9	8,529.9	10,425.1	12,223.7	13,336.9	13,363.2	12,453.4	20,540.6	18,841.5	4,359.1
Firewood and charcoal	1,661.6	1,599.2	1,810.1	2,152.8	3,233.2	3,299.6	2,633.0	3,700.6	3,211.7	831.6
Coal	31,460.7	33,370.1	36,219.3	39,346.1	41,994.0	38,670.4	38,566.2	48,799.2	44,621.8	10,423.5
Coke	351.7	424.5	633.2	817.9	1,147.9	1,819.6	1,804.4	1,928.8	1,861.8	514.7
Ore	2,273.0	2,535.2	2,982.0	2,994.2	3,055.2	3,466.0	4,576.3	6,176.9	6,101.9	1,334.3
Limestone	1,925.3	2,169.9	2,161.9	2,115.0	2,393.2	2,651.0	3,131.0	3,457.3	3,256.3	715.3
Ballast	2,590.3	2,255.1	2,663.7	3,116.0	4,071.4	4,963.6	4,813.1	9,982.0	9,986.3	1,931.0
Iron and steel	241.4	2,123.0	2,395.4	2,607.0	1,947.4	2,090.7	2,581.2	4,953.3	5,969.6	1,175.6
Oil	265.6	1,172.1	1,181.0	1,114.8	1,037.2	840.6	658.0	1,632.2	1,625.4	425.7
Fish	254.8	1,236.4	1,451.4	1,586.0	1,639.4	1,744.9	1,313.7	1,434.1	941.3	345.9
Salt	95.6	647.8	730.8	785.9	882.4	838.9	1,017.9	1,262.7	1,029.4	280.5
Fertilizer	1,100.1	4,262.3	4,352.9	5,105.1	5,264.2	4,281.3	3,854.4	2,845.9	1,967.8	357.7
Fiber and fiber products	308.1	1,815.0	1,772.6	1,844.8	1,700.0	1,556.9	966.4	820.9	1,626.1	501.4
Cement	398.2	2,052.4	2,136.8	2,481.1	2,894.9	2,902.9	2,410.7	2,695.2	2,279.8	438.8
Paper and paper products	281.9	1,349.6	1,363.7	1,461.1	1,468.4	1,604.3	1,494.3	1,488.0	1,003.1	216.8
Total ..	56,519.8	70,950.6	78,335.6	86,765.7	92,146.2	89,770.9	90,739.8	119,595.7	112,249.9	25,712.1

GRAND DIVISIONS OF THE JAPANESE IMPERIAL RAILROADS



FIGURE 21



HIGHWAY MAP OF JAPAN

LEGEND

- HEAVY DUTY, SURFACED HIGHWAY,
(2 OR MORE LANES)
- - - UNSURFACED NATIONAL HIGHWAY

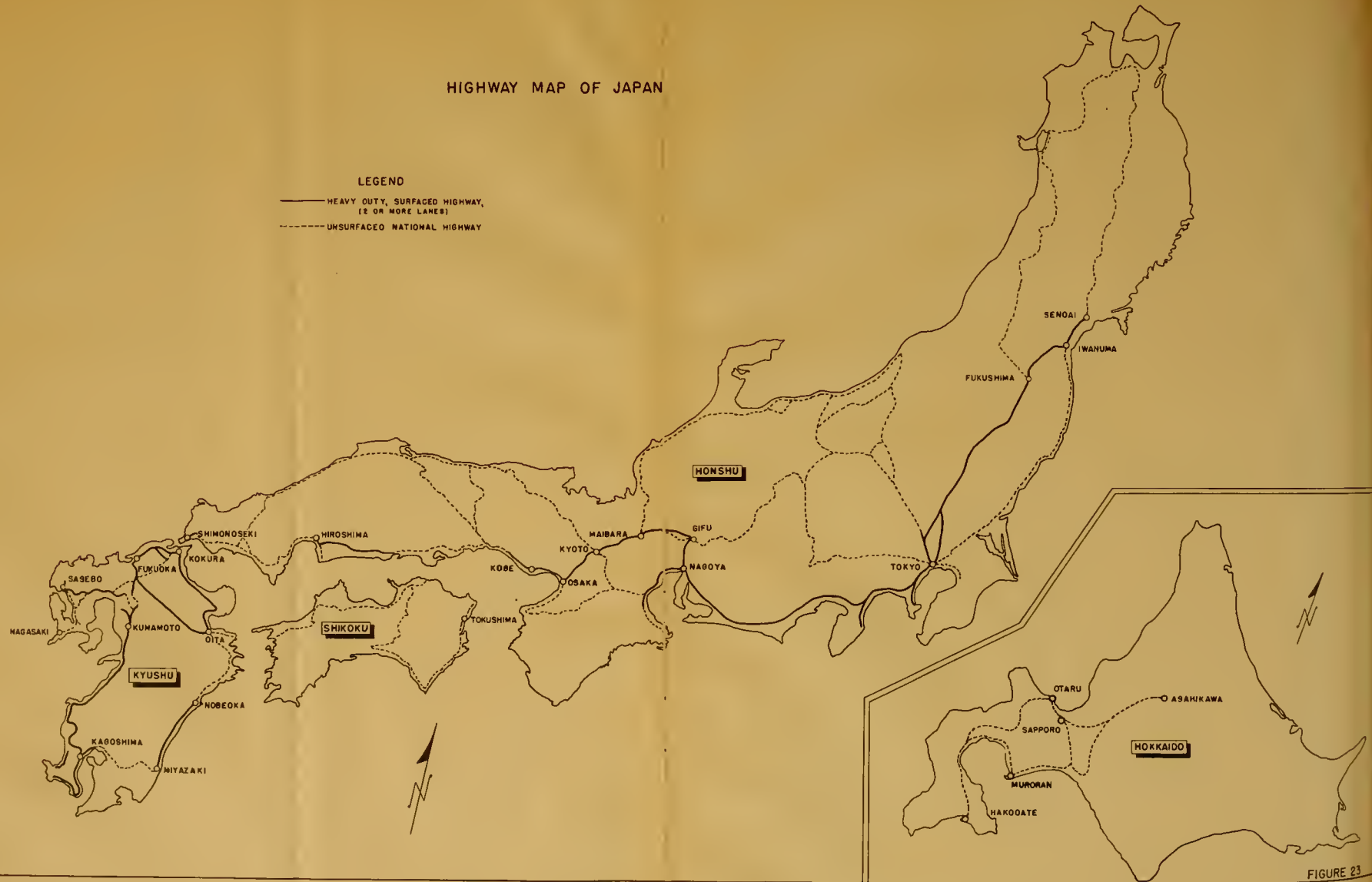


FIGURE 23

(4) Finished products transported from industrial centers to consuming areas: cement, iron and steel, and synthetic fertilizers.

Freight traffic was most dense in the Nagoya and Osaka divisions. The total freight carried in 1936 and 1937 amounted to 89,342,111 tons, probably a little more than one-half the waterborne domestic trade tonnage for the period. Freight ton-kilometers for the same year reached 15,656,579,602.

Highway Transportation and Roads

The Japanese highway system is primitive. Of about 900,000 kilometers of roads of all kinds, only about 9,000 kilometers are classed as "major national highways." These are almost entirely unsurfaced. A party of Survey personnel, traveling one of these typical "national highways" across Honshu to Niigata by jeep, required 12 hours to cover one 77-mile stretch. Improved or paved roads are concentrated largely around the industrial centers of Honshu and the northern tip of Kyushu. Except in the Tokyo-Yokohama and Kobe-Osaka areas there are no inter-city trunk highways (Figure 23).

Trucking operations in Japan were almost exclusively short haul operations. Bus traffic moved over short distances only. In 1940 there were 60,000 trucks and 23,000 buses, of which only 37,000 and 14,000, respectively, were operational. The motor division of the Imperial Japanese Railways confined its work to pickup and delivery of railroad freight.

The Effect of the Chinese War

The outbreak of the "China Incident" in 1937 found the Japanese merchant marine a flourishing industry, busily engaged simultaneously in carrying the home island commerce necessary to the development of the industrial machine, supplying the materials necessary to the development of a new industrial growth in Manchuria, and also participating heavily in all kinds of world trade in all five oceans. In 1937 Japan carried 54 percent of her foreign trade in her own ships.

Almost immediately a shipping shortage developed as a result of tonnage requisitioned by the Army for their Chinese operations. The degree of shortage varied from time to time in the ensuing years, but the supply of shipping available to Japanese for military and civilian

purposes never again equaled the demand. In 1937 a very far-reaching piece of legislation was enacted: the emergency shipping control law, the first step in government control of shipping. While this legislation gave the Ministry of Transportation absolute authority over all phases of shipping (ship transfers, prices, construction, routes, freight, and charter rates) this authority was not strongly exercised at first. A committee of shipowners for "voluntary joint action" for the benefit of the industry was set up under the Ministry of Transportation. The initial regulatory action was entirely in the form of consultation and cooperation to forestall direct government control. Construction was increased to about a third of a million tons a year.

An immediate effect of the "China Incident" was the increased need for ships for "near-sea" transportation, as contrasted with the increasing pre-occupation in preceding years with ships for world trade. The "near-sea" fleet was increased during the first few years of the Chinese war from two million to three and one-half million tons, one-half million tons being taken off world routes and the remaining one million tons coming from the shipways of the booming Japanese shipyards. Purchase of foreign ships was encouraged. Many ships were chartered abroad. The average amount of foreign shipping under charter to Japanese operators increased from 390,000 tons in 1937 to 550,000 early in 1941. In spite of all these efforts, the shipping shortage remained acute and freight and charter rates rose irresistibly. Succeeding committees fixed and constantly revised standard freight and charter rates. By 1938, 85 years after the arrival of Commodore Perry, Japan stood next to Britain and the United States as the third maritime power in the world.

By 1939 the developments of the Chinese war resulted in the consolidation of all the various Japanese coastal operations in China into one company, the Toa Company. The increasing need for medium and small ships for "near-sea" service resulted in a new subsidy policy fostering the construction of small ships under 5,000 tons for servicing the expanding Japanese military and industrial activity on the continent. The intense shipping activity in Japan in this period is clearly illustrated by the fact that at

the end of 1938 only three-tenths of one percent of Japan's merchant fleet was laid up as compared with 3 percent for Britain and 10 percent for the United States. In 1939 Japan carried 60 percent of her foreign trade in her own ships. At this time, in order to stimulate ship production and reduce construction costs, a set of standard ship designs was adopted for several sizes ranging from 500 to 6,500 tons. New and ever more favorable shipbuilding subsidy laws and government financing projects were instituted.

The effect on the Japanese railroads of the war in China was mainly felt in the great expansion of the industrial economy of the Japanese home islands with the consequent increase in production. This expansion was reflected in increasing activity on the railroads without any corresponding increase in physical plant or track mileage. From 1936 to 1941 freight tonnage increased 55 percent; freight ton-miles 83 percent; average length of haul 18 percent (to 122.8 miles). Meanwhile, partly because of heavy military movements, passengers carried increased 105 percent, and passenger-miles 111 percent. Total locomotives increased from 4,142 to 5,106, freight cars from 75,000 to 100,000 and passenger cars from 9,500 to 11,000.

The Japanese had long recognized the need for a long-term expansion of their rail system—an expansion which would keep pace with their country's general economic development. A part of this plan was the construction of the Kanmon tunnel beneath the Shimonoseki Straits, plans for a standard-gauge railroad from Tokyo to Shimonoseki, and the construction of a tunnel beneath Tsugaru Strait which would connect Hokkaido and Honshu, as well as a number of line extensions and the double-tracking of certain existing lines. The Japanese did not, however, expect the rapid increase in freight developing during the war in China. The freight load they had expected in the distant future was upon them in a few months.

War in Europe

The outbreak of World War II again removed the bulk of foreign shipping from the Japanese sphere, and Japan again experienced a near-monopoly of Far Eastern markets. In three months the total ship tonnage of all nations in Far Eastern waters dropped from 4,500,000

tons to 3,200,000, the remainder being almost entirely Japanese. In the spring of 1940 the German invasion of Denmark and Norway resulted in the removal by Britain of almost all the few remaining Scandinavian ships in the Far East. The urgent need for shipping in home waters to service the home islands, supply the war in China, and bring in strategic materials from Southeast Asia and the Indies brought about a tremendous curtailment of Japan's "transoceanic" services. The radical changes in the disposition of her merchant marine are here illustrated:

GROSS TONS OF SHIPPING

	1929	Beginning of 1941
Round the world		60,000
Atlantic coast of North America	385,271	138,817
Pacific coast of North America	616,601	193,001
South America	249,018	109,072
Africa	23,213	10,779
Indian Ocean	435,900	77,320
Australia	235,838	98,474
Total shipping engaged in "world trade"	1,945,841	687,463
South Seas: Southeast Asia, Netherlands Indies, Philippines and Pacific Oceania	175,231	899,229
The yen bloc: Japan, Korea, Manchuria, Formosa, and occupied China (including ships operated by the Army and Navy) (approx.)	2,000,000	4,200,000
Total merchant marine (kisen)	4,121,072	5,786,692

Most of these changes took place after the beginning of the Chinese war, accelerated greatly by the effect of the European war in late 1939 and 1940. By this time, as might be expected, Japan was carrying over 65 percent of her "foreign" trade in her own bottoms, in addition to all her domestic trade and trade with the yen bloc.

Early 1941 found the Japanese busily exploiting their small fleet of tankers bringing in oil from the United States and from the Netherlands Indies. French Indo-China and Thailand were brought into the Japanese sphere in May, but by that time the increasing tenseness of the world political situation had reduced Japanese trade to Europe to a trickle, and shipowners were even hesitating to send their ships to the United States. The further withdrawal of British-controlled shipping from the China trade, the increased requisition of Japanese shipping by the military for the Chinese operations and for infiltration into French Indo-China and Thailand further aggravated the shortage. A concerted movement was made to mobilize 1,000,000 tons of kihansen for the coastal trade in the home islands to free larger kisen for deep-water service. Meanwhile, mer-

chant ship construction, which had been on a rapid upgrade since 1936, was considerably hampered by priorities given to naval building; only 200,000 tons were built in 1941.

The stiffening attitude of the United States, becoming evident in more and more embargoes on scrap, steel and war implements, encouraged the Netherlands Indies to resist Japanese demands, and negotiations similar to those preceding the virtual annexation of Indo-China broke down in June. Simultaneously, partly because of the fear of the effects of ship control legislation pending in the United States Congress, but mainly on account of the shipping shortage for "near-sea" operations, the Japanese began canceling their few remaining foreign sailings and recalling the few ships they had abroad. The shortage was so acute that the government ordered all routing maintenance and repair of ships deferred as long as possible and not performed during the busy summer months. In June the Army and Navy requisitioned 80,000 tons of merchant shipping.

On 26 July 1941, the United States, followed by the British Empire and the Dutch colonies, froze all Japanese assets in their countries, and all Japanese trade outside their own sphere came to an end. No more oil, copper, iron, steel, or aluminum were imported into Japan. The chartering of foreign vessels fell off greatly, and foreign vessels virtually ceased calling at Japanese ports.

During the five months before Pearl Harbor the preparations of the Army and Navy entailed the requisitioning of great tonnages of merchant ships. The approximate disposition of the Japanese merchant fleet during 1941 was as follows (in thousands of gross registered tons) :

	Army	Navy	Combined military	Civilian shipping
July 1:				
Cargo and cargo-passenger..	768	622	1,390	4,080
Tankers.....	13	261	274	406
	781	883	1,664	4,486
Oct. 1:				
Cargo and cargo-passenger..	1,927	1,123	3,050	2,240
Tankers.....	13	300	313	262
	1,940	1,423	3,363	2,502
Dec. 1:				
Cargo and cargo-passenger..	2,150	1,557	3,707	1,715
Tankers.....	13	342	355	219
	2,163	1,899	4,062	1,934
Grand Total, Dec. 1.....				5,996,000

The details of the make-up of this fleet, as of Pearl Harbor day, together with an approximation of the tonnage of kihansen, is shown in Figure 24, roughly summarized as follows:

1,250 cargo and passenger ships (over 1,000 tons).....	5,200,000
74 tankers (over 1,000 tons).....	563,000
1,126 miscellaneous types and small ships (under 1,000 tons).....	437,119
2,450 kisen	6,200,119
18,789 kihansen (84 percent under 100 tons)	1,197,349

The Outbreak of the Greater East Asia War

The actual outbreak of war was, of course, no surprise to the Japanese, and it is therefore not to be wondered at that they lost no ships to the Allies: they were all called back safely within the Japanese sphere of operations. One of the first benefits of the war was the acquisition by conquest of considerable tonnage of foreign ships, caught for one reason or another in areas occupied by the Japanese. During the first 3 months of the war, their fleet was augmented by 823,000 tons of ships seized in this manner. A further breakdown of these ships is given in Figure 25. Although many of them were scuttled by their crews, most were subsequently returned to service by the Japanese.

It will be noted that the tonnage left to civilian control, and which had to suffice for the purely economic traffic within the empire, was reduced to a dangerously low point by the requisitions of the military in the latter part of 1941. The shortage of shipping for essential industrial traffic and the import of food, already critical enough in the spring to result in curtailment of normal repair operations and to be given part of the blame for the slight slump in steel production, was rendered disastrously acute. From the point of view of the maintenance of civilian production, more ships had to be devoted to the movement of civilian goods. With this necessity in mind, plans were made to return at least a million tons to civilian control immediately after the completion of the first phase of the operation: occupation of the Philippines, Malaya, and the Netherlands Indies. However, as a result of the ease with which these initial operations were conducted, the plan was extended and the ships were needed longer. Furthermore, ship losses in early 1942 were heavier than expected. The Navy

FIGURE 24.—Japanese Merchant Fleet as of Pearl Harbor Day

	Cargo Number	Passenger, miscellaneous, GRT	Kisen (over 500 tons)				Small Ships			
			Tankers		Number	GRT	Kisen Number	GRT	Kihansen Number	GRT
			Number	GRT						
20-100 tons										742,935
100-500							841	203,512	15,851	442,163
500-1,000	264	198,036	20	12,770	284	210,806			2,930	1,710
1,000-3,000	527	1,055,224	10	15,740	537	1,070,964			3	10,543
3,000-6,000	486	2,330,577	13	61,379	499	2,391,956			5	
6,000-10,000	219	1,603,219	32	253,458	251	1,856,677				
Over 10,000	19	234,087	19	232,117	38	466,204				
Total	1,515	5,421,143	94	575,464	1,609	5,996,607	841	203,512	18,789	1,197,349

made no substantial releases at all. Although the Army began releasing ships in April and returned a total of 720,000 tons during the next 5 months, it was not nearly enough, and the flow of ships was reversed after the setback at Guadalcanal.

FIGURE 25.—Foreign ships captured or salvaged by the Japanese, listed according to the approximate date recommissioned

Month	500—1,000 tons		Over 1,000 tons		Total	
	Number of ships	Gross tons	Number of ships	Gross tons	Number of ships	Gross tons
1941						
December	2	1,409	15	105,498	17	106,907
1942						
January	2	1,452	23	98,794	25	100,246
February	2	1,341	13	60,916	15	62,257
March	2	1,578	18	60,512	20	62,090
April	2	1,450	25	77,430	27	78,880
May	2	1,452	13	33,146	15	34,598
June	2	1,859	18	38,466	20	40,325
July			12	47,405	12	47,405
August	1	968	11	18,810	12	19,778
September	1	961	12	57,617	13	58,578
October	1	546	11	25,592	12	26,038
November			6	16,218	6	16,218
December			6	19,091	6	19,091
1943						
January			11	22,042	11	22,042
February			3	7,889	3	7,889
March			3	5,976	3	5,976
April			5	14,612	5	14,612
May			5	8,498	5	8,498
June	1	812	5	13,706	6	14,518
July	1	910	3	5,059	4	5,969
August			2	3,888	2	3,888
September			1	1,893	1	1,893
October			6	10,835	6	10,835
November			3	4,828	3	4,828
December			2	8,080	2	8,080
1944						
January			2	12,754	2	12,754
February						
March			3	4,394	3	4,394
April			2	4,281	2	4,281
May	1	830			1	830
June						
July						
August			2	4,303	2	4,303
September	1	800	3	8,282	4	9,082
October						
November						
December						
1945						
January						
February			2	5,880	2	5,880
March						
April						
May						
June						
July						
August						
Total	21	16,368	246	806,695	267	823,063

Because the Japanese entered the war with a severe shortage of merchant tonnage, which was aggravated by the heavy requisitions of the

military, the problems of organization and administrative control, which were developed during the first shortages occasioned by the Chinese war, came rapidly to a climax. Discussions of tighter control measures, begun in the summer of 1941 under the stress of the first heavy requisitioning, culminated in the establishment on 24 March 1942, of the wartime shipping control ordinance. Under this law the government seized all civilian-operated ships, paid the owners' charter, and turned the ships over to an organization called the shipping control association to be operated. The shipping control association consisted of personnel from the Transport Ministry and members of most of the large shipping companies. They handled all contracts with shippers, set rates, and allocated space for the movement of goods according to the commodity movement plan of the total mobilization bureau of the Ministry of Munitions. In actual practice the original shipowners were employed by the association to man, victual, supply, and operate the ships under the direction of the association acting as a central dispatching office.

The prime object of the commodity movement plan, according to which all "C" ships² were dispatched, was of course the import into the home islands of the raw materials and food necessary to the operation of the Japanese industrial machine and the maintenance of her population. The movement of these ships was governed accordingly, most of them going to ports in the Inner Zone or to Southeast Asia and Indies ports. Their movements (in the beginning at least) had no connection with the military campaigns in progress; in fact, "C" ships almost invariably went out in ballast. Meanwhile, the tremendous fleets of the Army and Navy, operated separately by the respec-

² Ships operated by the shipping control association were called "C" ships. Those operated by the Army and Navy "A" and "B" ships.

tive shipping departments of the two services, were performing primarily a military function. They carried troops and weapons in the occupation of the conquered areas; they supplied these troops in the field and moved them from base to base as the campaigns developed, returning to Japan when necessary for reinforcements, food and supplies. Sometimes, in the case of ships returning from important Army bases such as Singapore, which happened also to be an important source of industrial raw materials, these ships brought back civilian imports. More often, especially in the case of ships returning from purely military ports such as Truk and Rabaul, the ships of the Army and

Navy returned empty to Japan in their great hurry for more troops or supplies. Thus developed the paradox of a maritime nation, desperately short of ships, waging a far-flung war across the seas, but still permitting a condition to exist where empty ships might frequently pass each other going in opposite directions. The stage was set for a crippling attack by the Allied forces against the weakest link in the Japanese organization for war: her merchant marine.

The outbreak of the war with the United States had no immediate effect on the traffic of the Japanese railroads.

CHAPTER IV

THE ATTACK ON TRANSPORTATION

Shipping attacks during the war in the Pacific were executed by a variety of agents and methods. The weight of attack laid on is shown in Appendix E. The early prominence of the submarine, operating from distant bases into the heart of enemy territory is apparent, as is its continued prominence as a major striking agent against shipping. All of the air forces that operated in the general Pacific theater shared to a greater or less degree in the all-out over-all attack on the enemy's ability to transport men and material by sea. A great variety of aircraft was applied to this task, and every single plane in operation was potentially concerned in it; any aircraft, armed or unarmed, regardless of the mission at hand, could at least observe and report the presence of a Japanese ship, or one that was suspected of being Japanese. It should be emphasized, however, that the controlling motive in the attention of air to Japanese merchant shipping was the tactical objective of interfering with the enemy's military logistics rather than the strategic objective of reducing his war-making potential at home. Hence the proportion of effort devoted by air to the destruction of large vessels was never great, whereas the submarine effort had as a major objective the disposal of Jap merchant tonnage wherever it could be found. It is perhaps debatable whether a sharper realization of the importance of reducing merchant tonnage would not have suggested a more intense and specialized employment of air against it, but it is difficult to appraise the availability of air for this purpose in the face of current tactical requirements of seemingly prior local importance.

Some units of our air power were wholly concerned with the detection and attack of enemy ships, some made occasional all-out planned attacks on such concentrations as were reported in hostile harbors, near or distant; some scoured the areas adjacent to points of invasion for limited periods prior to and during landings; some either periodically or constantly concentrated on the isolation of by-passed enemy areas,

even to the extent of attacking surface craft as small as canoes. More closely examined, the methods of attack varied further, from the high-altitude bombing of harbors by heavy bombers to the glide and dive-bombing tactics of marine and carrier aircraft; the skip bombing and masthead-height attacks by low-altitude bombers; the night radar rocket attacks by mediums; the strafing, bombing and dropping of gasoline tanks by fighters; the strafing of river barges and launches, the mining of enemy waters.

The agents concerned were aircraft of practically all the friendly units from India to Australia to Fiji to Hawaii to Alaska to China. Some of these agents, such as the fleet air wings, had enemy shipping as the top priority target and objective constantly; others had it only periodically.

However, it can generally be stated that all aircraft capable of being effective in any way against enemy shipping had it as their highest priority as a target of opportunity, other commitments permitting.

Submarine action against shipping commenced immediately after Pearl Harbor. United States submarines in the southwest Pacific immediately engaged in resisting Japan's southward advance; the majority of the central Pacific submarines moved quickly to the focal shipping lanes off the eastern and southern coasts of Japan. Despite the limited force initially disposable, results were at once achieved which developed gradually into a major threat of Japanese merchant shipping. The submarine alone, in the early stages of the war, was able to reach major lanes of economic shipping and strike them effectively.

Spheres of Action

The spheres of action of the various air forces and their roles of action against enemy shipping can, in general, be set forth simply (Figure 26).

Northern Pacific.—In the northern Pacific a small air force composed of the Eleventh AF

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

THE ADVANCE OF THE AIR FORCES THROUGH THE PACIFIC

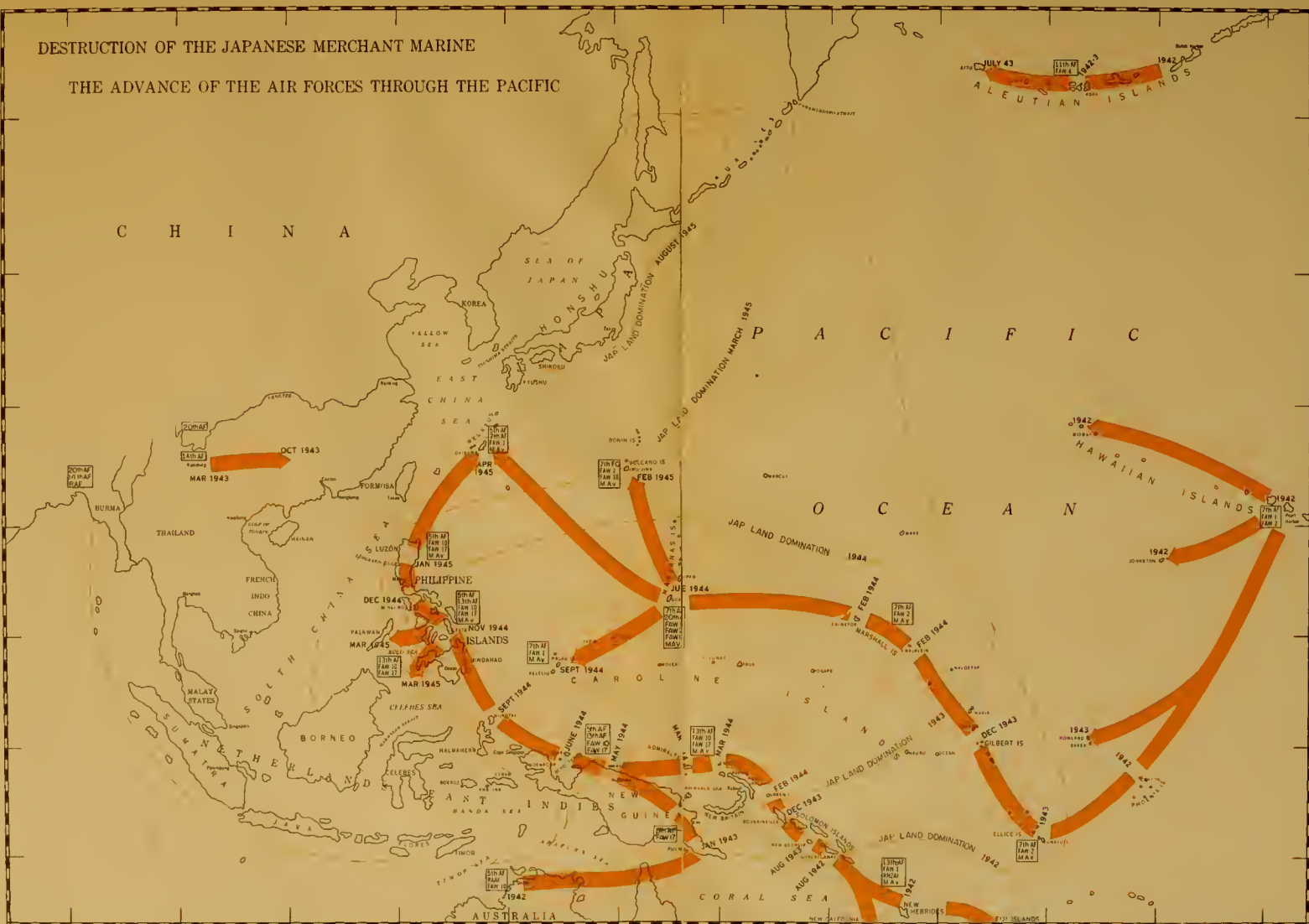


FIGURE 26

and Fleet Air Wing 4 operated from the Aleutians southwestward toward the Japanese mainland. Their main antishipping actions were continual and extending search down the Kurile chain and medium bomber shipping sweeps in Paramushiru Straits.

Central Pacific.—In the central Pacific the Seventh AF, Fleet Air Wing 2 and marine aviation units operated progressively through the Phoenix, Ellice, Gilbert and Marshall Islands to the Palau group and the Marianas. The Seventh thereafter went on to Okinawa and operated against Japan. In the fall of 1944, B-29 units of the Twentieth AF were deployed in the Marianas and operated in this theater for the remainder of the war. The main shipping action of the central Pacific force in its course westward was extended search in the direction of projected new landings, constant attempt at isolation of by-passed areas in the Gilberts and Marshalls, and efforts to neutralize Japanese shipping centers in the Marshalls, Carolines, Bonins, and Volcanoes.

South and Southwest Pacific.—In the south Pacific the Thirteenth AF went the long road from Guadalcanal to the Philippines by way of the Solomons, the Admiralties, northwest New Guinea and Morotai. Fleet Air Wing 1 operated in the south Pacific area until mid-1944; then, after reforming, it went to the Marianas. The Fifth AF and Fleet Air Wings 10 and 17, all originating in Australia, were met by the Thirteenth in northwest New Guinea and Morotai after swinging a dog leg through eastern New Guinea and proceeding northwest along the coast. While the Thirteenth (until almost the end of the war) and Fleet Air Wings 10 and 17 stayed in the Philippines, the Fifth and Fleet Air Wing 1 advanced to Okinawa and with the Seventh saw action against the Jap homeland. Royal Australian and Royal New Zealand air force units operated with the Fifth and Thirteenth in the general southern area.

The Fifth and Thirteenth shared with the fleet air wings, the Marines and the Allied units in the reduction of shipping in the Solomons and Bismarck areas, attacking convoys and small shipping, and pounding the isolated shipping centers in New Britain and New Ireland. Both forces operated night low-altitude bombing squadrons from the Solomons and Bismarck areas to the Philippines, both attacked the Jap

shipping and supply centers in the Carolines and the Palau group, and both scourged the waters of the eastern Netherlands Indies. From the Philippines they operated against ports along the China and Indo-China coast. The Fifth went on to Okinawa and operated as the tactical air force with the Seventh against the Jap mainland and the waters adjacent.

The fleet air wings operated night search and attack aircraft (Black Cats) along the whole route from the Admiralties to the Philippines as bases advanced west and north during the war, and conducted a great part of the ever-extending daylight armed-reconnaissance searches that finally left practically no part of the western Pacific seas and harbors uncovered.

China-Burma.—From China the Fourteenth AF, when the locations of their bases permitted, bombed harbors along the China coast, and mined waters near Hongkong, Takao, Haiphong, Canton and Shanghai, and in the Yangtze river. They searched and attacked shipping in the waters from the Gulf of Tonkin to the Formosa Straits, and carried on a continual campaign against river shipping in the Yangtze.

Shipping attacks in the Burma theater by the Tenth AF were directed mainly against harbor facilities and shipping ports along the west Burma coast; they mined harbors and rivers in the same area.

XX Bomber Command operations in China-Burma included a dozen or more attacks from India-China bases on port facilities the length of the Asiatic coast from Shanghai to Singapore, and the mining of the waters near Shanghai, Nanking, Singapore, Saigon and Palembang during the period June 1944-March 1945.

Carrier Aircraft.—Carrier aircraft included shipping among their targets in such early raids as those against the Gilberts and Marshalls in early 1942, but aside from almost purely naval operations and with the exception of a few isolated raids during the remainder of 1942 and most of 1943, their first major operations against shipping took place in the Solomons and Bismarck areas in late 1943 and early 1944. Beginning with the Gilberts operation the reduction of enemy shipping in the areas of invasion was always of high priority, as demonstrated in the pre-Philippine attacks in September-November 1944, when in three months the car-

riers sank 460,000 tons of shipping. They struck repeatedly at military shipping and supply centers throughout the Pacific, such as Truk, Yap, Palau and Iwo Jima. Concurrent with landings they carried out diversionary raids such as that in January 1945, when at the time of the Lingayen Gulf landings a large force penetrated the South China Sea and made heavy shipping and coastal attacks in those waters. Finally, they carried their attack to the Jap homeland. The important carrier attacks against shipping are illustrated in Figures 28-43.

Marine Aviation.—The operations of Marine aviation units against shipping, which took place in practically every area of action in the Pacific, were to a great extent localized against the by-passed areas, and aimed at the continued isolation of those areas by attack on small reinforcement and supply craft. The major part of this action took place in the Solomons-Bismarck region, where in the earlier period the targets attacked included also the naval units and larger ships that then were to be found in those waters. During the last nine months of the war Marine medium bombers were active north of the Philippines and in the Ryukyus area as rocket-firing, night low-level searchers.

In the following account of the attack by all of these agents on Japanese transportation in the Pacific, tonnages mentioned will refer only to shipping of over 500 gross tons.

The Attack in 1942

The first six months of the war were months of withdrawal of Allied forces throughout the Pacific, and such air operations as took place against shipping, at least until the battle of the Coral Sea, can hardly be considered as having affected more than insignificantly the Japanese ability to transport men, material, and commercial goods at will.

In the summer of 1942, the general prospect of an offensive was somewhat more hopeful, with Allied forces disposed around the perimeter of the Japanese-held Pacific. In China the China Task Force (later the Fourteenth AF) had begun operations; the Tenth AF had flown its first heavy bomber strikes against Jap bases in Burma; the Seventh AF had spread out into south Pacific islands to contest new Jap landings; the Eleventh AF was prepared to take the offensive against Jap forces from the Aleu-

tians; the Australian and Fifth Air Forces had begun attacks on New Guinea and Rabaul; the Thirteenth AF and Marines were operating in the south Pacific.

Such shipping as our air power was able to attack was limited and was mainly that of reinforcement and supply to the enemy's forces in the south Pacific. The few Allied aircraft of types suitable for long-range attacks on shipping were engaged in scouting or attack on Japanese combat ships. Except as we were able, in hardly effective force, to challenge those of his shipping routes that could be reached from our China bases or from Darwin in northern Australia, his commercial and raw material shipping was unmolested by air attack. The submarine alone was able to penetrate to major economic shipping lanes but in the early part of the year was as yet in too weak force to accomplish significant results. The months of May, August and October were marked by especially heavy sinkings by submarine (86,000, 76,000 and 119,000 tons reported) which were a promising prelude to the sustained heavy sinkings of the following year.

Throughout the rest of 1942, air searches for shipping continued from the perimeter of the Japanese-dominated Pacific against those arteries or units of supply and reinforcement that could be reached by Allied air power.

In the north Pacific the Eleventh AF and Fleet Air Wing 4 made searches in the vicinity of Kiska and Attu endeavoring to prevent reinforcement and supply to those islands. These forces accounted for about 35,000 tons of shipping during this early period.

The Seventh AF and Fleet Air Wing 2 operating from Hawaii, Canton in the Phoenix Islands, and later from Funafuti in the Ellice group, continued their mission of reconnaissance of the sea approaches to the Hawaiian Islands. In 1942 little shipping was found or attacked in the central Pacific.

The Thirteenth AF, which prior to the Guadalcanal landings in August had searched the lower Solomons, extended operations to the northern Solomons during the balance of the year; Fleet Air Wing 1 joined in these operations in the early part of the autumn. The fleet air wing soon inaugurated the Black Cat operations, night, low-altitude, armed-search missions against shipping, using Catalinas. The dis-

advantages of these aircraft—slow speed, lack of maneuverability, and altitude limitations—were turned to advantages in these night masthead-height attacks. Over 200,000 tons of enemy shipping were destroyed by the combined Navy, Army and Marine aircraft in the south Pacific area in 1942.

The Fifth AF efforts against shipping were mainly against Rabaul harbor, and against a few targets in the Coral and Solomon seas and in the Netherlands East Indies. The fall of 1942 saw about 30,000 tons sunk by aircraft in the area. Carrier attacks on shipping were largely those in connection with naval actions in the Solomons. The Fourteenth AF attacks were mostly restricted to those on river shipping in the Yangtze, with a few sorties against harbors.

The number of submarines in the Pacific had risen slowly during 1942, and by the end of the year there were about 35 on patrol.

The Attack in 1943

By March 1943, submarines were available in sufficient force to inflict steady losses upon the enemy, averaging well above 100,000 tons monthly during the remainder of the year, and were threatening merchant tonnage in all shipping areas. The effort against enemy shipping by aerial power during 1943 gradually extended westward in the central Pacific and northwestward in the southern Pacific, bringing larger areas under air attack, and for the first time bringing some of the enemy's economic shipping under scattered attack. In the north Pacific during the first half of the year the greater part of the effort was continued attack on Attu and Kiska and the search of adjacent waters for supply craft, and reconnaissance for possible Jap task forces. After Attu and Kiska were occupied in June and August, search progressed further southwest over the Kuriles. Most of the effort expended by central Pacific air forces continued to be sea search and reconnaissance of Japanese bases within reach. In the south Pacific, search of the Solomons area continued in the attempt to prevent reinforcement of Jap bases. The Fifth AF, as the campaign in the Solomons progressed, increased its effort to support that campaign by shipping strikes. Early in March the first major test of its low-level technique took place in a medium bomber attack on a large convoy attempting to trans-

port reinforcements to the Lae Solomons area of New Guinea. All eight merchant ships in the convoy, nearly 30,000 tons, were sunk. In the China theater, the Fourteenth, late in the spring began regular sea sweeps and the bombing of coastal shipping and docks, marking the first appreciable air effort against the enemy's commercial shipping lanes since the beginning of our offensive.

The fall of 1943 was marked by the central Solomons campaign and the beginning of the northern Solomons campaign, the development of the New Guinea campaign, and the landings in the Gilbert Islands in November.

The air action against shipping was further augmented at the beginning of this period by the introduction of low-altitude heavy bombers (LABs or "Snoopers") the use of which was inaugurated in the south Pacific in August by the Thirteenth AF, and adopted in September by the Fifth and later by the Fourteenth. These B-24s equipped with radar, soon were used extensively for night ship bombing and long-range patrols. The Snoopers shared with the fleet air wings' Black Cats in the isolation of Rabaul by inhibiting fast shipping runs into the harbor at night.

The shipping action of the Fifth and Thirteenth Air Forces was a series of attacks on Rabaul Harbor, and attacks against supply routes off north New Guinea and in the Netherlands East Indies. About 90,000 tons of large ships were sunk by aircraft in this area in the fall of 1943, as well as considerable numbers of small vessels.

In support of the Gilberts' operation little shipping, and that usually concentrations of small ships in harbors, fell to the Seventh AF, but in December a heavy shipping strike by carrier aircraft against Kwajalein resulted in over 20,000 tons sunk. During the fall, Fleet Air Wing 2 took over most of the long-range armed searches in the central Pacific.

The Fourteenth AF during the fall of 1943 had started a program of regular sweeps from the Gulf of Tonkin through the Formosa Straits, in addition to preying on shipping in the harbors along the south China coast. Applying skip-bombing tactics the Fourteenth thus began the first major campaign against the enemy's raw material supply lines. Up to the end of the year about 35,000 tons of shipping

were sunk along the south China coast, and 8,500 tons of large ships on the Yangtze. The Tenth AF had begun the bombing of Burmese ports.

Submarine attacks averaged 77 per month for the first half of 1943, with the greatest number in the early months taking place in the Solomons-Bismarck area; as summer approached, attacks in that area decreased, and those throughout the Carolines and along the coast of Japan increased. In the latter six months of the year, the monthly average attacks were stepped up to almost a hundred, with a further increase in activity in the southern Jap mainland area and in the Carolines, in the Netherlands East Indies, and in the China coast area from Hainan to Formosa to the Ryukyus. The intensification of submarine effort is evidenced by the huge total of some 1,360,000 tons of merchant shipping sunk by this agent in the course of the year.

Early 1944

The progress of the operations of the central Pacific forces from over the Marshalls to over the Palaus, Bonins and Volcanoes; of the south and southwest Pacific forces from over New Guinea and the Banda Sea to over the Netherlands Indies, Borneo and the Philippines; and of the carrier-based aircraft from over the eastern central Pacific and the south Pacific to over the Philippines, Formosa and Okinawa, greatly increased the vulnerability of Japanese shipping to our air power during the year. During 1944, over 1,200,000 tons of shipping were sunk by air power, more than twice the total tonnage of 1942 and 1943.

In January 1944, search and reconnaissance in the central Pacific progressed to the Marshalls and the approaches from the Marshalls and the eastern Carolines. Three planned anti-shipping strikes were made against Kwajalein, Maloeap and Wotje, with some success.

In the south Pacific both land- and carrier-based aircraft were active in attacking shipping around Bougainville, New Britain and New Ireland. Three heavy strikes against shipping at Kavieng were made by the carriers early in the month, and later the land-based aircraft made four attacks on shipping in Rabaul harbor. About 55,000 tons were destroyed in these areas during the month, mostly by land-based aircraft.

In the southwest Pacific, barges and luggers received a large portion of the shipping attacks, although constant search for Jap re-supply convoys continued, with LABs scouring the shipping lanes.

During February 1944 the major action against shipping was the first large carrier-based attack, a two-day action against Truk in which some 186,000 tons of shipping were destroyed by dive-bombers and torpedo planes. Search efforts by the fleet air wing were made from Kwajalein by the middle of February; regular sectors were extended 700 miles north and west from that base. Shortly thereafter the use of Eniwetok further extended the areas of search. In the south Pacific, new bases north of Rabaul put the Thirteenth in more advantageous position for the continual isolation of by-passed areas.

Sea sweeps from China continued, with the searches extending from Saigon to the Philippines as the enemy turned to convoy tactics and moved his shipping from near-coastal waters to lanes farther out to sea. The Fourteenth AF sank over 15,000 tons of shipping along the China coast during February.

In the south Pacific an intensive effort was made by all air units to make the isolation of the entire Solomons-Bismarck area complete, but little shipping was found; the larger vessels had been driven from the Solomons-Bismarck area.

At the end of March, the carrier forces made the then deepest penetration of enemy defenses with a heavy attack on Palau. The attack took place after the entrance channels had been mined to immobilize Jap forces, and was designed in part to destroy merchant shipping there. About 87,000 tons of shipping were sunk in the attack.

April 1944 marked the first land-based attacks on the Marianas from the newly-developed Marshalls. In the south Pacific, bases in the Admiralties for the Thirteenth AF and the fleet air wings bettered control of the Bismarck Sea and the approaches to Rabaul and Kavieng, and enabled strikes against shipping and supply centers in the Carolines. The Hollandia landings were made late in the month.

In May, mediums of the north Pacific force began low-altitude sweeps against shipping in the Paramushiru Straits; these operations were

to continue intermittently for the duration. In the central Pacific, patrols as far west as the Marianas and north to Wake continued to yield little enemy shipping. The carrier-based aircraft found the same situation existing during strikes at Marcus and Wake, and in the course of an extended sweep 400 miles north of Marcus. South Pacific antishipping activities consisted principally of productive barge hunts by fighter aircraft and long-range searches in connection with the Hollandia landings. Late in the month searches were begun from Wake by PB4Ys over the areas west and north of the new base.

During May the use of LABs was introduced into the China theater; previously only daylight sweeps had been carried out. The early success of these radar-equipped B-24s led to an attempt to bring about an effective blockade of the Formosa Straits; out of 243 sorties in the period June-November, 122 contacts were reported. Continued antishipping activity by mediums during the same period was mainly sweeps in the vicinity of Hainan; by the fighters, large scale attacks on river shipping. The Fourteenth AF accounted for nearly 36,000 tons sunk during the period. The monsoon season ended a period of about six months during which some 80 missions had been directed by the Burma forces against seaports, mainly along the west coast of Burma; sea sweeps in the same area had been almost completely non-productive.

The first six months of submarine activity in 1944 saw further increase over 1943 in both number of days on patrol (average 619) and number of attacks (average 115). Especially notable were an increase in activity in the Netherlands East Indies, a falling off during the spring throughout the Carolines, and the beginning in May of a considerable number of attacks in the Philippines and the south China Sea areas. The rate of sinkings more than doubled as compared with the first six months of 1943 and reached a peak of nearly 265,000 tons in May.

June 1944—the Marianas

Action in the Pacific ocean area in June centered on the campaign to capture the Marianas. In the central Pacific practically all activity was in preparation for, or in the execution of,

this operation. Daily searches were maintained as far west as Saipan. After D-day seaplanes from Saipan searched still farther to the west. Just prior to the movement of our forces westward for the assault, the range and scope of the searches were increased to cover the entire approach route, while from New Guinea they extended northwest almost to the Philippines, and north to the Yap-Palau area.

In the southwest Pacific, activities were largely concentrated on the completion of the Biak campaign and the continual blockade and neutralization of enemy forces in New Guinea and the Bismarck archipelago. A considerable effort was also put forth in attacking the barge and small shipping traffic in the Schouten Islands; later the attack moved on to the Halmaheras and Celebes, where luggers and barges were being constructed.

The carriers' participation in the Marianas' campaign covered an area stretching from Guam to the Volcanoes, and 500 miles west of the Marianas. The action included shipping strikes in which over 65,000 tons were sunk.

In July, while the completion of the Marianas conquest was underway, search and reconnaissance planes began missions over the Bonins and Volcanoes, with the primary mission of harassing shipping. In the southwest, daily searches were made regularly from Green, Emirau, Manus and Biak in such a way as to cover the area generally south of a line from Truk, through Yap, Palau and the northern tip of Mindanao. These were augmented by searches out of Darwin covering the Arafura and Banda Seas.

The carrier-based aircraft besides continuing support in the Marianas, attacked the Bonins and Volcanoes and, in greater strength, Palau toward the end of the month of July.

Early in August the carrier planes again attacked shipping in the Bonins and Volcanoes, sinking almost 23,000 tons, while the PB4Ys continued their operations against those islands from Saipan. During the summer, aircraft from the Marshalls and Gilberts had been continuing the effort to neutralize the eastern mandates, and planes from the southwest had attacked Woleai, Palau, and Yap; by this time, however, there were found no worthwhile shipping targets east of Palau.

In the southwest Pacific, with planes operat-

ing from bases at Biak, Noemfoor, and Cape Sansapor, the scope of attacks on shipping was broadened throughout the neighboring seas; the heavy bombers went as far west as western Borneo, and included Davao Gulf in their operations. All of the shipping claims of the southwest Pacific planes during August were west of the Carolines.

Morotai, Leyte

In September, with the Central Pacific aircraft concentrating their attack on the Volcanoes and Bonins, the southwest Pacific forces and the carrier aircraft were mainly concerned with the simultaneous landings in the southern Palau group and on Morotai. The land-based aircraft covered the sea areas as far north as Mindanao; the carriers began a series of operations early in the month which were to result in over 200,000 tons of enemy shipping sunk. Attacks were made against the Palaus, Yap and Ulithi, then Mindanao, the Palaus again for a three-day strike, and back to the Philippines. Shipping was a major target in these raids and was found in abundance.

In October 1944, prior to the Leyte landing, the carrier forces struck first at Okinawa and next at Formosa. Shipping targets were numerous and successive strikes were made against them. Attacks followed against shipping in Manila harbor and off the northern Luzon coast, with the attacks against Luzon (the Manila area in particular) continuing up to and past the landing on Leyte, and on into November. In October, carrier aircraft sank 130,000 tons in the Philippines, Formosa, and the Ryukyus.

The submarines were now experiencing their most productive period of the war (July-December). Some 2,600 days on patrol during the two months October-November resulted in a total of 423 attacks, as part of a six months' period which produced monthly averages of 1,163 patrol days and 172 attacks. The brunt of these attacks was felt by Japanese shipping in the China coast and Philippines areas, with considerable effort still having been maintained in the south China Sea and in the Netherlands East Indies. The efforts in the Yellow Sea in November produced the heaviest attack month of the war in those waters. Altogether submarines sank 540,000 tons of merchant shipping in these two months.

Operations in the Burma theater were resumed in October against the Burmese ports and the mining program in those waters was intensified. These activities continued until the first of the year, when the Tenth AF turned almost exclusively to the Burmese railway system.

Throughout November and December 1944 both carrier- and land-based forces continued their support of the Philippines operations, with shipping attacks second in importance only to the effort to destroy the Jap air force. The total tonnage sunk throughout the Philippines by combined naval and Army air power in these two months was over 220,000 tons. Further south, all types of aircraft swept the waters of the Makassar Strait and the Banda, Ceram, Molucca, and Sulu Seas, concentrating attacks on the small ships with which the Japanese were found to be attempting to supply and evacuate the Indies. By the end of the year shipping in the Ambon-Ceram-Celebes area was reported difficult to find.

The focal point of searches by the forces advancing from the south was transferred from Morotai to Leyte in late December, and search sectors covered the south China Sea from the vicinity of Formosa south to Saigon. This offset the limitations now imposed on the China-based aircraft which beginning in June had begun to lose, one after another, bases in eastern China; for a considerable part they had been forced to withdraw out of effective range of the sea. Soon, with the establishment of bases on Mindoro, there was for the first time no wholly search-free shipping route between the Indies and the Japanese home islands. Regular search sectors swung in a complete arc from somewhat east of the Bonins around and down the China coast to Indo-China. Late in January the move to Luzon further extended the northern search areas to include the east China Sea, from near Shanghai almost to Kyushu.

Early 1945, Luzon

The outstanding event in the Pacific during the month of January 1945 was the amphibious invasion of Luzon via Lingayen Gulf. Concurrently, a great sweep of the south China Sea was made by a fast carrier task force; shipping and harbor installations from Saigon to Hongkong were primary targets. The force proceeded

first along the coast of Indo-China, making heavy shipping and harbor attacks, then continued further north with a series of strikes on Formosa and the China coast. About 280,000 tons of shipping were destroyed in these raids.

The Fifth and Thirteenth AF, Marine and carrier aircraft ranged throughout the waters in and about the Philippines in the attempt to prevent reinforcement and supply to enemy forces; fleet air wing Black Cats and Army LABs prowled from the Lingayen Gulf to Formosa, the Pescadores and the China coast. From the Marianas the main efforts continued to be against the Volcano and Bonin Islands. Daily shipping searches and numerous attacks were carried out over the same area and islands by fleet air wing aircraft; rocket-armed night searches by Marine mediums, which had begun in November, found targets more plentiful than previously in the waters north and northwest of the Marianas as the enemy appeared to realize the imminence of an amphibious operation against Iwo Jima.

Submarine sinkings fell off after December, because of the reduced size and exposure of the enemy merchant fleet, and sinkings by aircraft for the first time (with the exception of November, 1942) exceeded submarine sinkings. This was the result particularly of the heavy activity of carrier aircraft in this month, but thereafter submarine activity was of less relative significance.

Iwo Jima, Okinawa

During February and March carrier operations centered about the Iwo Jima and Okinawa landings. In the east China Sea, particularly in the waters between Okinawa and Kyushu, over 30,000 tons of enemy shipping were destroyed.

By February aircraft from the Philippines had extended their operations to the area along the China coast still partially covered by the Fourteenth AF operating from China, thus bringing under constant air attack Japan's remaining shipping route to the southern area. The approaches to Shanghai, and the Yangtze, were mined by the Fourteenth and Twentieth to reduce further Japanese communication with central China; in the first four months of the year a considerable loss of enemy tonnage was attributed to the latter program. By March

1945 Japanese shipping through the south China Sea had virtually ceased.

Spring 1945

During the spring the Seventh AF continued neutralization attacks against the Bonins and Volcanoes and the by-passed Caroline Islands. The Fifth AF operated in the northern half of the Philippines, and sent missions against the ports of China and Formosa; both LABs and daylight strafing missions were sent along the coastal convoy routes in the east China Sea. The Thirteenth operated to the south of the Fifth, and in addition to continuing the isolation of the by-passed areas of the central and southern Philippines, made long-range strikes against ports along the Asiatic coast as far as Malaya and Java. Fleet air wing search sectors also were further extended in that direction, in April and May reaching southwest as far as Singapore; soon after that they covered the entire southern extremities of the south China Sea, extending even into the Gulf of Siam.

To the north, as early as February, Fleet Air Wing 1 began operations from a floating seaplane base south of Iwo Jima, and searches 500 miles north and west were instituted. This was followed in March by the basing of a limited number of aircraft on Iwo proper, which enabled PB4Ys and rocket-firing Venturas to make coordinated efforts against shipping in the waters to the north—the Liberators “flushing” and the Venturas attacking. In April long-range search began from Okinawa, with the new Privateers forming the vanguard, and sectors extended past the east China Sea into the Tsushima Straits, soon reaching into the Yellow Sea and Sea of Japan. In May in the straits and along the coasts of southern Korea about 56,000 tons of shipping were destroyed by fleet air wing Privateers. Late in the spring, fleet air wing aircraft undertook also a series of mining flights to block the passages among the small islands of southern and southwest Korea.

Summer 1945

Movements of the Fifth and Seventh AF to Okinawa began in July. Before the end of the war these combined forces reached a total of over 1,000 aircraft operating from that island against the empire. Their first priority objec-

tive was, as usual, neutralization of enemy air power; following that, the disruption of communications on land and sea.

The general plan against communications and transport was to employ the fighters and fighter-bombers to the fullest extent when air superiority was achieved, to sweep the harbors and coasts and then to sweep the waters of the Inland Sea and Tsushima Straits. The heavies were to bomb rail centers and harbor installations.

Shipping attacks by the Seventh during the period were largely confined to single sea-search sorties and attacks against harbor installations as secondary or last resort targets, except for naval units and shipping attacked in Kure and Sasebo harbors. The Fifth reports altogether some 2,000 sorties flown in the execution of the plan, with attacks on shipping absorbing almost half the sorties flown; all missions were flown at medium altitude. In addition four harbors on the west coast, one on the south, and two on the east received concentrations of fighter sweeps, and fighters as dive-bombers attacked many bridges.

The general plan for the disruption of transportation facilities in Kyushu, slated as a major effort of the tactical air forces (the Fifth and Seventh) prior to the planned invasions of southern Kyushu, was begun late in July but never reached full force, partly because of the continued priority of enemy air power, mainly because the war ended.

The July carrier operations, in which the entire fast carrier force was directed fulltime against Japan proper, involved a maximum effort against shipping as well as airfields. The critical water transportation facilities between Hokkaido and Honshu were the targets of a two-day strike in the middle of July. Thereafter the carrier aircraft struck at fleet units in Tokyo Bay, and late in the month launched extensive strikes against shipping and naval units in the Inland Sea.

During the last weeks of the war, although search and attack by the fleet air wing throughout the waters surrounding lower Japan and Korea continued, some of their effort was turned to the Korean rail system, after the withdrawal of shipping from the Yellow Sea.

Mine Laying by the Twentieth AF

Mine laying plans of the Twentieth AF in-

tended that operations should be initiated and maintained against:

The enemy's main shipping artery, Shimonoseki Straits;

The Inland Sea lanes which connect Japan's industrial zones;

The northwest Kyushu and Honshu ports; Korean ports (if possible).

Phase I, 28 March to 3 May: Procedure was to begin by cutting off the enemy's shipping in the Inland Sea area by mining the Shimonoseki Straits, at the same time preventing the passage of enemy fleet units; mine fields near Kure-Hiroshima were to interfere further with any attempted fleet sortie. This first phase was carried out in late March. Later, in April, action was taken to reinforce gaps in the mine fields at Kure-Hiroshima, and to harass the fleet units by dropping mines in Kure harbor and at Sasebo.

Phase II, 3 May to 12 May: In this phase an industrial center blockade was extended to the Inland Sea as originally planned—to Kobe, Osaka, and along the entire Inland Sea routes. The Shimonoseki Straits blockade was maintained by remining, and mining of Tokyo and Nagoya was undertaken.

Phase III, 13 May to 6 June: The third phase was directed against the northwest Honshu ports. During this phase frequent remining, rather than large scale efforts once or twice a month, was carried out, and target widths were narrowed.

Phase IV, 7 June to 8 July (intensified Honshu-Kyushu blockade): A general study of the enemy shipping situation having indicated that mining of Tokyo, Nagoya, Nagasaki, Sasebo and the general Inland Sea areas would no longer be profitable provided the Shimonoseki Straits were kept closed, it was decided that second in priority to the latter objective would be the continuation of efforts against the northwest Honshu ports. In the execution of this phase, substantially longer periods of closure were believed to have been obtained at the smaller ports.

Phase V, 9 July to 15 August (complete blockade): The final phase of minelaying was planned against the ports lying the length of the Sea of Japan coast of Honshu, and those along the northern half of the east coast of

Korea. The blockade of the Shimonoseki Straits and Honshu ports was to be maintained. As Phase V proceeded into operation, success of other agencies made it possible to reduce the extent of attack and concentrate on mining heavily the ports of Genzan, Seishin, and Rashin as the enemy's main Korean terminals.

Weight of Attack

Throughout the entire period 27 March-10 August a total of 5,343 mines was laid in the Shimonoseki Straits. In the Inland Sea a total of over 2,300 was laid, generally in the period May-August, although somewhat earlier at Kure-Hiroshima. Forty-one mines were laid at Nagoya.

Along the northwestern shores of Kyushu and Honshu, generally from the middle of May on, almost 4,000 mines were laid. Among Nanao-Fushiki, Maizuru-Tsuruga and Niigata were distributed about 2,500 of the total.

The mining of Korean waters was begun in early July. Rashin and Seishin were the most heavily mined areas, with 420 and 208 mines respectively. An additional 310 were distributed among Genzan (133) and four other areas.

The Tokyo-Yokohama area was mined twice, a total of 33 mines being laid.

B-29 Attacks Against Transportation

Indo-China: During the period of the XX Bomber Command operations from the conti-

nent, between August 1944 and March 1945 18 attacks (including mining) of 2,487 tons were made on 7 ports and harbor areas from Shanghai to Singapore: 8 attacks were made on rail facilities at 5 cities in Burma during the same period.

Marianas: From the Marianas, up to the end of hostilities, 87 urban area attacks were made against the Japanese Empire; 33 of the total were spread among 9 cities, the most heavily bombed being Tokyo, Nagoya, Osaka and Kobe. Urban areas of 62 other cities were attacked at least once. Approximately 90 percent of the total tonnage was dropped during the final five months of the war.

Area Raids: Aiming points on area raids were selected for the purpose of coverage of industrial targets within the area. Generally speaking, consideration was given to transportation targets, such as rail installations, within the area. Obviously, many urban areas contained their share of railroad yards, repair shops, dock yards, harbor facilities, etc., and the destruction of these was part of the larger purpose of the attacks.

Iwakuni Railroad Yards: This was the only target in Japan bombed by the Twentieth AF as a specific rail transportation target. The yards were bombed visually by 180 aircraft dropping 709 tons of high-explosives. All buildings were destroyed and the yards were inoperative for 102 hours.

CHAPTER V

THE EFFECTS OF ATTACKS ON TRANSPORTATION

THE DESTRUCTION OF THE MERCHANT FLEET

The loss of the Japanese cargo and tanker fleet under the advancing attack of Allied power is illustrated in Figures 27-43, where the relation between various forms of attack and the results achieved during different phases of the war are clearly shown. Figure 44 lists these losses month by month. (The information on which these maps and tables are based is from a compilation of Japanese sources, accounting for over 95 percent of the merchant tonnage controlled by the Japanese.)

The first target to feel the weight of Allied power was the Japanese merchant fleet. Even during the period of Allied retreat through the Philippines, Malaya, and the Indies, serious damage was done to Japanese merchant shipping by Allied air power. During these 5 months prior to the battle of the Coral Sea, the Japanese lost about 60 ships aggregating about 375,000 tons. Nearly two-thirds of this tonnage was sunk by Allied submarines. In spite of the valuable additions of merchant tonnage by conquest and their shipbuilding at home, the balance of shipping afloat and available to the Japanese began to decline as a result of preponderant losses as early as April 1942. Total serviceable tonnage reached its peak about February 1942 and declined steadily thereafter.

In the opening months of the war, during the period of retreat and defense, sinkings were few and scattered. Few submarines were on duty, but they sank ships from Tokyo to Singapore. Some surface skirmishes in the Straits of Macassar in January 1942 resulted in losses. Occasional scattered aircraft sinkings indicated success on the part of the few aircraft available. In this period it is astonishing that the Japanese should have prepared so inadequately for an ocean war that, in spite of the windfall of captured ships, an attack as weak and sporadic as that directed against them during the first 9 months of the war should have been able to ac-

complish the signal success of starting Japanese net merchant tonnage on the downward trend as early as April 1942 (Figure 28).

The submarine campaign continued with fluctuating results but without any significant events through 1942 and the first half of 1943 as the forces available were gradually increased.

Air activity began increasing rapidly after the battle of Guadalcanal and the securing of Henderson field. The merchant shipping sent by the Japanese to reinforce their forces in the Solomons was largely lost to air attack. At the same time the air forces in New Guinea were able to accomplish a steady attrition of the shipping along the New Guinea coast in the Bismarck Strait.

During the twelve months of the campaign in the Solomons and New Guinea areas after the Guadalcanal landing, Army and Navy air forces, almost entirely land-based, sank about 250,000 tons of ships (Figure 29). This expenditure of shipping by the Japanese was a very potent factor in reducing her total war potential at this time. During the closing months of 1943 and early 1944, land-based air power in New Guinea and the Solomons accounted for another 175,000 tons of shipping in this area. In December 1943 and January 1944, carrier aircraft first began to strike successfully at merchant shipping in the Marshalls and the Bismarcks. The first really serious concentrated blow by carrier aircraft came at Truk in February 1944. About 186,000 tons of shipping were sunk in two days (Figure 30).



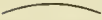
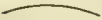




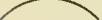



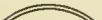

Meanwhile the advancing Fourteenth AF in China had commenced to prey upon the Japanese supply line along the China coast. Beginning in November 1943 and reaching a peak in February of 1944, the Fourteenth AF attacked shipping on the coast between Shanghai and Hongkong.

In March 1944 another carrier raid against Palau resulted in the destruction of 86,000 tons

MAP SERIES SHOWING THE DESTRUCTION OF THE JAPANESE MERCHANT MARINE

Figures 28 to 43 inclusive portray the time, place, and manner of destruction of the Japanese Merchant Marine and the disposition of American attacking forces during the progress of the war. Figures 28 to 39 inclusive indicate the action taking place in the Outer Zone. Figures 40 to 43 illustrate the action in the Inner Zone.

LEGEND

<i>Ships</i>	<i>Cargo and Passenger Ships</i>		<i>Tankers</i>	
	<i>Sunk</i>	<i>Disabled</i>	<i>Sunk</i>	<i>Disabled</i>
Over 10,000 gross tons	●	○	▲	△
6,000 to 10,000 tons	●	○	▲	△
3,000 to 6,000 tons	●	○	▲	△
500 to 3,000 tons	●	○	▲	△
	Army air bases (red)			
	Navy air bases (green)			
	600 mile radius (red)			
	600 mile radius (green)			
	Submarine bases (blue)			
	Indicates one U S submarine constantly on patrol in the area (blue)			
	Carrier bases (green)			
	Carrier raids against merchant shipping (green)			
	300 mile radius (green)			
	Tracks of carrier raid (green)			
	1000 active mines in the area			
	500-1000 active mines in the area			
	100-500 active mines in the area			
	Less than 100 active mines in the area			


Note: Where the arc is alternately red and green, Army and Navy air bases were located at or near the same point. Where a smaller radius is used around an air base, only fighter-bombers were available, and 300-mile radius was used.

Where two agencies participated in the sinking of a single ship, the color of the symbol is half and half.

LEGEND FOR MAP SERIES SHOWING THE DESTRUCTION OF THE JAPANESE MERCHANT MARINE.

THE FOLLOWING 16 MAPS PORTRAY, FOR VARIOUS PERIODS DURING THE PACIFIC WAR, THE LOSSES SUSTAINED BY THE JAPANESE MERCHANT MARINE IN RELATION TO THE ATTACKS OF THE UNITED STATES AND ALLIED FORCES. IN THESE MAPS ONLY SINKINGS AND DISABLING DAMAGE TO SHIPS OVER 500 GROSS TONS, RESULTING FROM SUBMARINE, AIRCRAFT, AND MINE ATTACKS, ARE SHOWN. LOSSES BY SURFACE GUNFIRE AND MARINE ACCIDENTS (AMOUNTING TO LESS THAN 5% OF THE TOTAL) ARE OMITTED, AS WELL AS ALL SHIPS UNDER 500 TONS WHICH ALSO AMOUNTED TO A RELATIVELY UNIMPORTANT TONNAGE. THESE MAPS ARE PLOTTED FROM SHIP SINKING LISTS COMPILED BY THE SURVEY, SUMMARIZED IN TABLE 44, AND BELIEVED TO BE AT LEAST 95% ACCURATE.



ARMY AIR FORCES:

FORWARD BASES AT THE END OF EACH PERIOD ARE SHOWN THUS  (IN RED). 600-MILE RADIUS AROUND FORWARD BASES SHOWN IN RED. SHIP SINKINGS (88% BY U.S. AAF) SHOWN IN RED.



U.S. NAVY LAND BASED AIR FORCES:

SAME AS ABOVE, IN GREEN.

CARRIER AIR FORCES:

CARRIER FORWARD BASES SHOWN THUS  (IN GREEN). APPROXIMATE CARRIER TRACKS IN SHIPPING RAIDS SHOWN THUS  (IN GREEN). 200-MILE RADIUS AROUND AIRCRAFT LAUNCHING POINTS SHOWN IN GREEN. SHIP SINKINGS SHOWN IN GREEN. (88% BY U.S.N.)

U.S. SUBMARINES:

BLUE SYMBOL:  INDICATES SUBMARINE BASE. BLUE SYMBOL:  INDICATES AN AVERAGE OF ONE SUBMARINE ON OFFENSIVE PATROL IN THE AREA. SHIP SINKINGS SHOWN IN BLUE.

MINES:

BLACK ARCS REPRESENT MINING ACTIVITY; NUMBER OF CONCENTRIC ARCS INDICATES INTENSITY OF MINING.

1 ARC	INDICATES	LESS THAN 100	ACTIVE MINES	IN THE AREA.
2 ARCS	"	100 - 500	"	" " " " "
3 "	"	500 - 1,000	"	" " " " "
4 "	"	OVER 1,000	"	" " " " "

SHIP SINKINGS SHOWN IN BLACK.

SHIP LOSSES:

				<u>SUNK</u>		<u>DAMAGED & DISABLED FOR THE REST OF THE WAR.</u>	
				<u>TanKers</u>	<u>Cargo, etc.</u>	<u>TanKers</u>	<u>Cargo, etc.</u>
500 - 1,000	GROSS	TONS	▲	●	▲	○	
1,000 - 3,000	"	"	▲	●	△	○	
3,000 - 6,000	"	"	▲	●	△	○	
6,000-10,000	"	"	▲	●	△	○	
OVER 10,000	"	"	▲	●	△	○	

SHOWN IN RED IF BY ARMY AIR, GREEN IF BY NAVY AIR, BLUE IF BY SUBMARINE, BLACK IF BY MINE.

FIGURE 27

DESTRUCTION OF THE JAPANESE MERCHANT MARINE
DECEMBER 1941 - AUGUST 1942

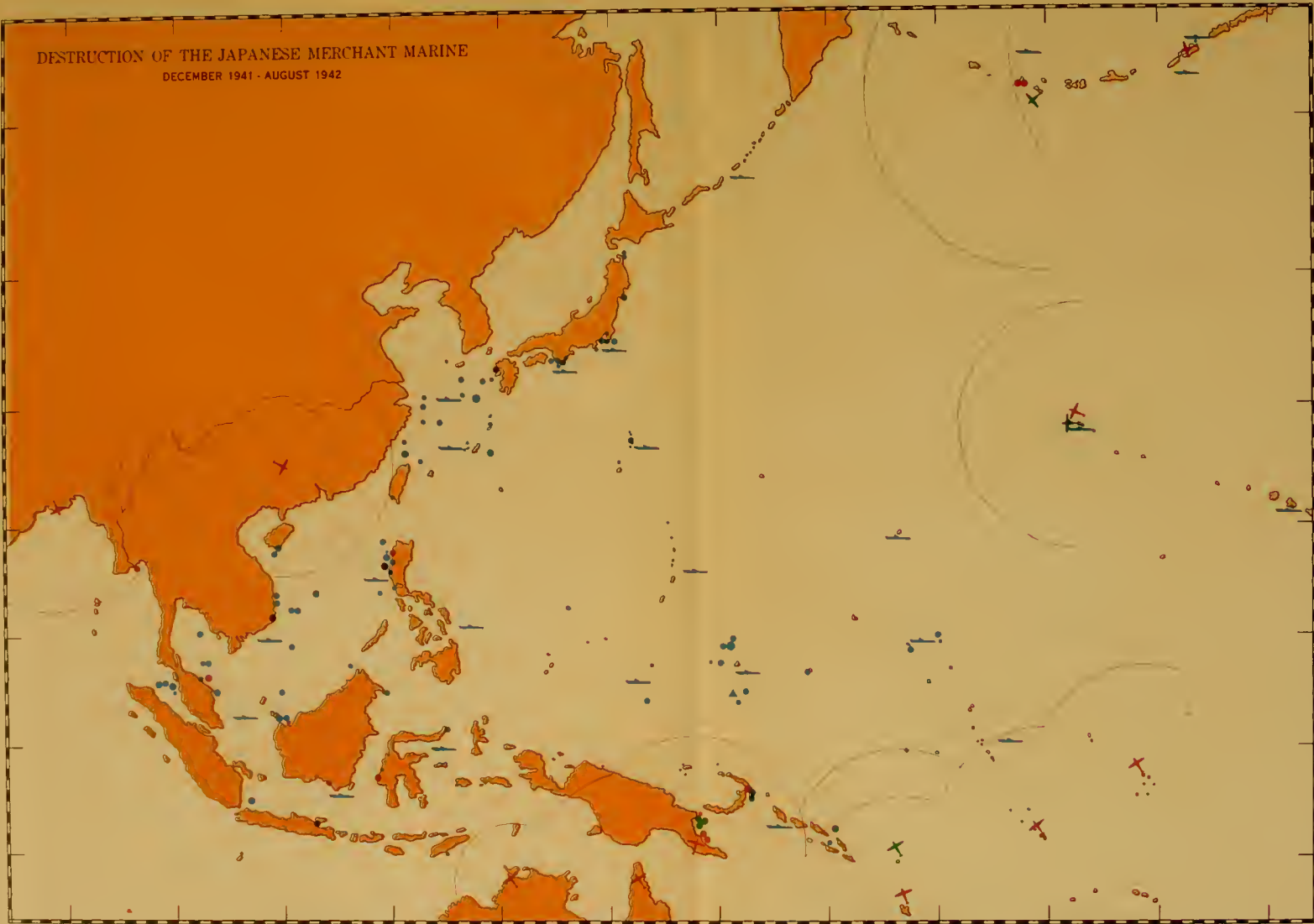


FIGURE 28

DESTRUCTION OF THE JAPANESE MERCHANT MARINE
SEPTEMBER 1942 - AUGUST 1943

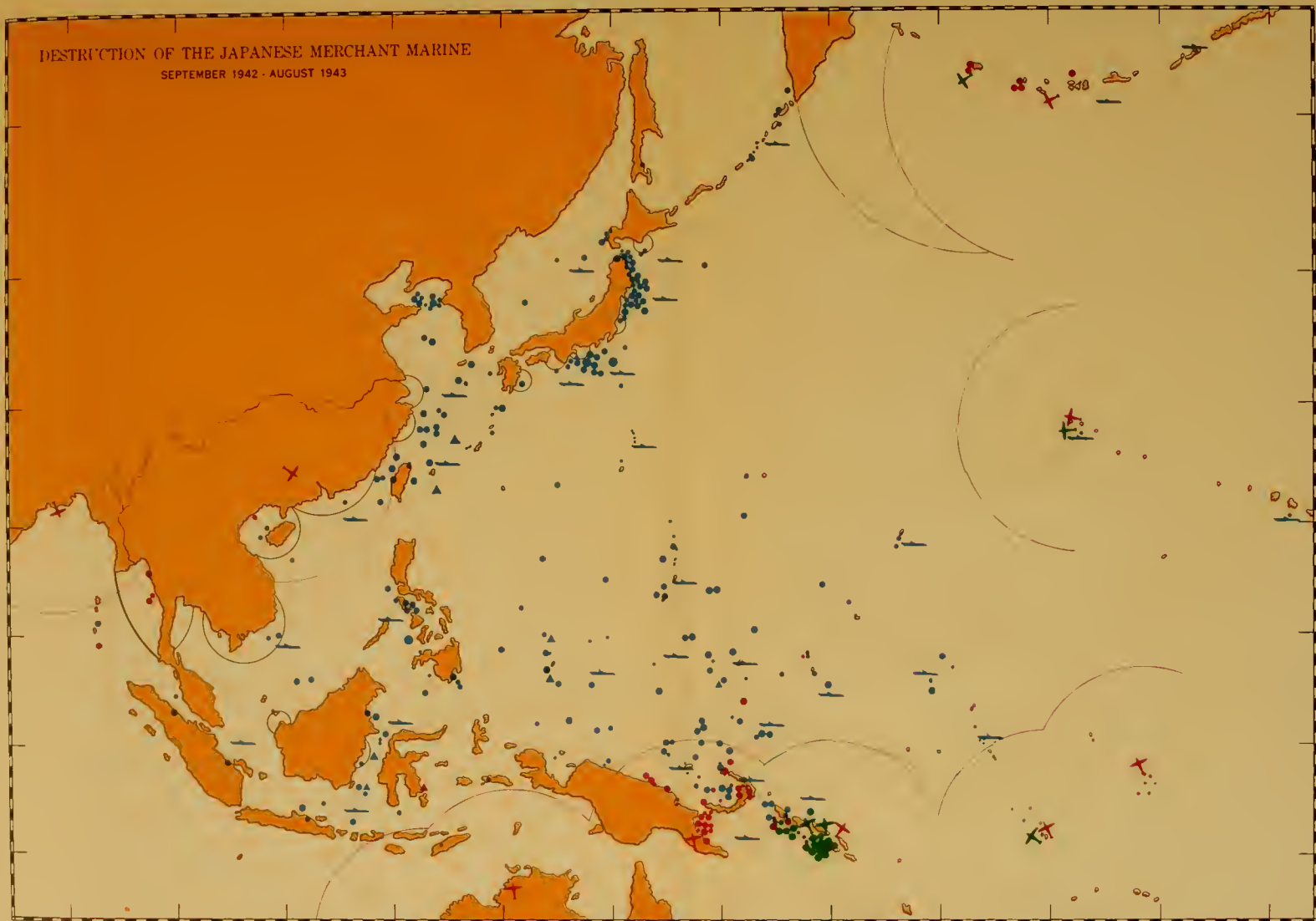


FIGURE 29

DESTRUCTION OF THE JAPANESE MERCHANT MARINE
SEPTEMBER 1943 - MAY 1944

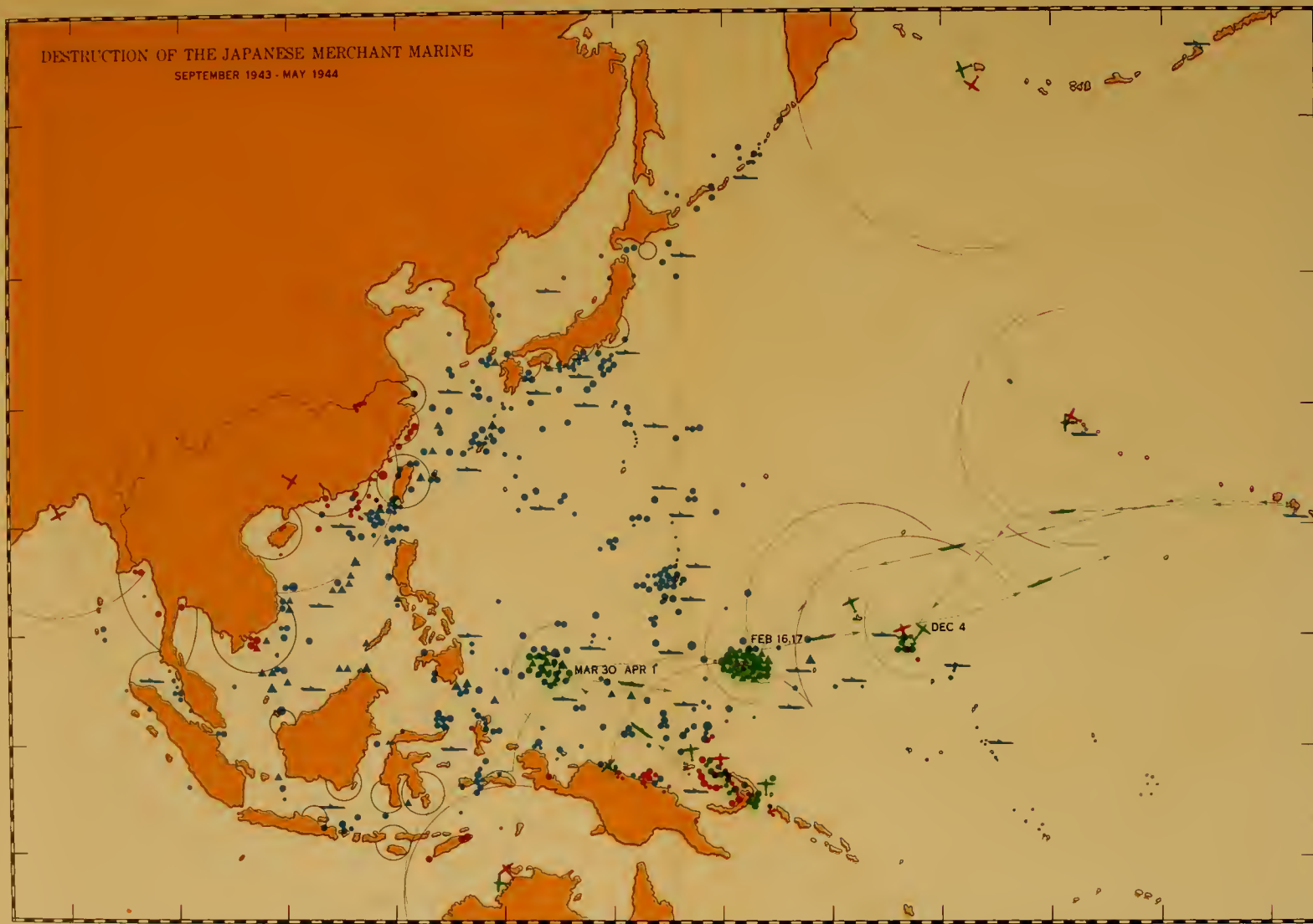


FIGURE 30

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

JUNE 1944 - AUGUST 1944



FIGURE 31

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

SEPTEMBER 1944

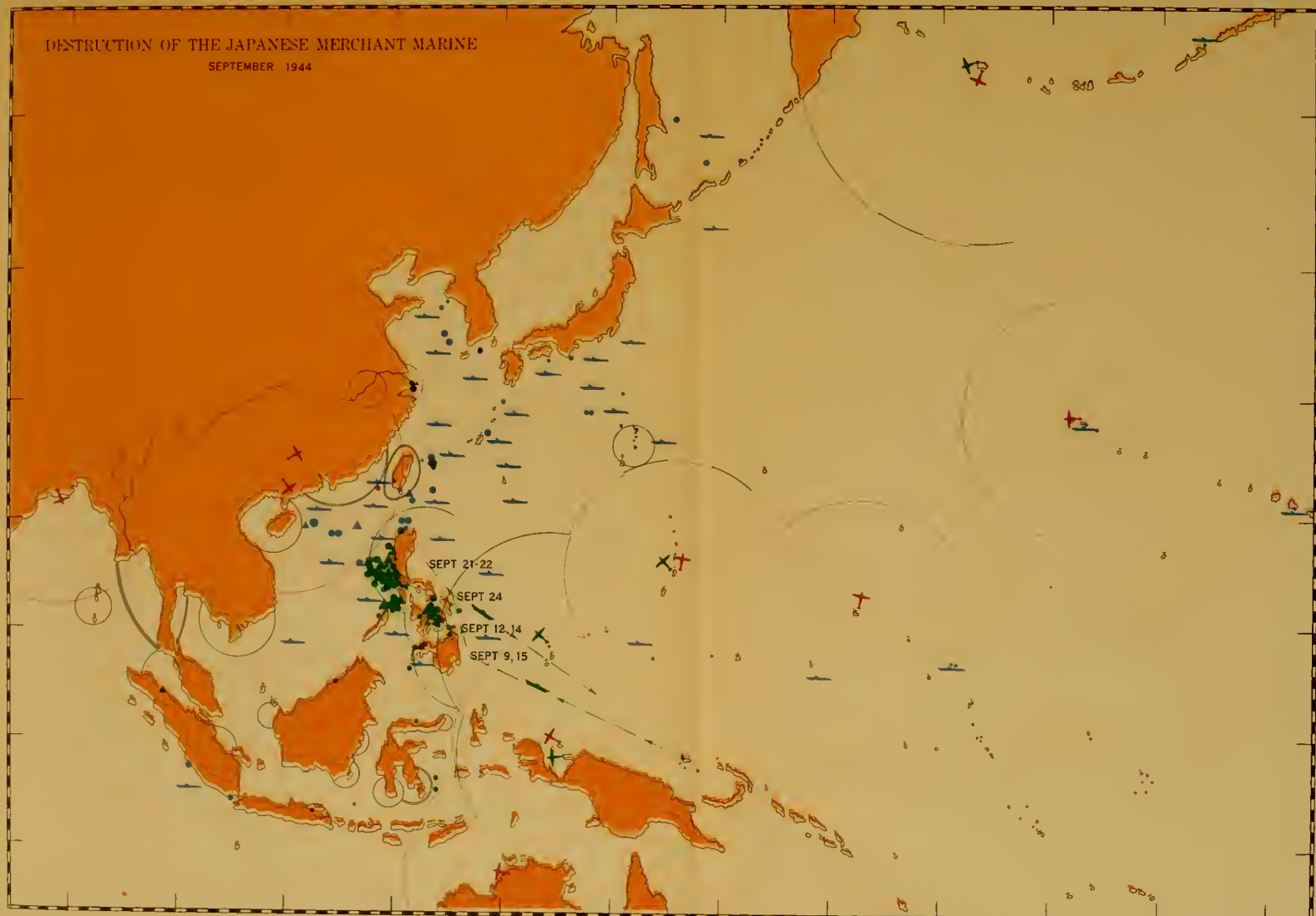


FIGURE 32

DESTRUCTION OF THE JAPANESE MERCHANT MARINE
OCTOBER 1944

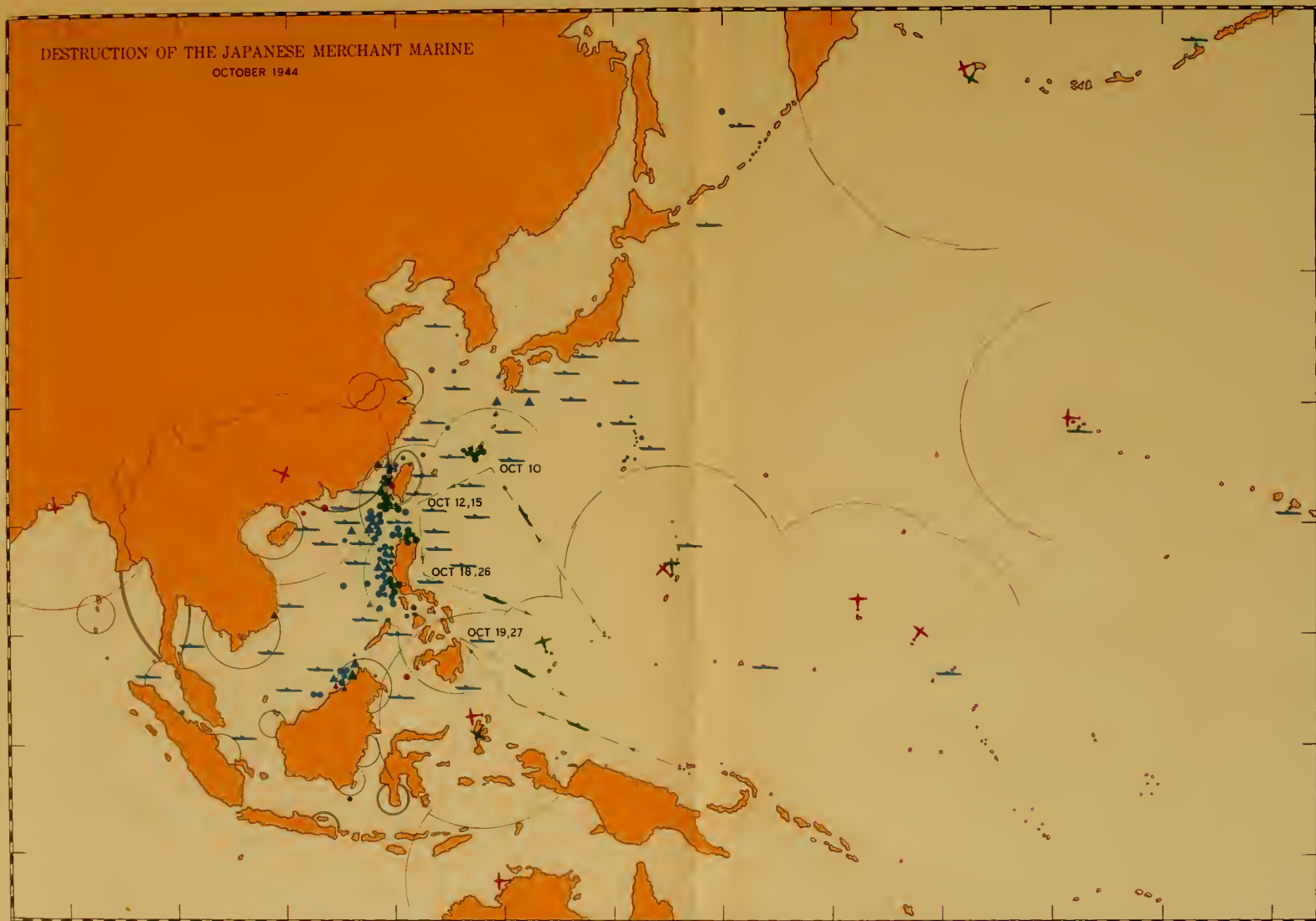


FIGURE 33

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

NOVEMBER 1944



FIGURE 34

DESTRUCTION OF THE JAPANESE MERCHANT MARINE
DECEMBER 1944



FIGURE 35

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

JANUARY 1945



FIGURE 36

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

FEBRUARY 1945



FIGURE 37

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

JULY & AUGUST 1945

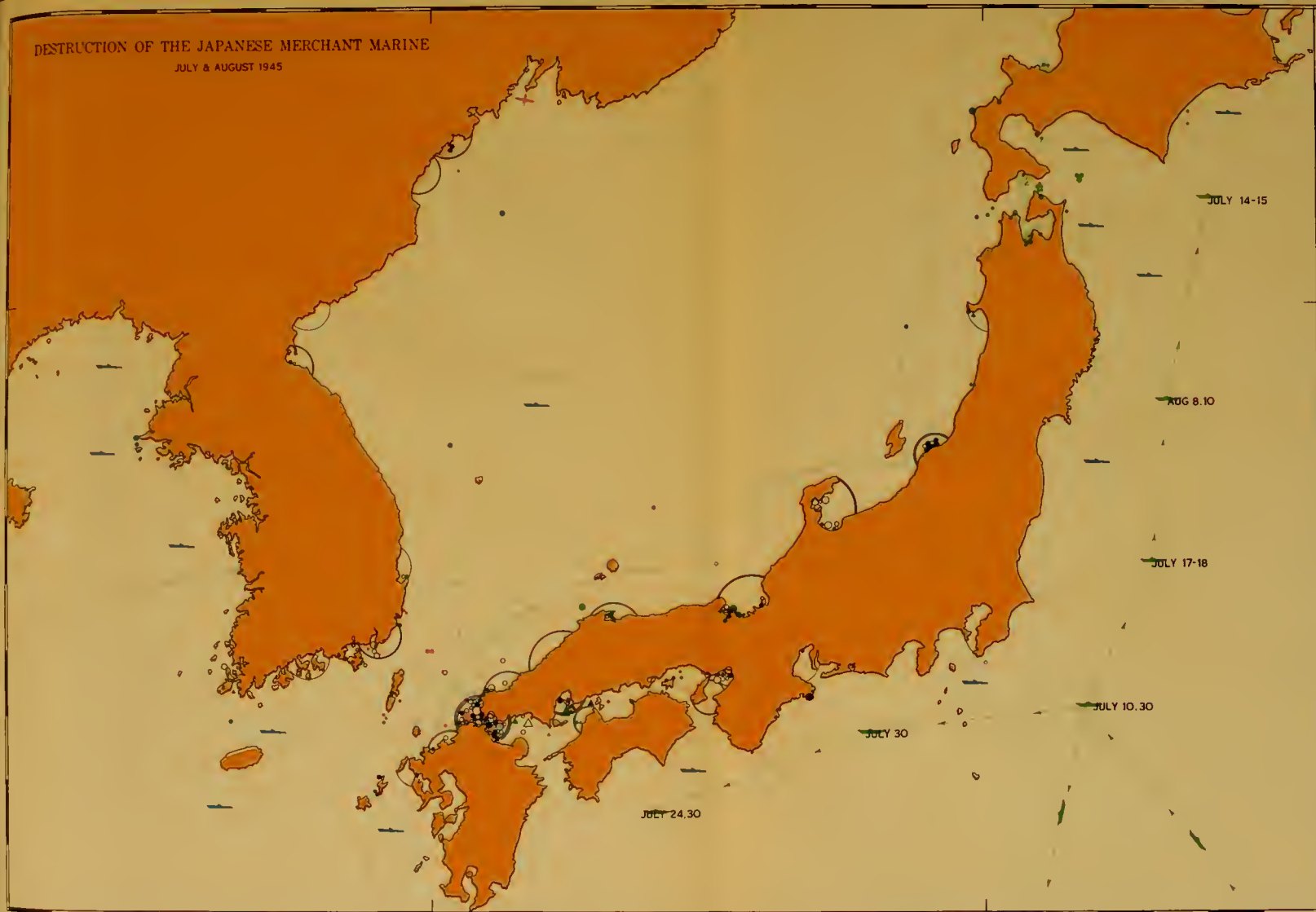


FIGURE 43

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

APRIL 1945



FIGURE 39

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

APRIL 1945



FIGURE 40

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

MAY 1945



FIGURE 41

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

JUNE 1945

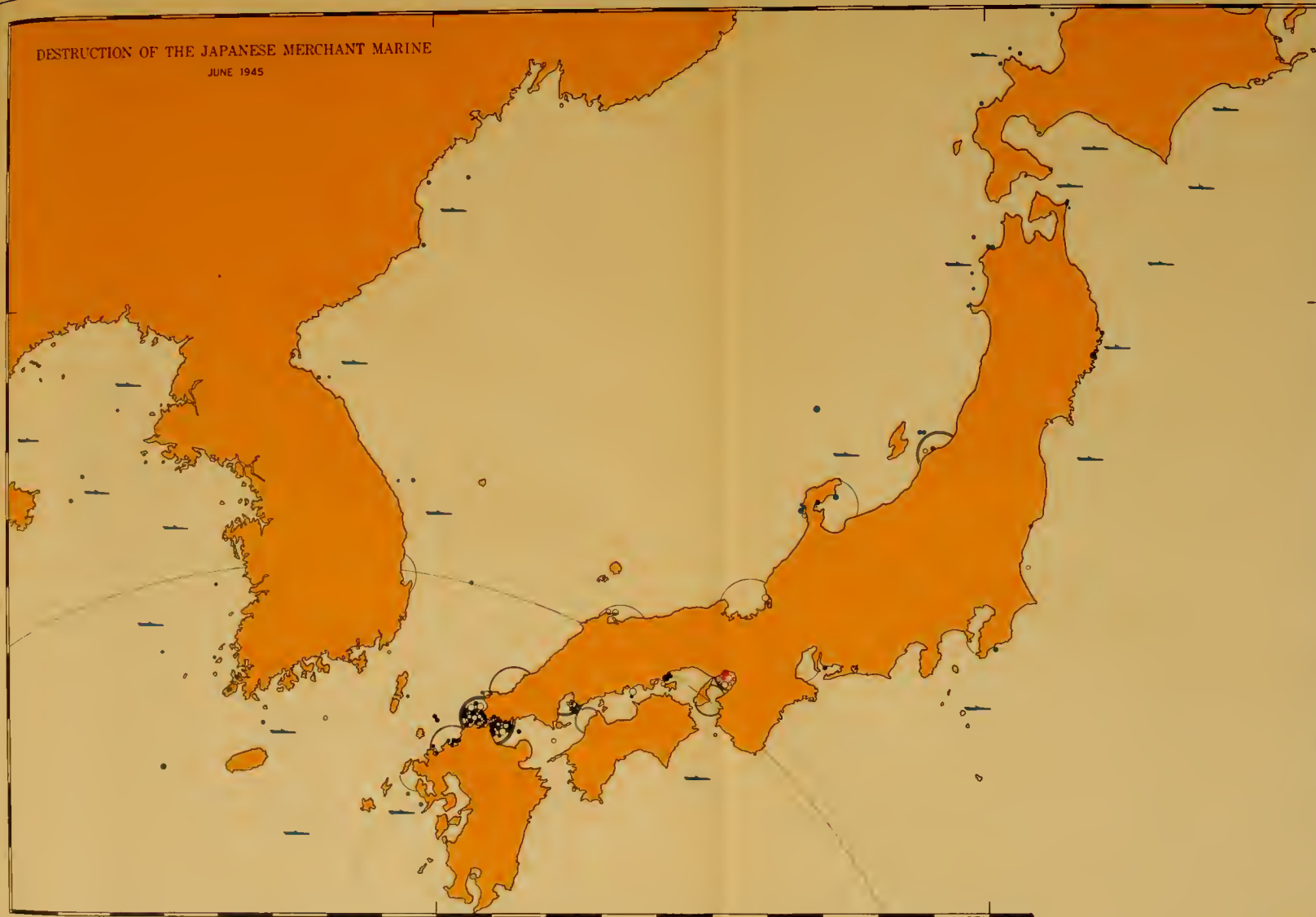


FIGURE 42

DESTRUCTION OF THE JAPANESE MERCHANT MARINE

JULY & AUGUST 1945

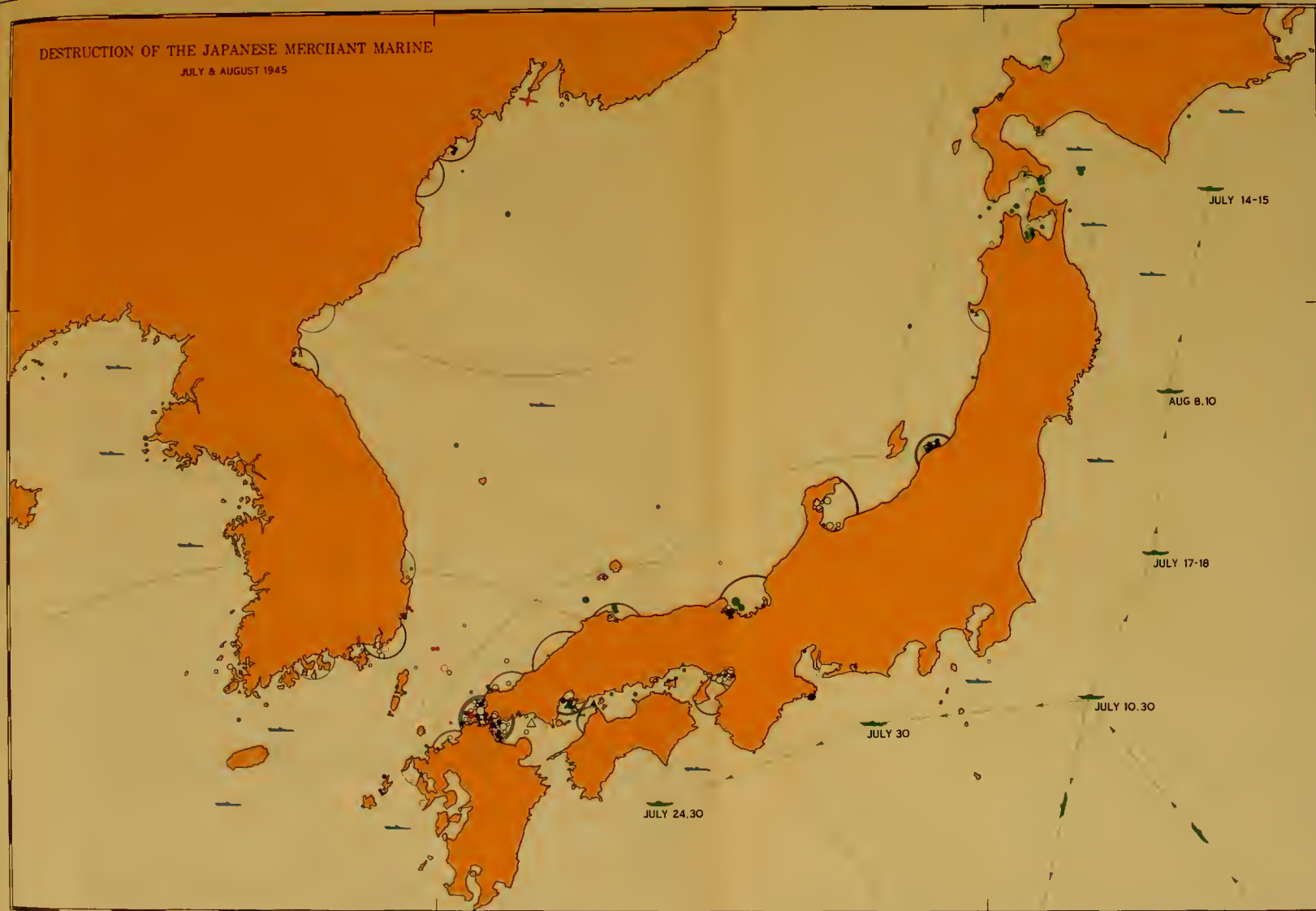


FIGURE 43

FIGURE 44.—Japanese Merchant Marine Ship Losses

(Ships over 500 gross tons)

Year and Month	Army Air ²		Navy Land-based Air		Carrier Air		Submarines ⁴		Mines		Surface Gunfire		Marine Casualties		Unknown		Total	
	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT	Num-ber of ships	GRT
1941-1942																		
December.....	3	16,901					6	31,693		1	1,548		3	7,466			12	56,060
January.....	1	6,757					7	28,351				4	22,751				17	33,795
February.....							5	15,975				3	10,485				9	33,248
March.....	1	4,109					7	26,183				1	7,170		1	6,788	15	78,139
April.....	2	9,798					5	26,886									7	36,684
May.....							20	86,110									22	96,656
June.....	2	12,358					6	20,021									8	32,379
July.....	2½	20,775					8	39,356				½	4,286				12	67,328
August.....	1½	7,190					17½	76,652									20	92,331
September.....	1	5,863					11	39,389									12	46,579
October.....	1	5,863					25	118,920				1	3,811				32	164,857
November.....	5	24,510					8	35,358				1	10,438				21	158,952
December.....	3	9,591					14	48,271									21	71,787
1943																		
January.....	9	41,269					18	80,572				1	3,121		1	179	28	122,590
February.....	3½	19,478					10½	54,276									19	131,175
March.....	10	37,939					26	109,447									33	150,573
April.....	7	24,521					19	105,345									37	131,782
May.....	3	2,060					29	122,319									37	131,440
June.....	1	953					25	101,581									23	109,115
July.....	3	4,425					20	82,784									25	90,507
August.....	1	4,468					19	80,799									23	98,828
September.....	5	15,429					38	157,002									47	197,906
October.....	7	15,253					17	119,623									38	145,594
November.....	20½	70,458					44½	231,683									68	314,790
December.....	13	36,266					32	121,531									61	207,129
1944																		
January.....	12	22,823					50	240,840				1	3,595				87	339,651
February.....	16	40,983					54	256,797									115	519,559
March.....	5	13,224					26	106,529									61	225,766
April.....	8	21,942					23	95,242				1	2,722				37	129,846
May.....	3½	9,626					63½	264,713									69	277,222
June.....	3	7,753					48	195,020				2	8,742				75	285,204
July.....	5	7,865					48	212,907									63	241,652
August.....	6	13,610					49	245,348									65	294,099
September.....	3	3,258					55	181,363									121	424,149
October.....	9	23,627					40½	131,308									134	514,945
November.....	11	37,350					53½	220,476									97	391,408
December.....	13	54,996					18	103,636									45	191,876
1945																		
January.....	7½	20,620					83½	283,234				1	584				125	425,505
February.....	3	8,593					2	1,884									(5)	(26,888)
March.....	(1)	(10,605)					15	55,746									29	87,464
April.....	(6)	(21,482)					23½	70,727									(7)	(31,310)
May.....	2	2,358					18	60,696									73	186,118
June.....	(2)	(1,670)					17	32,394									(12)	(48,067)
July.....	(8)	(23,839)					43	92,267									(17)	(58,732)
August.....	(8)	(23,709)					12	27,408									(11)	(41,702)
September.....	(8)	(22,884)					(1)	(63,450)									(6)	(21,536)
October.....	(14)	(50,757)					(1)	(14,442)									(2)	(10,126)
November.....	(14)	(50,757)					(1)	(14,442)									(4)	(6,664)
December.....	(14)	(50,757)					(1)	(14,442)									(4)	(6,664)
Total																		
	260	774,680	130½	363,518	359½	1,329,184	1,150½	4,859,634	210	397,412	16½	77,145	116	308,386	16	31,632	2,259	8,141,591
	(40)	(134,892)	(14)	(19,650)	(34)	(123,951)	(2)	(1,683)	(147)	(420,725)	(2)	(8,811)	(34)	(44,334)	(2)	(1,756)	(275)	(755,802)
Grand total disabled.....	300	909,572	144½	383,168	393½	1,453,135	1,152½	4,861,317	357	818,137	18½	85,956	150	352,720	18	33,388	2,534	8,897,393

¹ Figures in parentheses are ships damaged and put out of action for the duration (not included in sinkings).

² At least 12 percent of Army air sinkings listed were by Allied planes (Australian, British, Russian, etc.).

³ At least 23 percent of carrier air sinkings in July 1945 were by British carrier planes.

⁴ About 2 percent of submarine sinkings were known to have been the work of British and Dutch subs.

"Half" ships listed above are cases where credit is divided between two attacking agents; tonnage is divided equally.

of shipping. These two raids at Truk and Palau almost completely wiped out the means of reinforcement of Japanese forces to the south and greatly weakened the Japanese potential in this area (Figure 30).

Beginning about September 1943 the submarine campaign had been stepped up to the point where tremendous tonnages of shipping were being lost by the Japanese all over the ocean. No route was secure from their attack; no ship was safe south of Honshu. In the 16 months from September 1943 through the end of 1944, the period of heaviest submarine sinkings, the Japanese lost over 3,000,000 tons to submarine attacks alone. This tremendous loss of tonnage (averaging about 192,000 tons a month) represented more than half of the effective fleet with which the Japanese began the war. During this same period the combined United States and Allied Army and Navy air forces sank only about 1,400,000 tons, including those sunk in the heavy strikes at Truk and Palau. This ratio between the air and undersea attack against shipping was the dominant theme throughout the entire middle part of the war. The successes of various air forces, though spectacular and locally significant from a tactical point of view, were only a relatively minor factor in the general strategic attrition of the Japanese "bridge of ships."

Incident to the Saipan landings, carrier aircraft again bit a sizable chunk from the dwindling Japanese fleet—some 65,000 tons in June 1944. The relative unimportance of this strike in the over-all shipping situation, paralyzing though it was locally, is best illustrated by the fact that in the same month submarines, ranging from Singapore to Kamchatka, sank 195,000 tons of shipping—45,000 tons in the Marianas area alone (Figure 31).

In a report on the "state of the nation" submitted to the cabinet at the end of the year, the total mobilization bureau summarized the shipping situation up to the summer of 1944 as follows: "Shipping lost and damaged (since the beginning of the war) amounts to two and one-half times newly-constructed shipping, and formed the chief cause of the constant impoverishment of national strength."

In the fall of 1944 the Allied attack against Japanese shipping reached a crescendo. In Sep-

tember, October, and November, immediately before the Leyte landings and during the first efforts of the Japanese to reinforce the Philippine garrison, carrier aircraft struck terrific blows against Japanese shipping. In September naval aircraft sank over 200,000 tons of ships in the Philippines. In October the concentration of submarines off Luzon sank about 205,000 tons of shipping in this area alone. Carrier aircraft ranging from central Luzon to Formosa and the Ryukyus sank another 130,000 tons of shipping. In November, in combined crushing blows against Japanese logistic efforts, submarines and planes, largely carrier aircraft, sank over 230,000 tons of Japanese shipping in the Philippine area, thus putting an end to the hope of logistic support of Japanese resistance in the Philippines.

These 3 months of the Philippine campaign finally and completely broke the back of the Japanese merchant marine. During these months, in all areas and from all causes, the Japanese lost over 1,300,000 tons of ships, more than a third of the tonnage afloat at the beginning of this campaign. Again it should be pointed out that in spite of the intense carrier activity, 55 percent of the ships lost in this period were sunk by submarine. (Figures 32-34).

JAPANESE COUNTERMEASURES

The Japanese apparently went into the war without providing adequately for the vulnerability of their merchant marine to attack. In the early months of the war, merchant vessels were not armed, and no effective convoy system was in use. Until about March 1944 there were only about 25 vessels regularly assigned to convoy escort duty. An additional 40 subchasers too small for open-water sailing were distributed among the various naval bases for local defense. Convoying was not regularly begun until 1943 and then only on the Singapore run. But escort was provided to some degree, at least in the southern area, early in the war. What few convoying ships there were were stepchildren of the Navy, wornout vessels that were no longer of use to the fleet. The great bulk of the ships went unescorted. Each naval base was responsible for the safety of ships passing through its area of operation and ship captains were required to check with the local

Navy control office for information concerning the presence of Allied submarines. The only protection afforded, however, were such patrols as the local commander might feel inclined to make. Apparently for the purpose of mutual rescue, the plan of traveling in groups, even when unescorted, was adopted. The real, important and dire necessity of effective convoy of merchant ships did not become apparent to the Japanese until the first months of 1944. Then in rapid succession regular convoy routes were established to Saipan, Manila, Saigon, North Borneo, and Formosa. At the same time a large expansion in the convoy escort fleet was begun and by the end of 1944 the number of vessels regularly assigned to such duty had increased to more than 150.

The effectiveness of this belated effort was low. The most glaring shortcoming was in technical equipment. Sound and electronic devices for detecting submarines were almost entirely absent in the beginning. Merchant vessels traveling alone during the first 2 years of the war were sitting ducks for any sort of attack; no deck guns or anti-aircraft guns were provided. Ships' officers and crews were not trained or given any indoctrination in anti-submarine tactics, and all vessels were allowed to navigate between all ports independently according to the captain's discretion. No centralized system of disseminating information about submarines and other hazards existed. When the arming of merchant vessels began early in 1943, the most ridiculous stratagems were employed. Ships in the service of the Navy got top priority on naval guns, while the Army was frequently reported to be equipping its ships with field guns on wheels. Ships operated by the shipping control association received the least attention of all and were reported to have been driven to the installation of wooden guns to achieve at least the appearance of armament. Air cover for merchant convoys, when provided, was inadequate and poorly organized. No carrier escorts were ever provided, and poor liaison existed between land-based air headquarters and convoys. The construction of special convoy vessels was not even begun until the end of 1942 after the submarine attack had already reached serious proportions. By the time conveying began, the merchant fleet had suffered such serious damage already that the collections

of merchant and escort ships assembled into a convoy were usually unsuited for travel together. Fast ships sacrificed their speed to match the slowest; ships with long cruising radius had to put into port while ships with lesser fuel capacity refueled; staunch seaworthy merchant ships had to seek shelter and wait out storms which their less seaworthy escorts could not weather.

In spite of all the most intensive efforts of which the Japanese were capable in conveying, effective protection was impossible in the open sea. The short, straight-line routes between various empire points therefore had to be abandoned, and by the middle of 1944 all convoys were hugging the coastline wherever possible to stay in shallow waters beyond the range of submarines and within range of whatever land-based air protection was available. They even began to abandon night operations as being too dangerous from the point of view of submarine exposure.

The combination of all of the shortcomings of the Japanese convoy system and practices and the hindrances of ever-increasing Allied air and undersea attack very seriously impeded the movement of shipping. In the early days of the war, a one-way trip between Japan and Singapore required less than ten days. In the latter part of 1944 these trips sometimes took as long as 24 days. Countermeasures adopted by the convoys against submarines, hugging the China coastline and limiting their travel to daytime, only played into the hands of the Fourteenth AF in China. Following coastal waters to avoid submarines took shipping into shallow waters where mine laying by aircraft was feasible. No stratagem was successful against all forms of attack, and every effort made by the Japanese to improve their position was countered by heavier and increasing attacks by the Allied forces.

Various convey routes were maintained by the Japanese in the face of all attacks. In spite of incredible losses, their network of routes reached a maximum in mid-1944 and was progressively abandoned during the succeeding 12 months. Figure 45, reproduced from a chart provided by the Japanese Navy, gives a rough idea of when and why various routes were abandoned. The route to the Marshall Islands was abandoned in December 1943 on account of the

carrier raid that month. The route from Truk to Rabaul was abandoned the same month in the face of air attack from the Solomons and New Guinea. After the February and March 1944 raids against Truk and Palau, the routes from Palau to Truk and New Guinea were abandoned in March as the Japanese fleet was withdrawn from Truk and the task of reinforcing New Guinea from Palau became hopeless.

INDEX FOR CHART OF JAPANESE CONVOY ROUTES

FIGURE 45.—*Date and reason for termination of
convoy operations*

1. *Truk to Marshalls*—Abandoned December 1943 on account of carrier raids.
2. *Truk to Rabaul*—December 1943, on account of Cape Gloucester landings and the menace of land-based planes.
3. *Palau to Hollandia*—January 1944, on account of menace of land-based planes.
4. *Direct route, Moji to Shanghai*—Convoy operations abandoned January 1944; escorts transferred to Japan-Formosa run. Ships on this route traveled unescorted thereafter.
5. *Palau to Truk*—February 1944, on account of carrier raid and abandonment of Truk as fleet base. (No more need for Borneo oil.)
6. *Direct Route from Japan to Palau*—Abandoned March 1944. In order to meet increasing submarine menace with insufficient number of ocean escorts, it became necessary to concentrate ocean escorts to fewer and more indispensable lanes, and this lane was abandoned to save escorts for other communication lines, e.g., the lines in the East China Sea and the South China Sea as well as a newly initiated line between Formosa and Palau to be substituted for this old line.
7. *Morotai to Biak*—May 1944, occupation of Biak.
8. *Surabaya to Ambon*—May 1944, abandoned on account of menace of land-based planes from Biak.
9. *Saipan to Truk*—June 1944, occupation of Saipan.
10. *Saipan to Palau*—June 1944, occupation of Saipan.
11. *Japan to Saipan*—June 1944, occupation of Saipan.
12. *Balikpapan to Manila*—June 1944, abandoned on account of excessive submarine menace in the Sulu and Celebes Seas.
13. *Direct route, Takao to Palau*—July 1944, protection of Palau convoys transferred to Manila fleet headquarters; convoys routed Formosa to Palau via Manila.
14. *Manila to Palau*—Abandoned August 1944, expected occupation of Palau.
15. *Davao to Palau*—Abandoned August 1944, expected occupation of Palau.
16. *Balikpapan to Palau*—Abandoned August 1944, expected occupation of Palau.
17. *Takao to Hainan Island*—August 1944, shipping tonnage declined much. Bottoms for iron ore were trans-

ferred for carriage of bauxite which was more needed.

18. *Hongkong to Hainan*—August 1944, shipping needed more urgently on Singapore run.

19. *Davao to Halmahera*—September 1944, occupation of Morotai.

20. *Manila to Saigon*—September 1944, abandoned "to transfer escorts to more important routes which had felt shortage of escorts."

21. *Singapore to Madan*—October 1944, submarines in Malacca Strait shortage of tankers.

22. *Saigon to Miri*—November 1944, "to save escort vessels."

23. *Miri to Manila*—November 1944, "harassed by shore-based enemy planes" from Leyte; anticipation of heavier losses.

24. *Singapore to Balikpapan*—November 1944, air raids from Morotai.

25. *Surabaya to Balikpapan*—November 1944, air raids from Morotai.

26. *Manila to Ormoc and Davao*—November 1944, "Leyte proved unsustainable."

27. *Singapore to Miri*—January 1945, shortage of tankers; Miri unnecessary; menaced by shore-based planes from Morotai anchorage difficult on account of sunken ships.

28. *Singapore to Rangoon*—Shipping driven close in shore by submarines in the Andaman Sea; abandoned January 1945.

29. *Takao to Hongkong*—Abandoned in February 1945 to save merchant shipping, and because the fortification of Hongkong was finished.

30. *Shanghai to Takao*—Abandoned in February 1945 to save merchant shipping, and because the fortification of Hongkong was finished.

31. *Moji to Takao*—Abandoned in February 1945 to save merchant shipping, and because the fortification of Hongkong was finished.

32. *Takao to Singapore*—March 1945, on account of the expected imminent occupation of Formosa or Okinawa.

34. *Tokyo to the Bonins*—March 1945, on account of expected losses from land planes on Iwo Jima.

35. *Tokyo to Osaka*—March 1945, on account of expected losses from land planes on Iwo Jima.

36. *Moji to Tsingtao*—Abandoned June 1945 on account of land planes from Okinawa.

37. *Moji to Dairen*—Abandoned June 1945 on account of land planes from Okinawa.

38. *Roundabout route, Moji to Shanghai via the Yellow Sea*—Abandoned June 1945.

39. *Surabaya to Kendari*—Never abandoned.

40. *Singapore to Surabaya*—Never abandoned.

41. *Singapore to Palembang*—Airplane mines recurrent menace after summer of 1944 sailings interrupted occasionally but never abandoned.

42. *Singapore to Saigon*—Never abandoned.

43. *Tokyo to Muroran*—Never abandoned; more shipping diverted elsewhere; balance protected by anti-submarine mine barrage.

44. *Otaru to Paramushiru*—Never abandoned.

45. *Niigata to Rashin*—Never abandoned.

46. *Maizuru to Genzan*—Never abandoned.

47. *Moji to Genzan*—Never abandoned.



FIGURE 45

Occupation of Saipan in June 1944 caused the abandonment of routes from Japan and Palau to Saipan. In March 1944 direct communication between Japan and Palau was abandoned because of the shortage of escort vessels; all traffic was routed via Formosa to take advantage of the main Japanese-Singapore convoy system. Between March and June Palau-bound ships formed part of Singapore convoys as far south as Keelung in Formosa, at which point they broke off under separate escort for Palau. Though that routing almost halved the distance for which separate escort was required, the saving was still insufficient and in July Palau-bound ships continued south-bound as far as Manila, crossed through the Philippines and sailed almost due east to Palau. The direct routes from Manila and from the Borneo oil fields to Palau were abandoned only when Palau was occupied. The direct route between Manila and Balikpapan through the Sulu Sea was abandoned in June 1944 on account of the increasing submarine danger in the Celebes Sea. In September 1944 direct communication between Saigon and Manila was abandoned on account of the shortage of escort vessels. In the same month convoy communication between Formosa and the Hainan iron mines was abandoned entirely on account of a general shortage of bottoms. In November 1944 direct communications between the north Borneo oil fields and Saigon was abandoned on account of the shortage of escort vessels, and for the rest of the year ships going from Miri to Japan first went south along the Borneo coast to Singapore where they joined the Japan-bound convoys. In the same month communication from Borneo to Manila was interrupted because it was "harassed by shore-based enemy planes," this in spite of the fact that 12 vessels were sunk off north Borneo by submarines in October and November as compared with three by planes.

The year 1944 ended with the Japanese retaining only a tenuous foothold in Luzon. The remaining merchant marine, reduced by this time to a little over two and a half million tons (of which nearly a third were tankers), was engaged largely in frantic efforts to reinforce garrisons in Formosa and along the China coast where the next attack was expected, and in trying to bring in to Japan last-minute imports of vital goods from the southern area. All

communications with the southern area were limited to roundabout and devious voyages down the China coast from Formosa to Hainan and down the coast of French Indo-China to the Gulf of Siam.

Efficiency of Marine Transportation

The various hindering effects of the convoy system, aggravated by all of the other manifold symptoms of war, such as the slowdown and congestion in ports, gradually reduced the effectiveness of the available Japanese merchant fleet during the war. The Japanese measure of vessel efficiency was a factor called "kakoritsu." This factor was computed by dividing actual cargo carried (in metric tons) in a given time period by the cargo-carrying capacity of ships in use during that period in that particular service. The following tables, though inadequate and incomplete, will serve to indicate the gradual decline in efficiency of shipping:

Kakoritsu Factors

Period	Manchuria-China	Singapore area	All civilian shipping
<i>1942</i>			
January-March.....			1.41
April-June.....	1.316		1.28
July-September.....	1.262		1.33
October-December.....	1.209		1.35
<i>1943</i>			
January-March.....	1.321		1.38
April-June.....	1.254	0.426	1.31
July-September.....	1.140	.470	1.31
October-December.....	1.087	.349	1.30
<i>1944</i>			
January-March.....	1.034	.303	1.30
April-June.....	1.025	.234	1.30
July-September.....	0.9995		1.30
October-December.....	1.016		1.30
<i>1945</i>			
January-March.....	1.018		1.10
April-June.....	.993		1.10
July.....	.943		.80

The shipping section of the Tokyo Army headquarters offers the following information regarding their experience in operating "A" ships under the convoy system:

Average round trip time of Army vessels carrying munitions (in days)

Period	South China run	Singapore	Philippines	Rabaul	Saipan
<i>1942</i>					
April-October.....	26.9	38.5	28.0	48.2	
<i>1943</i>					
March-May.....	26.9	56.4	41.5	71.2	
June-August.....	26.9	56.4	41.5	76.7	
<i>1944</i>					
March-May.....	26.9				31.5
August-September.....	36.4		70.5		

Merchant Marine Crews

At the beginning of the war Japan had a highly trained and efficient personnel aboard its merchant ships. On kisen there were about 16,000 officers and 60,000 crew (something over 0.01 man per gross ton). Kihansen crews amounted to about 45,000 officers and 77,000 crew. The crew problem during the war was largely in kisen on account of their greater exposure and loss to the hazards of war. During the war, casualties to crews of kisen were as follows:

Type of action	Number dead and missing	Wounded	Others ¹	Total
Air	8,100	1,200	25,500	34,800
Submarine	16,200	2,400	51,000	69,600
Mines	2,700	400	8,500	11,600
Total	27,000	4,000	85,000	116,000

¹ Marooned, ill or suffering from minor wounds.
Source: Bureau of Crews, Transportation Ministry.

It will be noted that the losses in dead, missing, and wounded amounted to 40 percent of the crew complement necessary to man the fleet. The losses, were, of course, heaviest in big ships on long runs. NYK alone lost 40 percent of its captains.

The crew problem did not become serious until late 1943 and 1944 when the combination of sinkings averaging 200,000 tons or more a month and new construction averaging over 100,000 tons a month made the problem of always having a crew available when needed an extremely difficult one. This is revealed in the following two tables:

Training of Seamen

	Officers	Crew	Total
1942	2,254	4,098	6,352
1943	3,032	13,404	16,436
1944	5,080	22,960	28,040
1945	3,177	7,039	10,216

Number of New Recruits Each Year

	Officers	Crew	Total
1942	2,380	13,152	15,532
1943	3,059	31,712	34,771
1944	5,611	46,054	51,665
1945	4,055	11,012	15,067

An interesting supplementary statistic is the number of survivors of sinkings sent back to sea: 121,771,—160 percent of the number of men in the merchant marine at the outbreak of the war. The manpower troubles which beset the in-

dustry in late 1943 and 1944 were the result of overwork, exposure, illness, and the lack of volunteers because of the increased violence of the war. Conscription was never resorted to, however; the need was supplied by intensive voluntary recruitment. The inefficiency of the large proportion of green hands in the latter part of the war contributed considerably to the poor showing the merchant marine made and was probably largely responsible for the increase in shipwrecks from 1.1 percent of Pearl Harbor tonnage during 1942 to 4.5 percent (of January 1st, 1945, tonnage) during the last 8 months of the war.

Crew morale was apparently not a great problem except insofar as it increased the difficulties of recruiting. Various interrogations of ship captains indicate that discipline was generally good. Desertions, as such, were rare or non-existent although frequently when crews were paid off on arrival at their Japanese home port they would go "over the hill" and spend the rest of the war on the farm. A common subterfuge, with the collusion of the family doctor, was to present a certificate of physical unfitness. Inquiry into the greatest fear of merchant seamen produces various answers. The consensus of opinion appeared to be that crews in general feared air attack the most, but ship captains with a more realistic outlook on their chances of survival feared submarine attack the most. Mine explosions were apparently not an important factor. The special danger to which tanker crews were exposed was compensated for by a 15 percent bonus to tanker crews in general and 30 percent to those carrying gasoline cargoes.

Ship captains in general with long experience at sea and a better "knowledge of the world" than the average Japanese, knew that Japan was defeated by the summer of 1944 after the fall of Saipan when the percentage of losses on the Manila and Singapore runs skyrocketed in spite of all the Japanese convoy efforts. The captain of one of the last ships to reach Singapore from Japan (in January 1945) stated as follows: "When I was in Manila for repairs in the summer of 1944 and learned of the heavy submarine losses of ships crossing the Bashi Straits from Formosa to Luzon, I and my associates began to fear that the war was beginning to be lost * * * In March 1945 at Singapore

I began to think that the war was lost." His reason for that conclusion was stated as "the fact that few or no ships were able to arrive at their destination safely." When queried as to his reaction to the fact that Japan's shipping balance had begun to decline early in 1942, he replied, "I didn't believe the actual state of affairs. I believed in the statements of Japanese imperial headquarters that Japan was winning the war. I actually knew the merchant fleet was becoming smaller and smaller, but I liked to believe in the statements issued by Japanese imperial headquarters that Japan was winning the war against America."

In the latter part of the war there were also considerable crew troubles in manning kihansen as these small vessels were coming off the ways in such large numbers and had to have a certain proportion of competent personnel.

Japan ended the war with about 8,000 officers and 42,000 men on kisen (0.07 men per gross ton) and 34,000 officers and 60,000 men on kihansen. The relative ineffectiveness of manpower on kihansen can be illustrated by the April 1945 ration of about 20 tons of cargo handled per man in kisen as against about 6 tons per man in kihansen.

Steel Shipbuilding

The shipbuilding industry in Japan at the beginning of the war was primarily devoted to naval construction. Combatant ships had top priority in 1941 and well into 1942. The Navy had the pick of shipyard capacity for this purpose and had no interest in merchant ship construction. The latter was under the control of the Ministry of Transport, and they had to be content with such shipyard capacity as the Navy was not using. Merchant shipbuilding suffered and after reaching a peak of 374,000 tons in 1937, declined steadily to 210,000 tons in 1941 (Figure 20). In 1942 construction still lagged; only 214,000 tons were built in the first 11 months—this in spite of the fact that in this same period 880,000 tons of ships were sunk.

However, the urgency of the situation became apparent to Japan's leaders early in the year, and the Navy took over all vessel construction, combatant and non-combatant, in the summer of 1942. The reorganization of the industry took some time, and the effect was not felt in shipbuilding until November. Beginning

in November 1942 the shipbuilding index shot up rapidly. Assuming the 1941 rate of production as 100, it had only increased to 113 by October 1942. In November this index of production stood at 147. By February of 1943 it had increased to 210.

Up to this time merchant shipbuilding in Japan had been retarded, primarily by the top priority of naval shipbuilding, but also by the lack of imagination and failure to expand shipyard capacity. Maximum production was limited to about the same tonnages as were achieved in World War I. It was not until March 1943 when Japan had already lost a million and a quarter tons in the war, when her serviceable merchant fleet, in spite of large conquests, was reduced 7½ percent below its Pearl Harbor size and when sinkings were occurring at the rate of about 125,000 tons a month, that any really ambitious merchant shipbuilding plan was inaugurated. This plan called for an expansion of shipyard capacity beyond the previous approximate maximum of one-half million tons a year to reach a goal of 1,400,000 tons in 1944. Under the impetus of this plan construction increased rapidly (Table 46). The shipbuilding index rose to 272 by May, 357 by August, and 392 in November, 1943. Deliveries increased from 20,000 tons in April to 60,000 tons in August and 96,000 tons in November. Japan was making an all-out effort to adjust her replacement effort to match her losses. However, it was a losing battle. Total ship construction in 1943 was only 769,000 tons compared with 1,803,000 tons of ships sunk. Replacement was less than 45 percent of losses. Eventual culmination of this situation could only be disaster, and the Japanese apparently belatedly realized the seriousness of the situation.

At the same time that the far-flung though ineffectual convoy system was planned and inaugurated, an even more ambitious construction program was undertaken in December 1943, calling for the production of nearly 2,000,000 tons of merchant ships in 1944. The production index rose to 591 in January 1944, nearly six times the 1941 rate. That month the industry reached its peak. Yard capacity was probably reached and certainly the consumption of steel was about all that the hard-pressed steel industry could maintain. (Production of steel had passed the peak the month before.)

During 1944 Japan devoted about one-third of her steel production to merchant shipbuilding.

At about this time the loss of tankers had brought the tanker situation into the limelight for the first time. Although Japan started the war with a comparatively small fleet of 575,000 tons (not counting fleet oilers) and had added only 275,000 tons by construction in 1942 and 1943, her tankers had been singularly immune from attack during this period (largely because of their comparatively high speed and distance

from the zone of operations). As a result of this freedom from attack, plus a moderate program of conversion of cargo ships to tankers early in the war, her net tanker tonnage steadily rose during 1942 and 1943 to reach a crest of about 870,000 tons in October 1943. It reflects no credit on the foresight of the Japanese that they apparently assumed that this happy state of affairs would continue indefinitely. Tanker production in these two years amounted to only 27 percent of the total tonnage built. However, in the early months of 1944, the war finally caught up with the tankers. In the first three months of that year 244,000 tons of tankers were sunk, more than had been built in the preceding ten months.

This striking upset caused a sudden belated shift in emphasis as the Japanese, realizing their almost complete dependence on East Indies oil for the prosecution of the war, reorganized the shipbuilding industry, just as it reached its peak, to put more emphasis on tanker construction. This operation so deranged the smooth functioning of the industry that the peak of production reached in January was never again quite equalled (Figure 47). Tanker production reached a peak in July of 1944, but the industry as a whole suffered from this shifting of emphasis; the production index fell off 10 percent. For the last 8 months of 1944, the period of greatest tanker construction, tanker deliveries averaged 57,000 tons a month, 41 percent of total merchant ship construction. However, in spite of redoubled activity, tanker losses continued to increase. During the last nine months of 1944, 580,000 tons were sunk, and Japan ended the year with 790,000 tons of serviceable tankers, 3 percent less than the peak in October the year before.

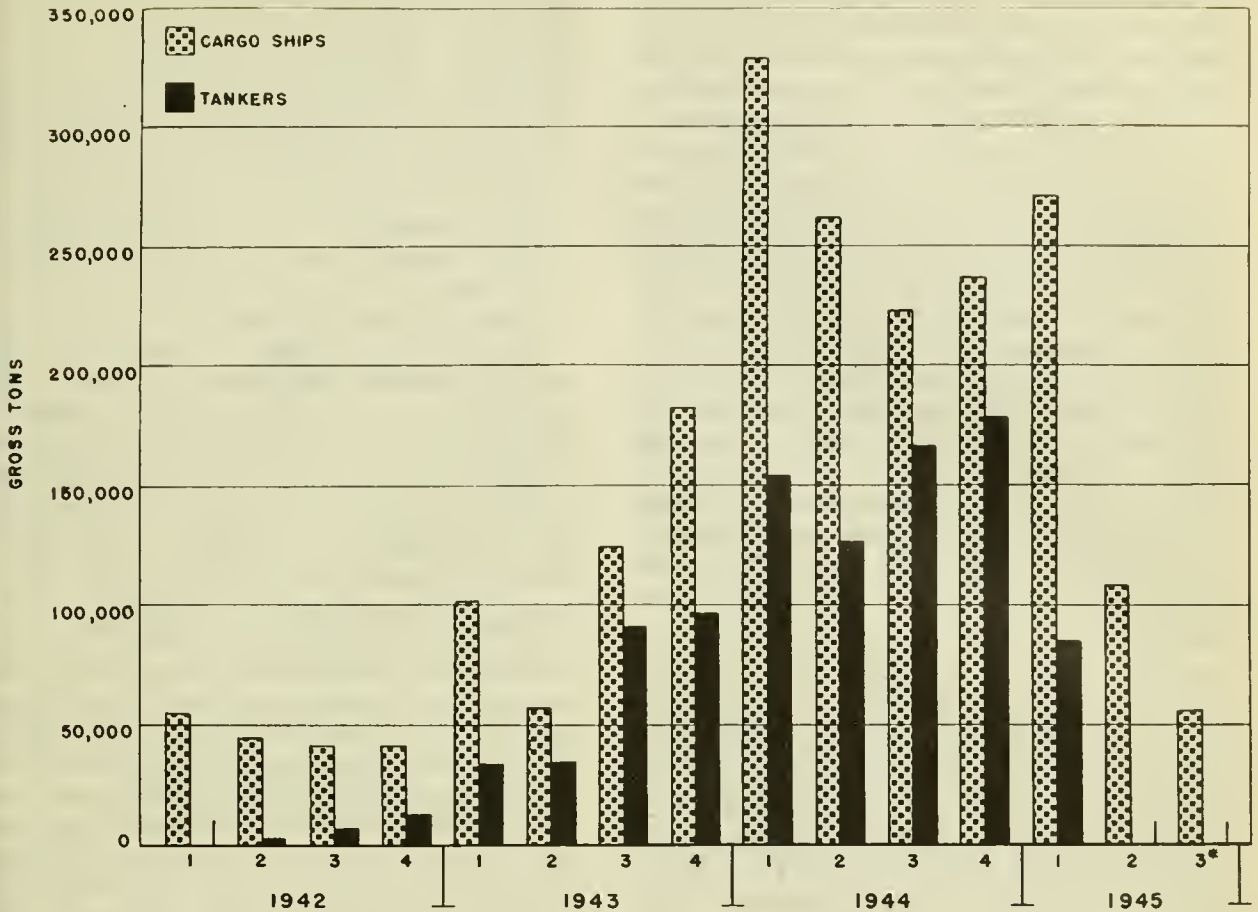
The Philippine campaign in the fall of 1944 apparently convinced the Japanese of the certainty of ultimate loss of contact with the Indies oil fields. At any rate this contingency, together with the very pressing need for dry cargo bottoms, caused the tanker program to be abandoned in November 1944. The emphasis was again shifted to cargo ships. The January tanker production had fallen off to one-fifth of the July rate; only 85,000 tons of tankers were delivered in 1945.

The general construction index which suffered a setback in early 1944 from the shift to

FIGURE 46.—*Japanese merchant ship construction during the war*
(Monthly deliveries in gross tons—ships over 500 tons)

Month and year	Cargo, passenger and miscellaneous		Tankers		Total	
	Number of ships	Tonnage	Number of ships	Tonnage	Number of ships	Tonnage
1941						
December.....	3	4,929	1	975	4	5,904
Total.....	3	4,929	1	975	4	5,904
1942						
January.....	4	23,894			4	23,894
February.....	7	16,638			7	16,638
March.....	8	21,250			8	21,250
April.....	3	5,896	1	1,186	4	7,082
May.....	6	16,242			6	16,242
June.....	6	23,081			6	23,081
July.....	5	12,895			5	12,895
August.....	5	33,958	2	6,416	7	40,374
September.....	8	22,879			8	22,879
October.....	5	21,779	1	572	6	22,351
November.....	3	7,753			3	7,753
December.....	10	33,478	3	12,142	13	45,620
Total.....	70	239,743	7	20,316	77	260,059
1943						
January.....	5	7,309	1	5,240	6	12,549
February.....	12	29,945	4	13,009	16	42,954
March.....	24	91,778	4	16,666	28	108,444
April.....	8	16,838			8	16,838
May.....	5	14,238	4	17,077	9	31,315
June.....	14	31,322	3	16,678	17	48,000
July.....	12	32,095	3	31,871	15	63,966
August.....	19	47,118	3	15,365	22	62,483
September.....	19	45,417	8	43,388	27	88,805
October.....	23	54,913	4	25,499	27	80,412
November.....	22	47,857	9	39,421	31	87,278
December.....	37	95,328	11	30,713	48	126,041
Total.....	200	514,158	54	254,927	254	769,085
1944						
January.....	45	72,342	10	35,874	55	108,216
February.....	39	84,053	14	40,849	53	124,902
March.....	67	178,419	22	78,031	89	256,450
April.....	31	73,075	4	10,108	35	83,183
May.....	40	95,852	23	66,387	63	162,239
June.....	38	93,322	18	49,060	56	142,382
July.....	33	51,184	17	55,428	50	106,612
August.....	36	73,200	18	28,688	54	101,888
September.....	44	103,497	22	81,724	66	185,221
October.....	42	75,520	18	69,155	60	144,675
November.....	43	87,536	21	62,295	64	149,831
December.....	41	86,913	17	46,691	58	133,604
Total.....	499	1,074,913	204	624,290	703	1,699,203
1945						
January.....	33	82,404	14	31,015	47	113,419
February.....	35	99,642	11	40,730	46	140,372
March.....	34	112,823	3	13,906	37	126,729
April.....	14	33,707			14	33,707
May.....	21	66,454			21	66,454
June.....	5	22,481			5	22,481
July.....	13	44,337			13	44,337
August.....	5	12,064			5	12,064
Total.....	160	473,912	28	85,651	188	559,563
Grand total.....	932	2,307,655	294	986,159	1,226	3,293,814

JAPANESE CARGO & TANKER CONSTRUCTION
DURING THE WAR
(QUARTERLY DELIVERIES IN GROSS TONS)



* INCLUDES ONLY MONTHS OF JULY & AUGUST

tanker construction rallied to nearly its January peak in October of 1944 at 577 percent of 1941 production. However, at that time the labor troubles beginning to pervade Japan began to make themselves felt. The drafting of competent men into the Army, their replacement with conscript and part-time labor, and the beginnings of material shortages started the entire shipbuilding industry on the down grade. The production index fell off to 470 in December 1944, 375 in January 1945, and 331 in February. The following table summarizes the relation between construction and losses throughout the war for all merchant shipping.

Construction in the first three months of 1945 was somewhat reduced over the latter part of 1944 on account of growing labor and material shortages, but so were losses—for very

different reasons: there weren't so many ships left to sink, and they had been largely withdrawn to the inner zone, temporarily out of reach of attack.

An important sidelight on Japanese merchant shipbuilding during the war was the standard ship program involving some half-dozen different standard designs from 500-ton F-type to 10,000-ton TL oil tankers. This standard shipbuilding program, conceived in 1939, was not actually begun until late 1942. In 1943 the

Year	Losses	Construction	Percent of losses
	Tons	Tons	
1942	952,965	260,059	27
1943	1,803,409	769,085	43
1st half 1944	1,776,248	877,372	49
3d quarter 1944	959,900	393,721	41
4th quarter 1944	1,098,229	428,110	39
1st quarter 1945	805,332	380,520	47
2d quarter 1945	802,346	122,642	15

FIGURE 47.

program was well underway and constituted 83 percent of all merchant ship production. In 1944 the industry was 97 percent devoted to the production of standard-type ships. However, by their own admission, the Japanese were never quite able to master the mass production of large merchant ships, and although the results were remarkable, by Japanese standards, the volume as shown above fell far short of the goal. Even more important, the quality of vessels produced suffered very considerably from the haste and hysteria which characterized the program. Harbor officials and ship captains tell monotonously similar stories of incessant breakdown of machinery at sea and cargo gear in port. Furthermore, in the interests of simplicity and speed of construction, every possible feature that could be dispensed with was abandoned. Bulkheads were minimized, double bottoms were eliminated. The net result made the product even more vulnerable to submarine, air, and mine attack. The likelihood of a hit resulting in a sinking was greatly increased.

During 1942 the emphasis in construction was on middle-sized ships between 1,000 and 6,000 tons, and 73 percent of the tonnage produced was in this tonnage range. In 1943 the production of the E-type (830-ton ships) was stimulated, and about 70 of these ships were produced. E-type ships were the only size in which the Japanese were able successfully to apply mass-production assembly-line methods. Four special yards were built just to produce these ships. Some additional construction in the large A-type (6,800 ton ships) was accomplished, but the bulk of construction was still in the 1,000-6,000-ton range, 64 percent. Beginning early in 1944 the production of "E" ships was stepped up as well as production of "A" ships. In this year 266 E-type cargo ships were built and 83 A-type cargo ships against only 92 of all other sizes. However, the large numbers of "E" ships are deceptive until the tonnages are examined and it is seen that the great fleet of "E" ships constituted only 24 percent of the tonnage built, while the smaller number of large "A" ships accounted for 51 percent. Although the construction of "E" ships was continued vigorously in 1945, the emphasis was shifted to "A" ships, and in that year "A" ships, the more efficient unit, constituted 66 percent of

the tonnage produced.

The size of ships the Japanese built was significant in several ways. The smaller the ship, the poorer the target it offers and the more attacks are necessary to secure comparable damage to the merchant marine. However, at the same time, the smaller the ship, the greater the investment in national effort and resources, and the greater the cost in fuel and manpower and all other contingent factors, in each ton of freight handled. It is apparent that in addition to the assembly-line production possibilities mentioned above, the abortive emphasis on E-type ships in late 1943 and 1944 was the result of an attempt to spread the target and minimize the effect of each torpedo and bomb reaching a Japanese ship. However, the Japanese must early have seen that the disadvantage of greater cost and lesser effectiveness of these small ships offset the advantage of their being a poorer target and shifted the emphasis in 1943 to the larger, more efficient A-type.

Increased Use and Construction of Kihansen

In addition to these efforts to preserve and augment her oceangoing fleet, Japan early planned to increase her kihansen strength in order to free the greatest number of kisen for the long hauls. In March 1942, all kihansen over 150 grt were transferred to control of the shipping control association, which in turn delegated their operation to 16 operating companies. (In November 1943 kihansen in the home islands between 50 and 150 grt also were transferred to the shipping control association.) At the same time an expanded program of kihansen construction was instituted along lines similar to those established for kisen. Standard designs were prepared, priorities in labor and material were established and an organization was created to coordinate orders and requisitions by the shipyards (Figure 48).

Like most other Japanese plans, results fell short of expectations. The standard designs were not too satisfactory, labor and material shortages appeared despite the priorities, and inexperience and corruption on the part of many shipyards seriously affected the performance of the ships built. Green lumber, green castings and inexperienced supervisors resulted in poor ships. While subsequent emphasis on quality instead of quantity effected marked

improvement in performance, the efficiency of these ships remained far below that of the larger vessels.

A report of the total mobilization bureau summarizes the situation: "Transportation provided by kihansen was lower than planned because of delays in the completion of kihansen, their continued inoperative condition, the decrease in number of kihansen mobilized, and the shortage of fuel." Planned and actual production of kihansen:

Fiscal year	Plan	Results	Percent
	Tons		
1942	16,000,000	16,000,000	100
1943	16,100,000	14,760,000	92
1944	15,960,000	11,790,000	74
1945	2,470,000		

(The drastic curtailment in planned kihansen shipping for fiscal 1945 reflected the severe shortage of distillate fuel, reaching its peak in April 1945.)

At no time during the war was small-boat traffic a very significant factor in Japan's overall shipping situation, although the relative importance of inter-island shipping increased as the volume of Japan's overseas shipping declined.

FIGURE 48.—Construction of kihansen during the war

	70-150 Gross tons		200-500 Gross tons		Total	
	Number	Gross tons	Number	Gross tons	Number	Gross tons
1943						
March	1	100			1	100
April	1	70			1	70
May	5	460			5	460
June	4	420	1	250	5	670
July	22	1,990	1	250	23	2,240
August	46	4,150	9	2,250	55	6,400
September	85	8,690	4	1,000	89	9,690
October	96	9,510	9	2,150	105	11,660
November	100	10,240	1	250	101	10,490
December	86	9,480	14	3,450	100	12,930
Total	446	45,110	39	9,600	485	54,710
1944						
January	51	5,170	7	1,750	58	6,920
February	80	7,130	20	4,650	100	11,780
March	65	4,760	44	9,200	109	13,960
April	52	5,090	7	1,750	59	6,840
May	153	17,160	35	8,750	188	25,910
June	320	34,100	103	25,050	423	59,150
July	236	26,240	88	21,800	324	48,040
August	83	9,460	38	9,350	121	18,810
September	75	8,650	35	8,750	110	17,400
October	78	9,210	27	6,750	105	15,960
November	65	7,390	30	7,550	95	14,940
December	61	7,310	30	7,500	91	14,810
Total	1,319	141,670	464	112,850	1,783	254,520
1945						
January	37	4,600	16	4,000	53	8,600
February	36	4,550	27	6,750	63	11,300
March	69	7,740	35	8,650	104	16,390
April	456	7,300	22	5,500	478	12,800
May	24	2,720	16	4,250	40	6,970
June	32	3,850	17	4,300	49	8,150
July	21	2,370	16	4,000	37	6,370
August	6	900	3	750	9	1,650
Total	681	34,030	152	38,200	833	72,230
Grand total	2,446	220,810	655	160,650	3,101	381,460

About 120,000 grt of kihansen were built in Japan in 1943, about 265,000 in 1944 and about 50,000 in 1945, representing only about 13 percent of kisen construction during this period (Figures 48 and 46). Not only did these amounts fail to fill the gap between kisen losses and kisen construction, but because of the difference in operative efficiency, they represented, in terms of effective transport capacity, only a small fraction of comparable kisen tonnage.

Coincident with the program in Japan a kihansen building program was also begun in the southern area under the direction of the southern Army. In an effort to stimulate local construction, in December 1942 the southern Army was made dependent on such construction for the bulk of its shipping replacements, only damaged kisen able to return to Japan for repair being replaced from the Empire. The plans were grandiose but actual results never ran much over ten vessels a month (exclusive of landing barges), an amount well under southern Army losses. Aggregate tonnage of new kihansen was about 2,000 grt monthly against losses of about 20,000 grt. In addition, the rate of loss was such that it was impossible to maintain more than about thirty operable at any one time. This strength was supplemented particularly in the most forward areas by various sized landing barges. At least by 1944 not more than 150 of the barges were available in the eastern Netherlands East Indies, the area of their principal use.

In the southern area, kihansen and other small craft were used to some extent in the collection of raw materials at central shipping points for transshipment in kisen, but their primary use was in the transport of men and supplies in these forward areas where Allied airpower created an excessive risk to large kisen. The comparative inefficiency of this type of shipping was even more apparent in these operational areas than in the home islands. Further removed from the repair yards, constantly short of spare parts, and operating not only in more open water but also under frequent Allied attacks, the rates of loss and damage were extremely high with little possibility of salvage and poor repair facilities. As the kisen situation tightened, the supply of marine engines formerly shipped from Japan to the southern yards was cut off, virtually stopping new con-

ARMY, NAVY, AND CIVILIAN CARGO AND TRANSPORT FLEETS

(GROSS TONNAGE OF SHIPS AFLOAT)

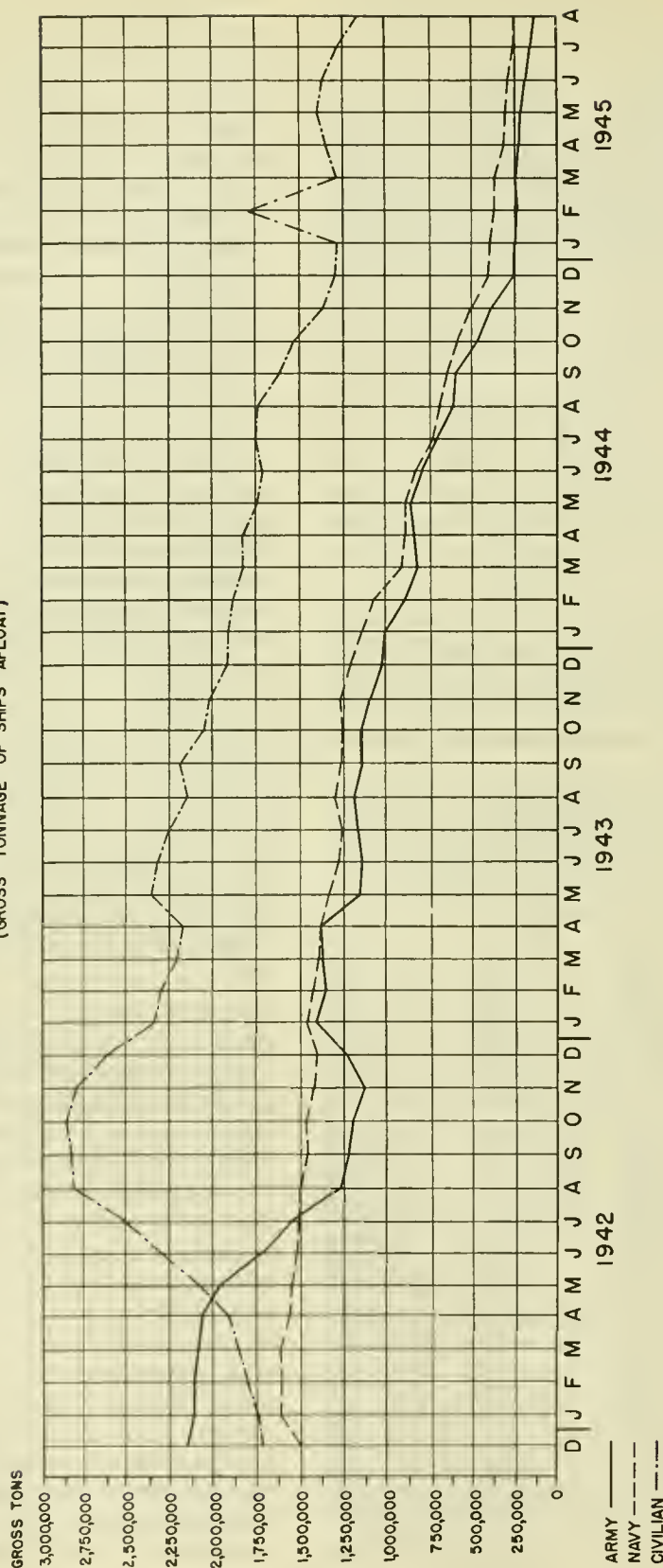


FIGURE 49.

struction. Further, although the southern area was rich in oil, sufficient shipping could not be spared for its local distribution, and front line operation even of the few boats available was seriously curtailed. By 1944 the situation had become so acute that even with top priority on available local shipping it had not been possible to move two divisions from the Ambon area to Singapore in six months' time.

ARMY-NAVY Vs. CIVILIAN SHIPPING

Pearl Harbor to Guadalcanal.—As described elsewhere, one of the most important features of the Japanese preparations for war was a very intensive requisitioning of ships by the Army and Navy. This activity began in earnest in July 1941, and in the 5 months preceding Pearl Harbor 2½ million tons of civilian shipping, the cream of the merchant marine, were taken by the Army and Navy. Japan entered the war with her merchant fleet distributed approximately as follows: Army, 2,163,000 tons; Navy, 1,899,000 tons; civilian, 1,934,000 tons. The approximate size of these various fleets during the war is shown in Figure 49. In the opening months of the war the Army and Navy fleets were devoted entirely to operational uses, and the movement of essential goods for the people and industries in Japan had to be performed by the very much reduced fleet available to civilian control. It was understood and well known by all concerned that this tonnage for civilian use was entirely inadequate to meet the needs of the Japanese economy. It was therefore expected and promised that the bulk of the 2½ million tons taken by the military in the latter part of 1941 would be returned to civilian control immediately after the completion of the initial plan of conquest. This expectation is further evidence of the wishful thinking of the Japanese that they were not about to engage in a long war but a quick, painless, and uncontested occupation of the territories they sought.

At what point in the war the Japanese were awakened to reality is hard to estimate, but it was plain early in 1942 that the return of any substantial portion of the 2½ million tons was out of the question. Two factors operated to prevent this. The ease with which the initial military successes were gained encouraged the

Japanese to improvise an extension of the original occupation plan calling for further unanticipated commitments farther and farther afield, increasing in geometric proportion their need for bottoms. At the same time the damage suffered by the merchant marine exceeded all expectation. In the first 4 months of the war the Army and Navy together suffered sinkings and serious damage totalling nearly 700,000 tons of shipping (Figure 28).

In the face of these events the program of returning ships to civilian control was so reduced as to be almost ineffective. The Navy made no real effort to return any ships to the civilians. On the contrary, during the first nine months of the war the Navy requisitioned 295,000 additional tons, while releasing only 55,000 tons (mostly damaged or unsuited to Naval service). The net loss to the naval service from the civilian pool was about 240,000 tons. During the same period the Army, which apparently had quite an ample fleet as of Pearl Harbor, only requisitioned two more ships. Beginning in April, "because of the termination of the operation of the first period," the Army made a determined effort for 5 months to get ships back to the civilian pool. About 721,000 tons were released.

Meanwhile in accordance with the over-all plan to begin the movement of essential raw materials from the southern area back to Japan, a gesture was made by the Army toward utilizing some of the space in their ships returning from Singapore. After April 1942, a total of some 460,000 gross tons of shipping space was utilized this way. This amounted to an estimated 85-90 percent of the Army cargo space returning from areas where civilian shipments for Japan were waiting to be loaded.

Between the Army and Navy requisitioning and releasing, the civilian cargo shipping pool made a gain from Pearl Harbor to Guadalcanal of 550,000 tons. At the same time war losses from the civilian pool (not yet subjected to heavy attack) were considerably less than those sustained by the fleets of the services. In the first nine months of the war the civilian shipping pool lost only about 209,000 tons of cargo ships sunk or seriously damaged. Meanwhile the product of the shipyards was almost entirely allocated to the civilian pool where the shortage of bottoms was most acute. A total of

181,000 tons was built in this period. The approximate arithmetic of the factors contributing to the size of the civilian shipping pool is summarized herewith.

Pearl Harbor to Guadalcanal

[Tons of Cargo and Transport Ships]

Navy requisitions	-192,162
Navy releases	+35,649
Army requisitions	-11,402
Army releases	+721,380
Civilian shipping sunk	-107,013
New construction	+181,662
Captures	+561,180

Approximate net gain to civilian shipping pool	+1,189,294
--	------------

This first phase of the war, therefore, although it resulted in an over-all reduction in the Japanese merchant fleet, left the civilian shipping pool in a vastly improved condition with about 2½ million tons of serviceable cargo shipping under the control of the shipping control association. This was the peak of their fleet.

The Repercussions of Guadalcanal.—The reverses at Guadalcanal and the shipping lost by the Army and Navy in prolonged efforts to throw back the first dent made in their line, (Figure 29) was the beginning of the end of the civilian merchant marine. During the next phase of the war, from September 1942 through March 1943, the civilian shipping pool lost heavily. In November and December the Army requisitioned moderate numbers of ships to replace their own losses which were becoming considerable. Neither the Army nor the Navy released any considerable number of ships, and it is to be assumed that those to be released were more in the nature of rejects. Meanwhile, civilian shipping losses mounted, and while the rate of new construction had also begun to rise under the stimulus of Navy management in the fall of 1942, the net result was a terrific loss to the civilian cargo shipping pool as summarized herewith:

September 1942 through March 1943

[Tons of Cargo and Transport Ships]

Army requisitions	-515,599
Army releases	+4,422
Navy requisitions	-173,162
Navy releases	+28,065
Civilian shipping sunk	-191,791
New construction	+192,042
Captures	+77,741

Approximate net loss to civilian cargo shipping pool	-578,282
--	----------

At the very time that the need for Guadalcanal reinforcement was greatest, the growing necessity for increasing southern area imports was felt. In this see-saw of conflicting needs the Army reluctantly transferred to Formosa and the Philippines (where they could do double duty in hauling military goods out and returning with civilian necessities) ships which might have been used for the evacuation of the Solomon's garrisons.

These disasters left the shipping control association in the spring of 1943 with about 1,800,000 tons of serviceable cargo ships, little more than the "temporarily" reduced fleet with which they began the war. The plans and potentialities of the Japanese war effort, depending entirely on shipping as a measure of their capabilities, had been held in check by the shortage of civilian shipping from the start. The directors of this pool had submitted patiently to the extravagant requisitioning of tonnage on the eve of war on the promise that the bulk of their tonnage would quickly be returned to the normal channels of supplying the wants of industry and the people. When this did not happen as rapidly as expected in the opening phase of the war, they were nevertheless content, as a very substantial improvement over Pearl Harbor was made. However, the disaster in the Solomons combined with the steady attrition elsewhere put an entirely new face on the situation. The shipping control association found its fleet not increasing slowly, but shrinking disastrously toward the irreducible minimum with which they entered the war. The seriousness of the situation was such that the civilian leaders were able to prevail upon the war council to limit the tonnage of the military and effect an immediate transfer of ships to the shipping control association. An arbitrary ceiling of 1,150,000 tons was placed on the size of the Army's cargo fleet (a drastic and significant reduction from the 2,150,000 tons with which the Army began the war). In line with this decision the Army immediately returned to the civilian shipping pool something in the neighborhood of 180,000 tons. For the next ten months the Army took as a share of new construction only enough to compensate for losses. The Navy was apparently able to avoid this arbitrary reallocation of ships. No significant releases were made by the Navy at this time.

1943: The Beginning of Disintegration

Meanwhile losses from all causes to the ships of the Army, Navy and shipping control association continued to mount disastrously as more and more submarines patrolled the Japanese sea lanes. In the summer and fall of 1943, Army and Navy requisitions took increasingly large portions of the available shipping. Combined Army and Navy losses in the last 7 months of this year were in the neighborhood of 750,000 tons. In partial compensation both services requisitioned all the ships they could get their hands on in the face of mounting resistance by the civilian forces in the government. Having control of the shipbuilding industry, the Navy fared somewhat better in getting new ships than did the Army. Meanwhile, the Navy made substantial releases of tankers during the period, not so much because they were damaged or unserviceable, but more probably because of the shift in administration of the oil-importing fleet. Army and Navy requisitions of cargo ships nearly equaled the total output of the shipyards so that the net results to the civilian shipping pool was approximately equal to their losses.

April through December 1943 [Tons of Cargo and Transport Ships]

Navy requisitions	-264,475
Navy releases	+27,402
Army requisitions	-173,296
Army releases (180,000 tons in April)	+196,912
New construction	+385,126
Civilian losses-sunk	-496,695
Captures	+73,121
Approximate net loss to civilian cargo fleet	-251,905

Thus we find that in spite of the pressure which was put on the government in the spring and the brief resultant flurry of solicitude for the needs of civilian shipping, the year 1943 closed with the civilian cargo pool reduced to less than two million tons afloat and only about 1,500,000 tons in a serviceable condition.

During this year new factors began to interfere with the Army's ability to return raw materials from the southern area. With the institution of the convoy system the urgent desire to maintain schedules frequently resulted in curtailment of loading to meet convoy sailing dates. As a result, not only were Army ships diverted from the Singapore run to meet the tactical needs of succeeding campaigns, but the

average utilization of Army cargo space returning from Singapore dropped to about 80 per cent. During 1943 not more than 90,000 gross tons of Army shipping all told participated in the return movement of "mobilization goods."

In the latter part of 1943 and early 1944 a typical Japanese paradox existed in the declining utilization of the few Army ships in a position to bring in "mobilization goods," while at the same time the shipping control association was urging the overloading of civilian ships and in March 1944 instituted special bonuses for extra loading of heavy cargo and for deck loading of ships carrying light bulky cargo in order to utilize available dead-weight capacity. Bonuses were also provided for extra fast trips, cleaning of ships bottoms and boilers, and other measures tending to increase the transport capacity of ships on hand. In July 1944 the maximum load line on all civilian ships was raised, and ship owners were directed to remove all miscellaneous weight on board within the limits of safe navigation.

1944: The Breakdown of the Three Separate Fleets

The year 1944 saw the Allied attack against shipping reach its peak. In February alone when submarine sinkings reached a new high of a quarter of a million tons in one month and carrier planes sank 186,000 tons of shipping at Truk, a total of over one-half million tons of shipping was sent to the bottom. Under the impact of these terrific blows the orderly system of requisitioning and releasing and attempting to maintain order in each of three separate autonomous fleets began to disintegrate. After February the Army was no longer able to maintain its cherished ceiling of 1,150,000 tons which, in the face of all losses, it had held for ten months. The Truk, Palau and Saipan air action supplementing the ever-increasing submarine activity had eliminated the possibility of any orderly maintenance of separate fleet status. In the first eight months of 1944, prior to the opening of the Philippine action, a total of 2,300,000 tons of shipping was sunk. In the face of such colossal losses, even the tremendous new construction in the same eight months of over 1,000,000 tons of ships left a deficit so great that any attempt equitably to distribute the loss between Army, Navy, and civilian fleets was impossible. However, the power of the

shipping control association in the government had so increased that they were able to keep a lion's share of the new construction and absorb a comparatively small share of the net loss. The first of September 1944 found the serviceable cargo fleet of the shipping control association still in excess of 1,100,000 tons, about 79 percent as big as it was on Pearl Harbor day, whereas the Army and Navy cargo and transport fleets had shrunk under the impact of attack and civilian demands at home to 28 percent and 43 percent respectively, of their Pearl Harbor tonnages.

January through August 1944

[Tons of Cargo and Transport Ships]

Navy requisitions	-303,661
Navy releases	+4,941
Army requisitions	-269,263
Army releases	+11,353
Civilian losses—sunk	-436,557
New construction	+721,447
Captures	+20,483
Net loss to civilian cargo pool.....	-251,257

During the summer of 1944 the Marianas campaign interrupted the Army's efforts to supplement civilian shipping imports, but after the campaign was abandoned, attention was again concentrated on coordinating the joint task of supply and import between Japan, Formosa, the Philippines, and the southern areas. In this the dwindling Army fleet was assisted by the temporary diversion of 200,000 tons of civilian shipping from the inner zone. From July to September Army, Navy and civilian ships cooperated in carrying troops and supplies to the Philippines and in bringing back urgently needed raw materials.

The importance attached to the attempt to make the Army and Navy fleets do double duty appears in the report of the total mobilization bureau at the end of 1944 in the statement that "the amount of assistance from 'A' and 'B' shipping directly affected the progress of the war." Their relatively minor contribution to the "mobilization of goods" is shown in the following table:

Fiscal year	Tonnage moved in "C" ships	Tonnage moved in "A" and "B" Ships	Percent of total
1942	39,405,490	12,100,000	5.3
1943	29,318,051	11,120,000	3.8
1944	11,264,408	11,590,000	14.1

¹Actual
²Planned

(Actually, from incomplete statistics available it appears that "A" and "B" ships did not move over 1,000,000 tons of mobilization goods in fiscal 1944.)

On the eve of the Philippine campaign the remaining Japanese merchant marine of about 3,700,000 tons was distributed approximately as follows:

	<i>Afloat 1 September 1944</i>
Army—Cargo ships and transports	605,060
Navy—Cargo ships and transports	665,000
Civilian—Cargo ships and transports	1,600,000
All tankers	830,000
Total	3,700,000

(Because tankers were not under the control of the shipping control association and the intensive tanker construction program had not gotten underway until well into 1943, their status as between Army, Navy and civilian fleets was not so clear-cut.)

The change in the relative situations of Army, Navy, and civilian fleets from Pearl Harbor day until late summer 1944 is very illuminating. At the outset of the war when Japan's cargo and transport fleet amounted to nearly five and one-half million tons, only 32 percent was left to civilian control, the remainder being devoted to military operations. After over two and one-half years of war and tremendous losses, the civilian portion of the fleet had shrunk but its relative share of tonnage afloat had increased to 55 percent. A small factor in this changed situation is the fact that the military with a considerably shrunken sphere of operations had less need for bottoms than in their hey-day in the spring of 1942. However, it is believed that the major reason for this shift in policy was a deliberate act on the part of the Japanese government, sacrificing military potential at the perimeter of empire in order to preserve the maximum possible industrial potential at home, and to import the food necessary to sustain the population.

The Philippine campaign in September, October, and November 1944 cost Japan about 1,300,000 tons of ships. At a time when her production of ships had passed its peak (during these three months only 480,000 tons of ships were built) this campaign ended all semblance of an orderly maintenance of separate fleets. Japan ended the year with only about two and

three-fourths million tons of all merchant ships afloat, of which only about 75 percent were in serviceable condition. The utmost efforts were made to use Army and Navy ships for movement of vital imports, and civilian ships were temporarily devoted to military service as needed. As early as the late summer of 1944 the civilian branch of the government had been pressing for the consolidation of all shipping services under one authority, but the Army and Navy, enjoying the special privileges pertaining to the armed services, resisted these attempts, and nothing was accomplished in 1944.

Submarine Transport

Beginning with her defeat in the Solomon's campaign Japan realized an increasing need for transport submarines. As allied air strength in the Solomons area increased, reinforcement of those garrisons by surface vessel became impossible, and the Army appealed to the Navy for submarine transportation. The Navy opposed such use of her underseas fleet since Japan had no specially designed submarines for cargo carrying and the use of combat-type ships would seriously reduce the striking power of the submarine force. Navy opposition was overcome, however, as the need for such transport became increasingly apparent.

During 1943 ordinary combat submarines were used with a cargo capacity not much over 100 tons¹, but in 1944 and 1945 one-half of the submarine building capacity was devoted to the construction of specially designed transport submarines, some of which could carry over 1,000 tons of cargo².

During the course of the war submarines were used to supply the garrisons on New Guinea, Truk, Rabaul, the Marshalls, Wake, Nauru, Ocean, Marcus and other Pacific islands cut off by the Allied advance. In the closing months of the war elaborate plans were made for blockade-running of oil and other critical materials from the southern area to Japan by transport submarine but the Navy considered the results to be achieved negligible, and only two trips were actually made.

¹ The larger part of this had to be carried in waterproof containers fastened outside the hull.

² Twenty-four of these ships were built during 1944 and 1945, one of 2,690 tons, 13 of 1,470 tons and 10 of 370 tons. Some of these ships were built specifically for the Army and some soldiers were sent for training to Navy submarine schools.

A separate phase of submarine transport consisted of the exchange of Japanese rubber, gold, tin and other eastern commodities for German technical plans, models and critical electronic items by long-range cargo submarines. Attempts were made early in the war to run the Allied blockade between Germany and Japan by fast surface vessel but the results were so unsatisfactory that after 1943 German-Japanese traffic was limited to submarine transport, 5 or 6 Japanese and probably about a dozen German submarines being used. Three of four of the Japanese submarines and a larger number of the German submarines engaged in this traffic were sunk, most of them by Allied submarines. Early in 1945 Japan tried to persuade Germany to devote the larger part of its submarine fleet to this traffic but Germany refused to divert her long-range submarines from offensive operations against Allied shipping.

Diversion of Traffic from Ships to the Railroads

By the latter part of 1942 the failure of the Army and Navy to return to civilian use a substantial portion of the shipping "temporarily" requisitioned for the initial war campaigns reinforced by the additional requisitions compelled by the losses in the Guadalcanal campaign, finally convinced the Japanese that any hope of immediate large increase in shipping available for handling industrial imports was vain. In an effort to alleviate this continuing shortage, the policy of shifting bulk traffic from water to rail haul was initiated and applied with increasing emphasis throughout the war (Figure 50, A and B).

This transfer generalized itself into two broad categories: (1) The all-rail haul of commodities from origin point to destination in place of the former method of rail movement to the nearest port for a water haul to a port near the destination where the freight was then transferred to the rails for the remaining movement; and (2) the unloading of ships at ports considerably distant from the consuming area and their further movement by rail to the latter areas. The most important phases of this activity are described in detail herewith.

Freight Traffic Between Hokkaido and Honshu

In describing freight traffic between Hokkaido and Honshu during the war it is conven-

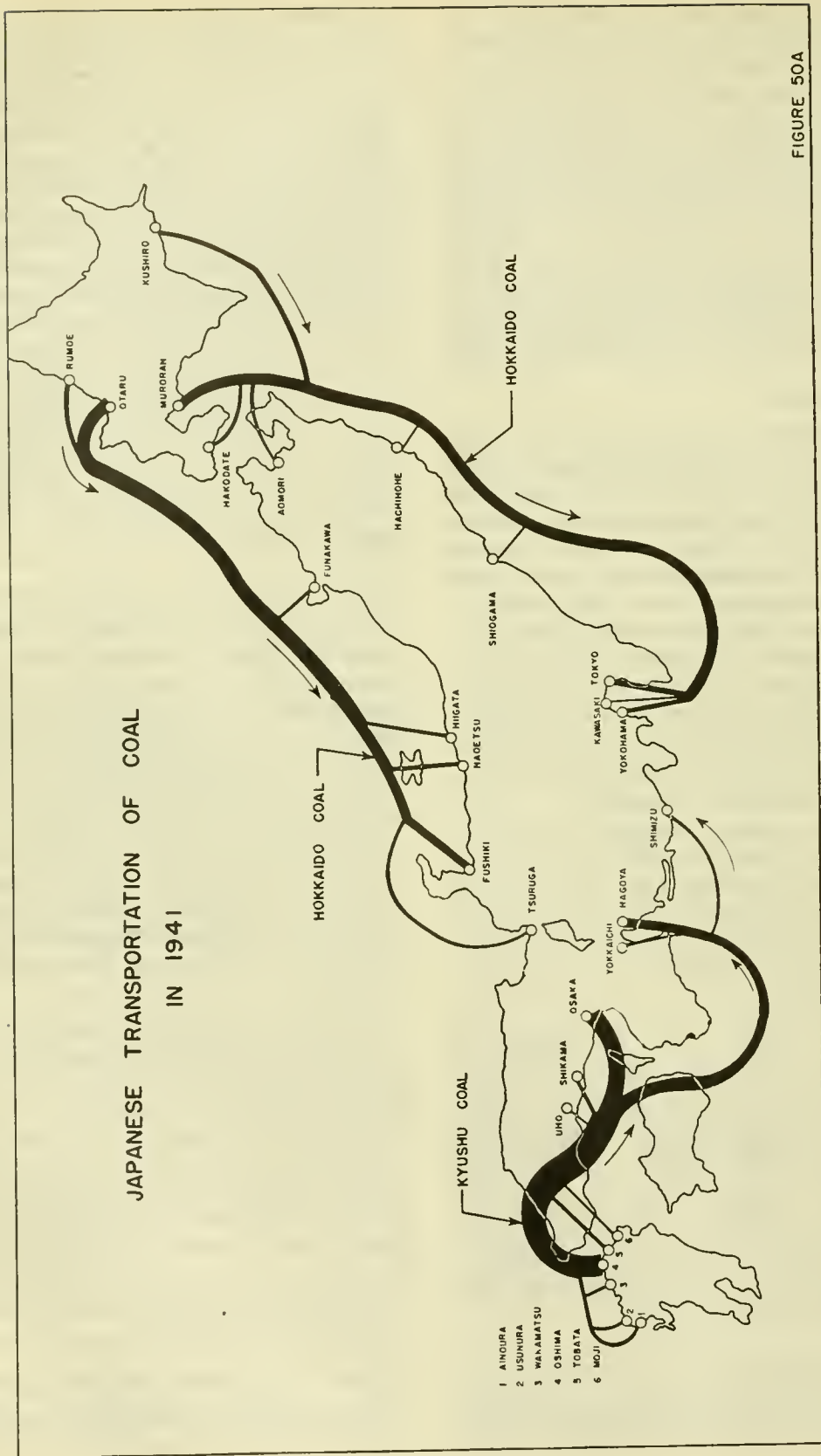




FIGURE 50A

JAPANESE TRANSPORTATION OF COAL AFTER 1941

LEGEND

-  KYUSHU COAL
-  HOKKAIDO COAL

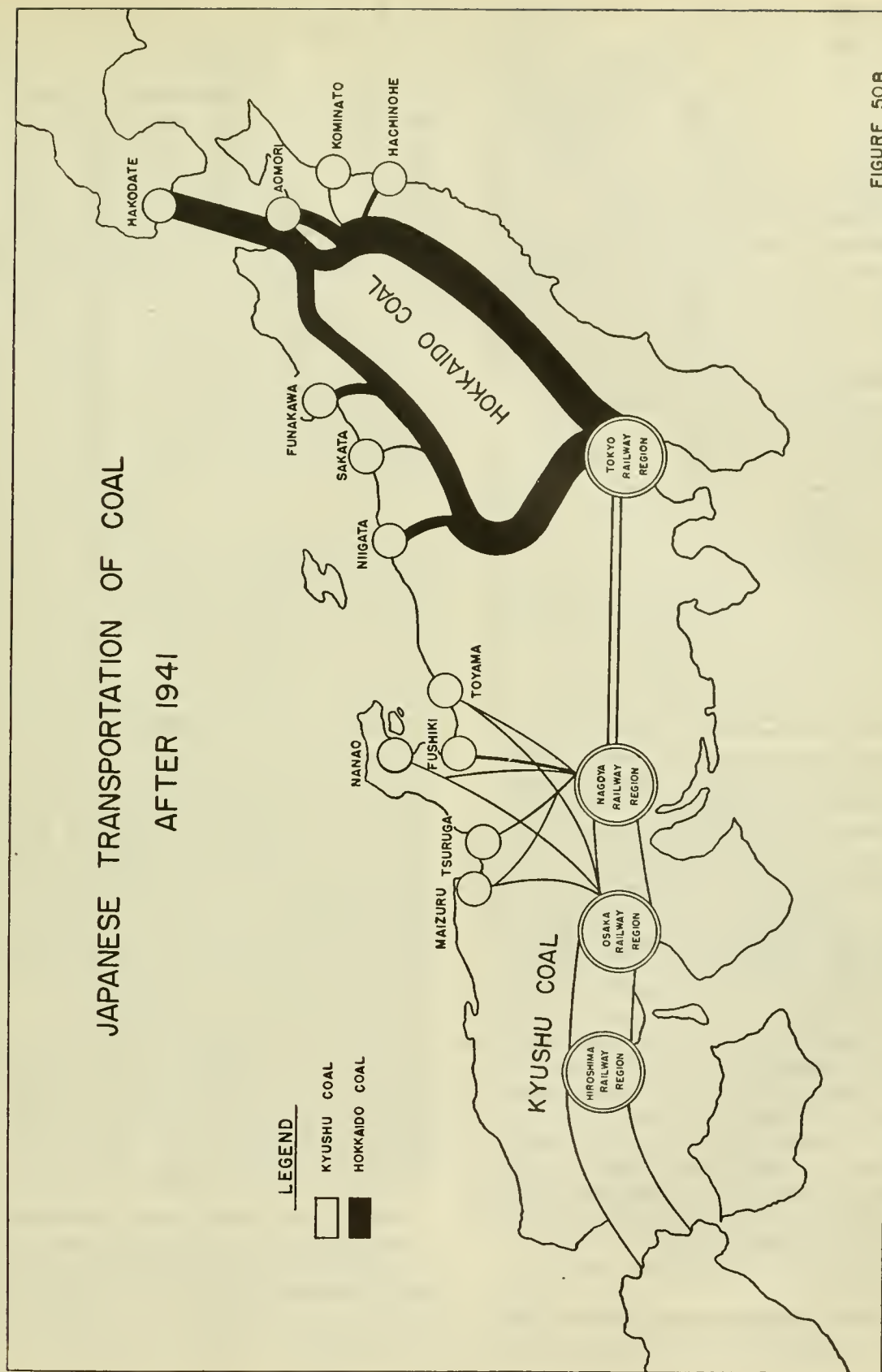


FIGURE 50B

FIGURE 51.—Coal shipments from Hokkaido to Honshu, by steamship, other vessels, and rail ferry, fiscal years 1941-42 to 1945-46

Period	By steamship			By other vessels			By rail ferry			Total		
	Tons (000)	Percent of Total	Percent of 1942-43	Tons (000)	Percent of Total	Percent of 1942-43	Tons (000)	Percent of Total	Percent of 1942-43	Tons (000)	Percent of Total	Percent of 1942-43
Fiscal 1941-42	7,192	98.1	92.9	124	1.7		13	0.2		7,329	100	89.5
Fiscal 1942-43	7,741	94.5	100.0	330	4.0	100.0	117	1.4	100.0	8,188	100	100.0
Fiscal 1943-44:												
First period	1,480	87.8		89	5.3		117	6.9		1,686	100	
Second period	1,023	81.1		119	9.4		120	9.5		1,262	100	
Third period	1,474	85.5		121	7.0		129	7.5		1,724	100	
Fourth period	1,652	77.9		234	11.0		236	11.1		2,122	100	
Total	5,629	82.8	72.7	563	8.3	170.6	602	8.9	514.5	6,794	100	83.0
Fiscal 1944-45:												
April	526			142			77			745		
May	218			130			125			473		
June	49			131			118			298		
Total, first period	793	52.3		403	26.6		320	21.1		1,516	100	
July	44			149			124			317		
August	274			136			157			567		
September	250			90			140			480		
Total, second period	568	41.6		375	27.5		421	30.9		1,364	100	
October	264			114			135			513		
November	338			111			141			590		
December	339			68			110			517		
Total, third period	941	58.1		293	18.1		386	23.8		1,620	100	
January	269			67			83			419		
February	273			53			86			412		
March	313			133			138			548		
Total, fourth period	855	60.4		253	17.9		307	21.7		1,415	100	
Total	3,157	53.4	40.8	1,324	22.4	401.2	1,434	24.2	1,225.6	5,915	100	72.2
Fiscal 1945-46:												
April	326			132			118			576		
May	335			125			135			595		
June	165			94			138			397		
Total, first period	826	52.7		351	22.4		391	24.9		1,568	100	
July	189			86			75			350		
Annual rate, 4 months	3,045	52.9	39.3	1,311	22.8	397.3	1,398	24.3	1,194.8	5,754	100	70.3

ient first to describe the coal traffic and then to deal with all other traffic collectively. This is the case for two reasons. First, it was the coal traffic which accounted for the bulk of the trade, which was of special importance to Japan, and which from the Allied point of view was the primary target. Second, since the coal traffic was so vital to Japan and was so closely controlled, fairly complete data with respect to it are available. For products other than coal, on the other hand, it is possible only to rely upon general observations by the Japanese that their movement constituted certain fractions of the coal movement and to fill in the most important details from fragmentary data of many types. Figure 51 is reproduced from the report on basic materials and gives a summary view of the trend of total movement of coal during the war and of the relative importance of the marine and rail facilities used.

Coal Shipments

Via Kisen.—As Figure 51 shows, on an annual basis, the fiscal year 1942-43 marks the peak

of total shipments. In that year about 7.7 million tons were moved, about 7.6 percent more than the 7.2 million tons moved in the previous year. The 1943-44 fiscal total of 5.6 million tons was off 27.4 percent from the peak and the 1944-45 fiscal total of 3.2 million tons was off 59.2 percent from the peak. During the last four full months of the war the movement by kisen was at an annual rate of 3.0 million tons, off 60.7 percent from the peak.

Monthly data, (which do not check exactly with the quarterly data in Figure 51 but which are believed, nevertheless, to be generally reliable) indicate that within the peak year 1942-1943, the peak month was March 1943, when about 867,000 tons of coal were moved.

Importance of Individual Kisen Loading Ports

Among the loading ports there were significant differences in the trend of shipments. For the entire war period Muroran accounted for about 46 percent of the total, and this figure may be taken as typical. The range for individual quarters was from 38.4 percent (April-

June 1943) to 59.5 percent (January-March 1945). Shipments from the neighboring port of Hakodate were inconsequential.

The second most important loading port was Otaru, which, for the entire war period accounted for 32 percent of total shipments. While the quarter-to-quarter changes in this percentage were wide, making it difficult to establish a trend, it is clear that although shipments from this port declined in absolute terms they declined less rapidly than total shipments from the island. (It should be noted that Otaru, on the west coast of Hokkaido, was relatively free from submarine blockade.) Thus, in the first five months of 1945, shipments from Otaru were 71 percent as large as they were in the first 6 months of the war, but in the later period they accounted for 38 percent of total shipments and in the earlier period for 26 percent of total shipments.

Kushiro, the Hokkaido port most exposed to submarine attack, was the port from which shipments declined most rapidly. At the beginning of the war they totalled about 350,000 tons per quarter, or 20 percent of the total. In the last three months of 1943 and the first 3 months of 1944 they reached about 400,000 tons. Thereafter they declined precipitously and after May 1944, ceased entirely.

A general and significant sequence of events may be observed in the facts just noted: Kushiro was an exposed port, isolated in the eastern part of Hokkaido: its natural markets were Honshu ports facing the Pacific ocean. Shipments from this port fell off first and most rapidly. Muroran, the largest port, is favorably located in southern Hokkaido. Its natural markets were the Honshu cities facing the Pacific but it was also favorably located for shipments to ports on the Sea of Japan. The decline in shipments from this port generally paralleled the decline in total shipments from Hokkaido. Otaru is the principal port on the west coast of Hokkaido and its natural outlets are Honshu ports on the Sea of Japan. Exports from Otaru fell off less than did those from the other major shipping ports.

Importance of Individual Ports of Destination

In addition to a 60 percent decline in coal from Hokkaido by kisen, a pronounced shift took place in ports of destination. This involved

the progressive curtailing of the long runs down the Pacific ocean coast of Honshu and the shifting of the burden to north Honshu ports on both the eastern and western sides of the island, principally the latter, away from the submarine-infested Pacific.

In the first year of the war something in the order of three-fourths of the outbound Hokkaido coal went down the Pacific ocean coast of Honshu, consisting of the bulk of that shipped from Muroran and Kushiro, and of smaller fractions of that shipped from Otaru and Rumoi. Of this coal about 25-30 percent went to ports south and west of Tokyo, principally to Osaka, Kobe, Nagoya and Shimizu. The largest fraction, accounting for 50-55 percent, went to the Tokyo area. The remaining 20 percent went to scattered ports on both coasts of northern Honshu.

The traffic for points beyond Tokyo was the first to suffer, the break coming in the first three months of 1943. In this quarter, in which as noted above total shipments from Hokkaido reached an all-time peak, shipments to ports beyond Tokyo fell by one-third as compared to the preceding quarter, accounting for less than 20 percent of the total coming down the Pacific coast. By the end of 1943 they had dwindled almost to nothing.

Shipments to the Tokyo bay area held up well for a few months longer, or until May 1943. By the July-September quarter of 1943 they were down to about 30 percent of the total coming down the coast and may have totalled 250,000-300,000 tons for the 3 months. After holding at this rate through February 1944, shipments measured both in absolute terms and as a fraction of Hokkaido shipments declined rapidly.

Shipments by kisen to Pacific coast ports north of Tokyo were of little consequence. At the beginning of the war they ran to 125,000 tons per quarter. By the last 3 months of 1943 they were down to 80,000 tons. In the first 3 months of 1945 they reached a peak of about 300,000 tons. Since a large fraction of this coal was used locally at the Kamaishi Iron Works, the amount of diversionary traffic loaded on the railroads for further movement south was small.

With respect to kisen shipments to Honshu ports on the Sea of Japan, it is clear that there

was a diversion in the sense that a constantly increasing fraction of a constantly decreasing total was routed in this direction. The trend of total tonnage shipped to these points was more complex. As noted above, at the outbreak of the war about three-fourths of all coal shipped by kisen went down the Pacific coast of Honshu and about one-fourth or 400,000 to 500,000 tons per quarter, went to ports on the Sea of Japan. The latter fraction may have increased to about one-third and the total to 800,000-900,000 tons by the first 3 months of 1943. Thereafter, down to the end of the war the fraction increased, finally reaching about one-half in the first 3 months of 1945 but the absolute total declined to about the 450,000-ton level. In the second 3 months of 1945, with Tokyo shipments almost abandoned and those to points north of Tokyo drastically reduced, ports on the Sea of Japan accounted for three-fourths of the total, or about 625,000 tons.

Railborne Coal Movements

The fact that kisen afforded by far the most efficient means of moving Hokkaido coal to Honshu may be made clear by noting that in the fiscal year 1942-43, when the normal pattern of traffic was relatively undisturbed, they handled about 95 percent of the total of 3.2 million tons shipped.

	Tons	Percent
Kisen.....	7,741,000	94.6
Kihansen.....	330,000	4.0
Rail ferry.....	117,000	1.4
Total.....	8,188,000	

Traffic in small vessels was confined to miscellaneous shipments for local use in north Honshu towns. Rail ferry traffic consisted mainly of coal moved by the railroads for their own use. There was substantially no long-haul rail movement, whether the coal was carried across Tsugaru Straits by ferry or small craft. Given this condition, it is evident that the extent to which these latter facilities absorbed the burden from the kisen may for practical purposes be measured by noting the increase in the load which they carried.

It may further be noted that, as explained in detail in the report on basic materials, transportation facilities were able collectively to move from the mines and to the local and Hon-

shu markets all coal that was produced. The growth of diversionary rail movement was gradual, and annual data drawn from Figure 51 are sufficient to show the trend.

Coal shipments from Hokkaido to Honshu, fiscal years 1941-42 to 1945-46

Fiscal year	[In thousands of tons]						Total	
	Kisen		Kihansen		Rail ferry			
	Ton-nage	Per-cent	Ton-nage	Per-cent	Ton-nage	Per-cent	Ton-nage	Per-cent
1941-42	7,192	98.1	124	1.7	13	0.2	7,329	100
1942-43	7,741	94.6	330	4.0	117	1.4	8,188	100
1943-44	5,629	82.8	563	8.3	602	8.9	6,792	100
1944-45	3,157	53.4	1,324	22.4	1,434	24.2	5,915	100
1945-46 (4 mos.) ..	1,015	52.9	437	22.8	466	24.3	1,918	100
Annual rate.....	3,045	52.9	1,311	22.8	1,398	24.3	5,754	100

Through the entire war period, small vessels and the Hakodate-Aomori rail ferry were of approximately equal importance as a means of moving coal across Tsugaru Straits. Between them they accounted for nearly one-half of the total shipments from Hokkaido in the fiscal year 1944-45, and in the first four months of 1945-46. After reaching the Honshu side of the Straits, nearly all of the coal was moved south by rail. The amount involved approached 2.7 million tons and constituted a major burden upon the railroads of Honshu. By 1944 kisen had been relieved of more than half of the coal transport load they had carried in 1942 in this service.

Traffic in Products Other Than Coal

In addition to coal, Hokkaido shipped to Honshu important quantities of iron and steel, lumber, pulp, potatoes, fish and other products. Collectively these products accounted for about 25 percent of the total southbound freight. The discussion which follows summarizes the available information on the importance of kisen, kihansen and the rail ferry in moving this traffic.

Kisen Freight.—Kisen traffic in products other than coal followed closely the trend of coal shipments. For Muroran, which was the most important shipping point for products other than coal (as it was for coal), these products accounted for about 25 percent of the total. For other ports, taken together the percentage was in the order of 15 percent. For Hokkaido as a whole the percentage was about 20 percent. On this basis, kisen carried about 1.5 million tons in 1942, 1.25 millions tons in 1943, 800,000 tons in 1944, and 250,000 tons in the first 4 months of 1945 (an annual rate of 750,000 tons).

Kihansen Traffic.—Shipments in small vessels were a minor factor throughout the war. Kihansen operating from Hakodate were concentrated in the coal trade. Muroran was the only other port from which these vessels had a relatively short haul in waters at least somewhat protected. Shipments from this port totalled only 125,000 tons in the peak fiscal year, 1944–1945.

Traffic via Rail Ferry.—The rail ferry was a most important factor in handling miscellaneous freight. Through the 1943–44 fiscal year, when 8 boats were in operation, the total was nearly 1 million tons, or 80,000 tons per month. The addition of a ninth ferry in March 1944 did not increase this miscellaneous tonnage because of increased emphasis on coal shipments. The addition of two ferries in July and October permitted an increase to 60,000 tons per month which held to the end of the war.

It is convenient to distinguish two features of the indirect effect of the progress of the war on freight traffic between Hokkaido and Honshu. First, the over-all attrition of the Japanese merchant marine had a pervasive effect upon all shipping movements. The Hokkaido-Honshu traffic was considered by the Japanese to be especially vital to the maintenance of economic activity, and an effort was made to keep kisen in this trade despite increasingly strong competing demands for their use. Second, the activity of American submarines off the Pacific coast of Honshu imposed a specific hazard along the principal shipping lane between Hokkaido and Honshu. It was this hazard which led to the shifting of the traffic to ports on the Sea of Japan.

Traffic Between Kyushu and Honshu

The analysis of traffic between Kyushu and Honshu will follow the same general pattern as that between Hokkaido and Honshu. In the latter case as in the former, coal was by far the most important commodity and in addition is the only commodity for which complete data are available. The coal traffic will be discussed in some detail and such comment will be made on traffic in products other than coal as the fragmentary data available make possible.

The data forming the framework for the discussion of coal traffic are drawn from the report on basic materials and are shown in Figure 52.

The Kanmon Tunnel.—Prior to June 1942, when the first single track tube of the Kanmon tunnel was opened, primary reliance was placed upon kihansen. These carried about 10 million tons of the annual total 13.8 million tons. Kisen accounted for 3.3 million tons and rail movements over the now-abandoned Komorie-Shimonoseki rail ferry for 400,000 tons. With the opening of the Kanmon tunnel, coal shipments by rail totalling 1.9 million tons in the fiscal year 1942 and 4.4 million tons in the year 1943 were made possible. Between October 1943 and June 1945, shipments were remarkably stable in the range of 400,000 to 490,000 tons per month. The total for 1944–45 was 5.5 million tons.

In October 1944 a second tube was opened. It is a somewhat remarkable fact that the tonnage of coal moved through the two tubes was no greater than it had been previously through the single tube. It seems clear that tunnel capacity was not the limiting factor on coal movement by rail, but rather that the capacity of the mines had declined by the time the second tube was completed. Of the total Kyushu and Honshu coal movement, the tunnel accounted for the following percentages:

	Percent
1941–42	3.2
1942–43	30.3
1943–44	45.5
1944–45	60.9

Water transport.—The trend of traffic handled by water, other than by kisen, was downward throughout the war, the annual totals for the years 1941–44 being 10 million, 9.9 million, 8.7 million and 4.6 million tons. Comparable totals for kisen movements were 3.3 million, 2.1 million, 1.4 million and 2.0 million tons. From these facts it is evident that the Kanmon tunnel absorbed the burden not primarily from kisen, which actually carried more coal in 1944 than they had in 1943, but rather from the sundry types of small vessels, kihansen and barges. This situation, somewhat surprising in view of the fact that kisen capacity was the short element in the shipping field, is probably to be explained on the following grounds, whose relative importance cannot, however, be assessed. The primary requirement was long-haul movement through the length of the Inland Sea. The impact of the progressive shortage of fuel oil fell with particular severity on kihansen.

FIGURE 52.—Coal shipments from Kyushu to Honshu, by steamship, other vessels, and Kammon Tunnel, fiscal years 1941-42 to 1945-46

Period	By Steamship			By Other Vessels			By Kammon Tunnel			Total		
	Tons (1000)	Percent of Total	Percent of 1942-43	Tons (1000)	Percent of Total	Percent of 1942-43	Tons (1000)	Percent of Total	Percent of 1942-43	Tons (1000)	Percent of Total	Percent of 1942-43
Fiscal 1941-42	3,345	24.2	153.8	10,034	72.6	101.5	1,444	3.2	23.9	13,823	100	99.3
Fiscal 1942-43	2,175	15.6	100	9,881	71.0	100	1,860	13.4	100	13,916	100	100.0
Fiscal 1943-44:												
First period	461	12.5		2,350	63.9		866	23.6		3,677	100	
Second period	351	10.1		2,214	63.7		913	26.2		3,478	100	
Third period	240	6.6		2,154	58.8		1,268	34.6		3,662	100	
Fourth period	360	9.7		2,006	53.9		1,355	36.4		3,721	100	
Total	1,412	9.7	64.9	8,724	60.0	88.3	4,402	30.3	236.7	14,583	100	104.5
Fiscal 1944-45:												
April	119			643			446			1,208		
May	172			452			489			1,113		
June	142			426			487			1,055		
Total, first period	433	12.8		1,521	45.1		1,422	42.1		3,376	100	
July	139			418			460			1,017		
August	132			381			427			940		
September	132			372			459			963		
Total, second period	403	13.8		1,171	40.1		1,346	46.1		2,920	100	
October	172			395			427			994		
November	259			388			461			1,108		
December	258			314			487			1,059		
Total, third period	689	21.8		1,097	34.7		1,375	43.5		3,161	100	
January	177			237			488			902		
February	183			280			459			922		
March	145			302			447			894		
Total Fourth period	505	18.6		819	30.1		1,394	51.3		2,718	100	
Total	2,030	16.7	93.3	4,608	37.8	46.6	5,537	45.5	297.7	12,175	100	87.5
Fiscal 1945-46:												
April	133			234			416			783		
May	92			168			467			727		
June	52			139			393			584		
Total First period	277	13.2		541	25.8		1,276	60.9		2,094	100	
July	50			139			311			500		
Annual rate 4 months	981	12.6	45.1	2,040	26.2	20.6	4,761	61.2	256.0	7,782	100	55.9

¹By rail ferry.

For this type of movement, small shipping was relatively inefficient; to the extent that the railroads could not handle the traffic, kisen were called upon to do so. Finally, the pressure of the shipowners to conduct "business-as-usual" despite the logic of ignoring individual interests from the national point of view was probably relatively great in this safe and regular trade.

Products Other Than Coal

Comprehensive data on traffic in products other than coal are not available since much of it, if it was controlled at all, was controlled only at the local level. Japanese officials made the crude estimate that coal accounted for 75 percent of the total tonnage between the islands.

Kanmon tunnel.—In Figure 53, all inbound freight through the Kanmon tunnel for the war period is broken down into commodity groups, each being represented as a percentage of the total. Since the percentages are derived from original data on carloadings they do not reflect

the tonnage volume with complete accuracy. Nevertheless they give a general picture. The percentage of total traffic accounted for by coal increased from a little less than 50 percent in the last three months of 1942 to about 70 percent for the period beginning in October 1944 and continuing to the end of the war. No other individual commodity, or even commodity group, accounted for as much as 10 percent of the traffic at any time during the war. Metals, principally iron and steel, were the large item next to coal. Otherwise, the listing of important items would be a catalogue of basic bulk materials: potatoes, rice, limestone, and cement, lumber and charcoal.

Water transport.—No comprehensive information is available on waterborne traffic in products other than coal. Some of it, of course, was conducted in an unorganized and uncontrolled fashion, consisting of small vessel traffic between the islands. There is no reason for believing that the pattern of waterborne traffic was greatly different from that of traffic which

FIGURE 53.—Carloads of important freight moved through the Kanmon tunnel from Kyushu to Honshu.

	Coal, coke, charcoal	Per- cent	Ores and minerals	Per- cent	Food- stuffs	Per- cent	Lumber and forest products	Per- cent	Mineral products	Per- cent	Miscel- laneous freight	Per- cent	Grand total
<i>1942</i>													
October	14,595	54.0	1,223	4.5	1,482	5.5	653	2.4	1,519	5.6	7,538	27.9	27,010
November	16,759	58.0	1,764	6.1	1,278	4.4	608	2.1	1,995	6.9	6,476	22.1	28,880
December	18,081	57.7	1,705	5.4	1,457	4.6	465	1.5	2,077	6.6	7,556	24.1	31,341
<i>1943</i>													
January	22,196	69.1	359	1.1	2,170	6.8	403	1.3	1,550	4.8	5,456	17.0	32,134
February													
March	20,343	58.5	2,790	8.0	2,139	6.2	682	2.0	2,542	7.3	6,272	18.0	34,768
April	18,180	55.0	2,850	8.6	1,980	6.0	750	2.3	2,550	7.7	6,750	20.4	33,060
May	21,204	58.4	3,193	8.8	2,139	5.9	682	1.9	2,542	7.0	6,541	18.0	36,301
June	23,730	61.0	2,730	7.0	2,610	6.7	870	2.2	2,310	5.9	6,660	17.1	38,910
July	24,087	61.6	3,317	8.5	1,329	3.4	837	2.1	2,511	6.4	7,041	18.0	39,122
August	23,839	62.1	3,782	10.0	1,240	3.2	620	1.6	2,530	6.6	6,367	16.6	38,378
September	14,560	45.9	3,150	9.9	1,320	4.2	420	1.3	2,010	6.3	10,280	32.4	31,740
October	29,245	64.9	4,279	9.5	1,083	2.4	455	1.0	2,311	5.1	7,677	17.0	45,050
November	28,966	65.8	4,424	10.1	1,250	2.8	404	.9	1,766	4.0	7,209	16.4	44,019
December	30,630	65.1	4,896	10.4	1,148	2.4	558	1.2	1,486	3.2	8,357	17.8	47,075
<i>1944</i>													
January	33,595	68.1	4,397	8.9	917	1.9	600	1.2	1,585	3.2	8,240	16.7	49,334
February	31,568	68.7	4,271	9.3	901	2.0	503	1.1	1,710	3.7	6,994	15.2	45,947
March	31,700	64.0	5,445	11.0	1,467	3.0	561	1.1	2,352	4.7	8,019	16.2	49,544
April	29,898	64.0	4,552	9.7	2,022	4.3	481	1.0	2,150	4.6	7,605	16.3	46,708
May	32,448	65.6	4,520	9.1	2,620	5.3	569	1.1	2,146	4.3	7,190	14.5	49,493
June	33,932	64.5	5,209	9.9	2,438	4.6	615	1.2	2,402	4.6	8,009	15.2	52,605
July	32,348	63.4	4,983	9.8	2,306	4.5	645	1.3	2,158	4.2	8,611	16.9	51,051
August	27,115	65.0	3,527	8.5	2,428	5.8	324	.8	1,632	3.9	6,698	16.1	41,724
September	28,931	72.7	3,014	7.5	1,222	3.1	237	.6	1,205	3.0	5,163	13.0	39,772
October	28,018	76.8	1,736	4.8	819	2.2	183	.5	1,014	2.8	4,724	12.9	36,494
November	30,694	67.8	3,584	7.9	1,163	2.6	331	.7	1,694	3.7	7,805	17.2	45,271
December	32,777	67.7	4,471	9.2	978	2.0	405	.8	1,575	3.3	8,188	16.9	48,394
<i>1945</i>													
January	32,768	77.3	2,876	6.8	891	2.1	200	.5	1,115	2.6	4,554	10.7	42,404
February	29,424	76.9	2,300	6.0	1,207	3.2	160	.4	992	2.6	4,199	11.0	38,282
March	26,283	69.2	3,341	8.8	2,260	6.0	141	.4	736	1.9	5,224	13.8	37,985
April	25,361	70.5	2,710	7.5	1,675	4.7	122	.3	923	2.6	5,176	14.4	35,967
May	27,811	71.4	2,856	7.3	1,063	2.7	157	.4	874	2.2	6,186	15.9	38,947
June	25,068	74.9	2,286	6.8	453	1.4	111	.3	751	2.2	4,784	14.3	33,453
July	18,131	74.2	1,408	5.8	1,146	4.7	106	.4	447	1.8	3,203	13.1	24,441
August	7,155	79.3	365	4.0	505	5.6	17	.2	102	1.1	881	9.8	9,025
September	6,155	89.1	60	.9	213	3.1	7	.1	29	.4	441	6.4	6,905
October	4,368	74.6	96	1.6	116	2.0	24	.4	57	1.0	1,192	20.4	5,853

was railborne through the Kanmon tunnel. Further indirect light on this traffic may be gained by examining data on the types of traffic general in Kyushu as measured by tonnages of different products hauled by the railways of the island. These show that for the fiscal years 1936-39, coal accounted for 70-75 percent of total tonnages. Thereafter the percentage declined and for the three fiscal years 1943-45 was stabilized at around 60 percent. It is fairly certain that products other than coal accounted for a smaller fraction of waterborne traffic from Kyushu than they did of traffic generally within the island. To cite the most obvious example, mine timbers are an important railway freight item in Kyushu but are moved to Honshu in much smaller quantities.

Tenka traffic.—Prior to the war the bulk of all freight moving from north China, Manchuria and Korea to Japan was moved by rail to seaports and was transshipped by sea to destination. The principal ports of export were Chinwangtao, Taku, Tientsin and Tsingtao in north China, Dairen in Manchuria, and Fusan in Korea.

There existed, however, primarily to carry traffic between mainland points, rail facilities

which became, under unified operation, a ready-made through rail system, much of it double-tracked, leading from north China and through Manchuria and Korea.

The continental overland rail routes were essentially two systems: The first route was formed from the lines running northeast from Peiping in north China to Mukden in Manchukuo and then south from the latter city to the south and central Korean ports. The second route consisted of the railroads branching away from the Harbin-Hsinking line in northeast Manchukuo to the north Korean ports. The first route was called the south Korean relay while the second was known as the north Korean relay.

The potentialities of this system were early appreciated by Japan and by the end of 1942, when the pinch of the shipping shortage first aroused the Japanese to action, diversionary traffic was beginning to flow over it. The Japanese adopted the term "tenka traffic" to refer to that freight diverted from normal, shipborne movement to transportation by rail to south Korean ports, where transfer to ship was affected for a much shorter sea route.

It is not possible to determine what fraction

of the total imports into Japan from north China, Manchuria, and Korea was routed over the tenka system. Short of an over-all comparison, however, it is possible to make a comparison on a list of individual items sufficiently long to arrive at a generally valid estimate of the importance of tenka traffic. The direct comparison includes 90 to 99 percent of all tenka traffic and a somewhat smaller percentage of total traffic. The data in Figure 54 omits tenka traffic for the first month of the program, December 1942.

The volume of imports of the specified products originating in tenka territory was about 12.1 million tons in 1942. This total excludes several important items, notably nonferrous metals and fertilizer materials. Nevertheless it suggests the great importance of this territory to the Japanese war economy. In 1943 the total imports of the specified products fell to 8.8 million tons, in 1944 to 7.1 million tons, and in the first six months of 1945 to an annual rate of 5.0 million tons. Part of this decrease was attributable to failure of supplies at their source, the decreases in imports of Korean rice, due to the 1943 crop failure, being a conspicuous case in point. With this reservation in mind however, it remains that the principal over-all bottleneck was transportation.

The tenka route became an increasingly important factor in maintaining such traffic as was possible. The data in Figure 54 suggests that for the enumerated products the tenka route handled about 15 percent of the trade in 1943, 37 percent in 1944 and 55 percent in the first 6 months of 1945.

Two subsidiary breakdowns of the data in Figure 54 are of interest. The first such breakdown is shown in Figure 55, which classifies tenka traffic by country of origin.

It will be noted that Manchurian goods were by all odds the most important component of tenka traffic during the entire period. The decrease in the traffic from north China toward the end of the war apparently resulted from increasing difficulties in production and rail shipment at that end. Korean products became a significant factor only in the first six months of 1945, when they accounted for nearly 20 percent of total tenka traffic. In earlier years the shipping pinch was not sufficiently acute to induce the diversion of normal short-haul Korean

water shipments by rail to ports even closer to Japan.

The second subsidiary breakdown of Figure 54 is shown in Figure 56, indicating by country of origin the fraction of total shipments of goods to Japan which traveled over the tenka route.

It is evident that tenka traffic constituted the largest fraction of total traffic in the case of Manchuria, more than 60 percent in 1944 and 1945. In 1945 tenka handled half of the total exports from Korea to Japan and more than a third of those from north China.

It is difficult to determine whether by the latter months of the war Japan had exploited fully the potentialities of the tenka route. Between 1944 and 1945 only a fairly small increase in the volume of tenka traffic took place, (from 2.8 million tons in 1944 to an annual rate of 3.1 million tons in the first six months of 1945). This suggests that the peak was being approached. Furthermore, there is considerable evidence that goods were piling up at the transshipment ports in southern Korea; the total volume of outbound shipments, including normal traffic of Korean origin and goods brought to port by the tenka route was taxing the capacity of the ports.

On the other hand, it appears that the railroads of Korea were capable of handling a larger volume of tenka traffic.

In the fiscal year 1943, the Korean state railways moved a total tonnage of 27,541,257 metric tons. This represented 87 percent of a planned movement of 31,706,905 tons. Planned tenka traffic comprised 2,076,347 metric tons or 15.3 percent of the planned total traffic. Actual tenka movements totaled 1,725,507 tons or 15.9 percent of all rail traffic. The 1944 fiscal year called for a total planned movement of 34,728,344 metric tons. Actual tonnage hauled was only 31,015,290 tons or 89 percent of the planned haul. Of these tonnages 4,166,514 metric tons were planned tenka and 2,659,411 tons were actually carried. The planned and actually carried tenka traffic thus represented 8.3 percent and 11.7 percent of the total rail tonnage. In the three months period of April through June 1945 (only figures available for 1945) tenka "planned" and tenka "carried" were 1,000,409 and 1,072,031 metric tons or 11.4 percent and 13.8 percent of the total tonnages, 8,-

FIGURE 54.—Total versus Tenka route imports of specified products from North China, Manchuria and Korea; total Tenka route imports; calendar years 1943 and 1944 and 6 months 1945

Product	Country of origio	1942 Total Imports	1943			1944			1945		
			Total Imports	Tenka Imports	Percent	Total Imports	Tenka Imports	Percent	Total Imports	Tenka Imports	Percent
Coal	North China Manchuria ¹ Korea	(¹)	(²)	(³)	(³) / (²) = (⁴)	(⁵)	(⁶)	(⁶) / (⁵) = (⁷)	(⁸)	(⁹)	(⁹) / (⁸) = (¹⁰)
		4,362,000	3,923,000			1,863,000	337,600		270,000	100,700	
		631,000	426,000	81,300		512,000	470,500		201,000	84,500	
		840,000	657,000			260,000			77,000		
Total		5,833,000	5,006,000	81,300	1.6	2,635,000	808,100	30.7	548,000	185,200	33.8
Iron and Steel	North China Manchuria ¹ Korea	57,000	161,000			275,000	2123,000		44,000	900	
		842,000	565,000	523,100		780,000	540,700		384,000	2103,800	
		130,000	270,000			250,000	125,400		54,000	28,200	
Total		1,029,000	996,000	523,100	52.5	1,105,000	789,100	71.4	182,000	132,900	73.0
Iron ore	North China Manchuria Korea	340,000	3230,000			555,000			30,000		
		93,000	3,000			17,000			3,000		
		745,000	242,000			583,000			236,000	75,100	
Total		1,178,000	475,000			655,000			269,000	75,100	27.9
Salt	North China Manchuria ¹	969,000	799,500	341,300		496,600	218,900		195,800	94,200	
		402,400	470,800			424,600	101,000		188,100	145,500	
Total		1,371,400	1,270,300	341,300	26.9	921,200	319,900	34.7	383,900	239,700	62.4
Foodstuffs, soybeans.	North China Manchuria ¹ Korea	33,600	23,400			4,000					
		615,200	525,300	335,400		629,500	421,300		596,100	395,900	
		50,900	41,900			33,500			10,800		
		840,000	72,000			559,500	(⁴)		142,000	(⁴)	
Rice and paddy Other grains and flours.	North China Manchuria Korea	2,300	5,000			4,500			3,000		
		72,800	80,500			122,000	(¹)		213,400	(¹)	
		600,000	25,200			25,000	(¹)		15,000	(⁴)	
Foodstuffs	Manchuria Korea	(³)	(³)			(³)	41,000		(³)	175,200	
		(³)	(³)			(³)	4,500		(³)	162,100	
Total		2,213,900	773,300	335,400	43.4	1,378,000	466,800	33.9	980,300	733,200	74.8
Soybean cake	North China Manchuria	51,000	28,400			9,100			1,600		
		398,500	276,100	24,800		375,600	215,300		161,800	28,200	
Total		449,500	304,500	24,800	8.1	384,700	215,300	56.0	163,400	28,200	17.2
Total above products		12,074,800	8,825,100	1,305,900	14.8	7,078,900	2,599,200	36.7	2,526,600	1,394,300	55.2
Other Tenka products: Nonferrous metals	Manchuria Korea			3,500			64,600			63,300	
							71,600			78,000	
Total				3,500			136,200			141,300	
Coke	Manchuria						5,800			100	
Raw cotton	North China						4,300				
Pitch	Manchuria			2,100			2,700				
Oil seeds	Manchuria			8,700			17,600			10,100	
Total				10,800			30,400			10,200	
Grand total tenka traffic				1,320,200			2,765,800			1,545,800	

¹ Includes Kwantung leased territory.

² No conclusive explanation available for the fact that tenka imports are larger than total imports.

³ Estimated.

⁴ Included under title "Foodstuffs."

⁵ Included principally under titles "Rice and Paddy," and "Other Grains and Flours."

FIGURE 55.—Tenka traffic by country of origin, calendar years 1943 and 1944 and 6 months of 1945

Country of origin	1943		1944		6 months 1945	
	Tons	Percent of total	Tons	Percent of total	Tons	Percent of total
North China	341,300	26.1	679,500	26.1	195,800	14.1
Manchuria	964,600	73.9	1,789,800	68.9	933,100	66.9
Korea			129,900	5.0	265,400	19.0
Total	1,305,900	100.0	2,599,200	100.0	1,394,300	100.0

775,409 and 7,776,252 tons (planned and carried). Total tonnage hauled was only 89 percent of expectations.

Although the normal capacity of the Korean railroad was lessened, due to the difficulties in providing proper and sufficient personnel and parts for ordinary maintenance, the railroads could undoubtedly have handled additional tonnage had the ports in southern Korea been able to solve their labor trouble and provide better equipment to enable them more nearly to reach the maximum number of freight cars unloaded in a day. The port difficulties in Korea were primarily due to two factors: absentee administration and the lackadaisical Korean stevedores.

FIGURE 56.—Total and Tenka imports into Japan, by country of origin, 1943 and 1944 and 6 months 1945

Country of origin	1943			1944			1945 (6 months)		
	Total Imports	Tenka Imports	Percent of total	Total Imports	Tenka Imports	Percent of total	Total Imports	Tenka Imports	Percent of total
North China	5,170,300	341,300	6.6	2,507,200	679,500	27.1	548,400	195,800	35.7
Manchuria	2,346,700	964,600	41.1	2,860,700	1,789,800	62.6	1,447,400	933,100	64.5
Korea	1,308,100			1,711,000	129,900	7.6	530,800	265,400	50.0
Total	8,825,100	1,305,900	14.8	7,078,900	2,599,200	36.7	2,526,600	1,394,300	55.2

Near port transshipment—In addition to the diversion of freight from ship to rail in the specific instances described above, the general practice of unloading inbound freight at the first Japanese port touched was followed wherever feasible. The most important ports so utilized were Moji and Shimonoseki, but other favorably located ports such as Niigata, Nagasaki and Kagoshima were also used for this purpose. In some cases ships with cargo destined for both Kobe-Osaka and Tokyo-Yokohama were unloaded at the former ports and the freight destined for the latter ports was transshipped by rail.

No comprehensive data are available which show the isolated effect of this practice, and it must be described mainly in qualitative terms. Reference to Figure 57 which follows will serve to illustrate in the particular case of imports of soybeans how this practice is believed generally to have operated.

The most important comment to be made is that while there was a tendency, assuming the proportions of a practice, to unload imports at near ports, there is no evidence that this practice was a matter of clean-cut policy. To cite the data in Figure 57, no sharp break can be found in the fraction of imports of soybeans carrying through to ports facing the Pacific ocean, of which Yokohama was by far the most important. The Inland Sea ports, of which Kobe was the most important, continued to receive a quarter or more of the total imports down to the beginning of 1945. Similarly, the ports facing Shimonoseki Straits, of which Moji was the most important, generally received something more than 20 percent of the total shipments from the beginning of 1943 to the end of the war.

The only clear instance in which the influence of this practice can be seen from the data in Figure 57 is that of the principal ports for the importation of soybeans facing the Sea of Japan. These in order of importance were Nii-

gata, Fushiki, Tsuruga, and Nanao. While there were wide quarter-to-quarter changes in the fraction of total imports which came through these ports, it will be noted that in three quarters (April-June 1943 and 1944, and January-March 1945) the percentage was in the neighborhood of 40-45. This fraction, of course, is much larger than can be accounted for by local requirements and a large part of it was moved across Honshu by rail to the principal industrial cities.

Approaching this problem from the point of view of information on railway traffic, it is evident that the "near port transshipment" practice would show up in increased lengths of hauls. This is borne out by the fact that average rail haul increased from 122.8 miles in 1941 to 160.5 in 1944.

Parenthetically, Figure 57 is interesting for the light which it throws on the diversion of imports incident to the mining campaign in the spring of 1945 (Figures 41-43). It suggests the danger of over-emphasizing the importance of minor ports on the Sea of Japan in the diversion program. True, import traffic to the minor ports and anchorages on the Sea of Japan increased manyfold in the April-June quarter of 1945. Yet these ports accounted for only 15 percent of the total imports. The principal diversionary ports were the normal ports of import on the Sea of Japan. In the April-June quarter these accounted for about 42 percent of the total, a figure less, however, than that which had prevailed in the previous quarter of 1945 and less than that which prevailed in the April-June quarter of 1943. With respect to the ports facing on Shimonoseki Straits, it will be noted that in April-June 1945 they handled over 20 percent of the total, about the normal fraction. This suggests the importance of the Japanese practice at the opposite pole from that of diverting traffic, namely that of pushing traffic through to normal unloading ports regardless of cost. The data shows on the other

FIGURE 57.—Imports of Soybeans from the Asiatic mainland, classified by general area of ports of destination, by quarters 1943-45

	1943								1944			
	January-March		April-June		July-September		October-December		January-March		April-June	
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
I. Pacific ocean ports ¹	37,970	15.0	23,187	10.1	12,646	28.6	18,370	36.1	34,590	19.2	26,190	8.2
II. Inland seaports ²	72,085	28.6	58,703	25.5	8,275	18.7	13,224	26.0	33,484	18.6	92,105	28.9
III. Hokkaido, Karafuto, Tsugaru Straits ports ³	12,775	5.2	5,487	2.4	477	1.1			685	.4		
IV. Shimonoseki Straits ports ⁴	49,721	19.6	37,612	16.4	11,449	25.9	8,678	7.2	40,205	22.4	67,797	21.3
V. South and west Kyushu ports ⁵	1,542	.6	2,968	1.3	1,380	3.1			7,618	4.2	6,214	1.9
VI. Normal Japan seaports ⁶	78,336	31.0	99,445	43.3	9,985	22.6	10,527	20.7	63,385	35.2	125,867	39.5
VII. Diversionary Japan sea ports ⁷			2,270	1.0							57	.2
Total.....	252,429	100.0	229,672	100.0	44,212	100.0	50,889	100.0	179,967	100.0	318,230	100.0

	1944				1945			
	July-September		October-December		January-March		April-June	
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
I. Pacific ocean ports ¹	19,467	14.9	20,670	20.6	24,294	16.9	46,540	10.6
II. Inland seaports ²	54,574	41.8	36,695	36.7	19,715	13.7	30,218	6.9
III. Hokkaido, Karafuto, Tsugaru Straits ports ³	2,930	2.2					4,472	1.0
IV. Shimonoseki Straits ports ⁴	32,981	25.3	28,529	28.5	24,290	16.9	95,386	21.6
V. South and West Kyushu ports ⁵	3,146	2.4	1,917	1.9	3,250	2.3	12,592	2.8
VI. Normal Japan seaports ⁶	17,273	13.2	12,191	12.2	66,021	45.9	185,003	41.9
VII. Diversionary Japan seaports ⁷	37	1.2	78	.1	6,130	4.3	66,852	15.2
Total.....	130,408	100.0	100,980	100.0	143,700	100.0	441,063	100.0

Principal port or ports of destination within the group italicized:

¹ *Yokohama, Shimizu, Tokyo, Nagoya, Chiba, Yokkaichi.*

² *Kobe, Osaka, Hiroshima, Sakaide, Uno, Oita, Takamatsu, Shodoshima, Tokuyama, Kyoto.*

³ *Onomichi, Esutoru, Otomari, Otaru.*

⁴ *Moji-Shimonoseki, Wakamatsu, Hakata, Fukuoka, Kokura.*

⁵ *Nagasaki, Misumi, Kagoshima, Miyazaki, Kumamoto, Omuta, Miike, Karatsu, Saga.*

⁶ *Niigata, Fushiki, Nanao, Tsuruga.*

⁷ *Maizuru, Senzaki, Yuya Bay, Hamada, Hagi, Imaharu, Kizaki, Izuhara, Hyogo, Yashishiro, Toyama, Sakata, Funakawa, Naoetsu.*

hand that shipments to ports on the Inland Sea fell off very greatly.

WARTIME RAIL HISTORY

The Japanese railroads were strained to absorb the increase in rail freight traffic. During the period from 1941 to 1945 substantial increases were made in tonnage hauled, ton miles (Figure 58), freight train miles, and the average length of haul. The increase in length of haul was largely the result of the shift of coal traffic from ship to rail (Figure 50). These increases are as follows:

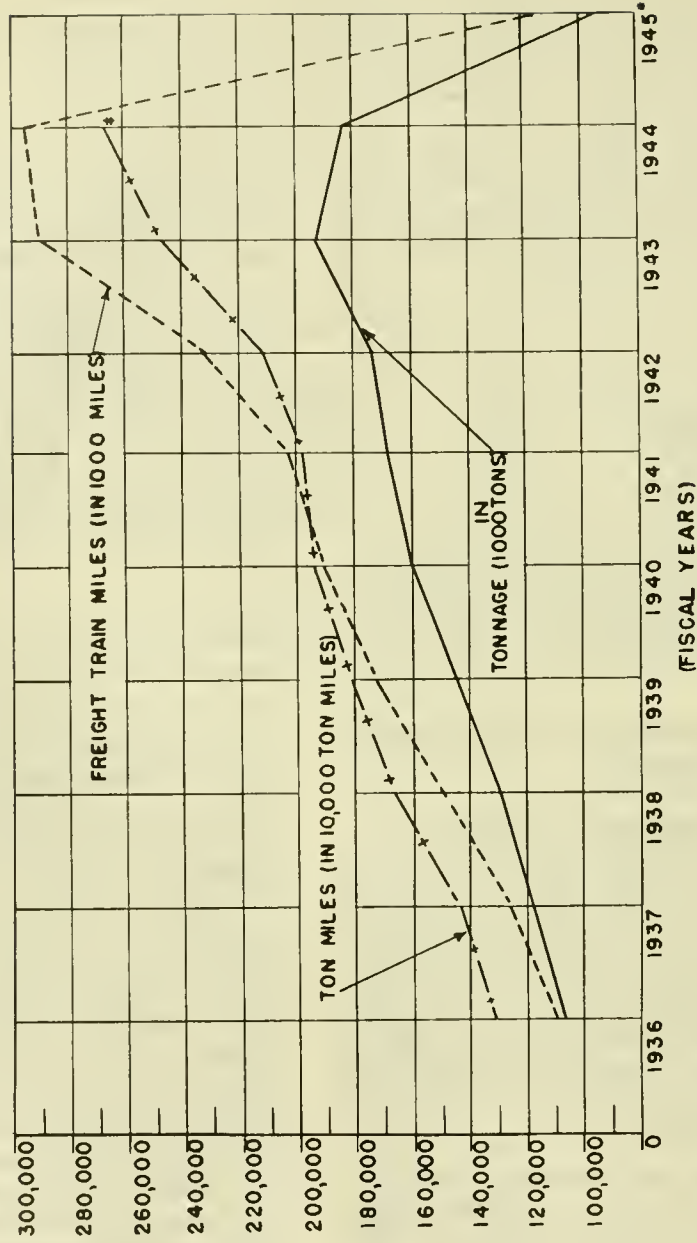
Year	Tonnage (1000 omitted)	Ton miles (1000 omitted)	Freight train mile (1000 omitted)	Length of haul (mile)
1941.....	167,212	20,460,536	198,202	122.8
1942.....	174,201	23,250,994	212,058	133.5
1943.....	193,975	29,185,846	247,112	151.3
1944.....	184,504	29,597,146	269,798	160.5

At the same time that freight transport was increasing tremendously, the volume of passenger traffic was also mounting. Although the dominant position of passenger traffic relative to freight transport declined after 1942, the

actual movement of passengers continued to rise. The government made strenuous efforts to reduce the volume of this traffic in 1943 and again in 1944. All excursions were stopped, students were not allowed to return home from school, etc., all but a few sleeping cars were withdrawn and converted to coaches, and no one supposedly was allowed to travel without a police certificate certifying the urgent necessity of the trip to be made. In spite of these drastic restrictions, passengers carried and passenger miles continually increased during the period 1941-1944 although the average distance travelled per passenger did decline slightly in 1944 from its peak in the previous year and passenger train miles declined after 1942. The following table presents statistics on the volume of passenger traffic:

Year	Passengers carried (1000 omitted)	Passenger miles (1000 omitted)	Average miles per passenger	Passenger train miles
1941.....	2,172,219	34,514,841	15.9	268,746
1942.....	2,279,840	37,562,887	16.5	270,734
1943.....	2,648,100	46,027,852	17.4	229,780
1944.....	2,889,399	47,486,783	16.4	219,135

TONNAGE & TON MILEAGE FOR JAPANESE RAILROADS



± 1945 NOT AVAILABLE
* APRIL THROUGH OCT.

FIGURE 58

These large increases in freight and passenger traffic were made during a time when the increase in rolling stock was only moderate. At three less important division headquarters IGR officials declared car shortages had prevailed throughout the war. There was an absence of complete records and a vagueness as to definite figures. However, no car shortages were reported at the headquarters of the four principal divisions, Tokyo, Osaka, Nagoya, and Moji. Representatives of Japanese industry report that freight car shortages were not responsible for the decline in shipments by industry. Industry definitely blamed their troubles on the difficulties and shortages of water transport.

Doubtless there were many cases of freight car shortages for varying periods in many localities but the IGR when pressed for data insisted they maintained no general records of car shortages or surpluses. Where car shortages were admitted the admissions came from the several division headquarters only as oral statements and unsupported by consistently maintained records.

It is fair to assume that claims of car shortages were inflated, and this assumption is supported by the record of daily average carloadings by grand divisions. Carloadings were remarkably consistent until the year 1945 (Figures 59 and 60).

FIGURE 59.—Japanese Government Railways—Daily carloadings—10-Day averages by divisions

	JANUARY 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	3,673	2,759	2,868	2,006	5,239	1,773	2,386	2,479	23,183
2d period	5,377	3,892	4,425	2,574	7,054	1,866	2,460	3,756	31,404
3d period	5,570	3,850	4,271	2,397	6,905	1,785	2,228	3,538	30,544
Monthly average	4,896	3,511	3,868	2,328	6,416	1,807	2,353	3,267	28,446
	FEBRUARY 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,703	3,571	4,290	2,452	6,888	1,598	2,141	2,827	29,470
2d period	5,635	3,893	4,255	2,451	7,240	1,852	2,210	3,665	31,201
3d period	5,738	4,119	4,486	2,669	7,607	2,026	2,357	3,845	32,847
Monthly average	5,689	3,842	4,334	2,513	7,219	1,811	2,227	3,774	31,409
	MARCH 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,627	4,016	4,465	2,746	7,549	2,044	2,392	3,931	32,770
2d period	5,462	4,128	4,585	2,805	7,788	2,108	2,446	4,255	33,577
3d period	5,642	4,152	4,485	2,633	7,760	2,120	2,327	4,459	33,578
Monthly average	5,579	4,101	4,511	2,725	7,701	2,092	2,386	4,223	33,318
	APRIL 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,609	3,902	4,646	2,548	7,018	1,918	2,174	4,122	31,937
2d period	5,726	4,048	4,681	2,619	7,494	2,019	2,299	4,125	33,011
3d period	5,660	4,057	4,753	2,719	7,515	2,042	2,320	4,137	33,203
Monthly average	5,665	4,003	4,683	2,629	7,342	1,993	2,264	4,128	32,707
	MAY 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,304	3,908	4,616	2,656	7,435	1,981	2,249	4,157	32,306
2d period	5,359	3,871	4,469	2,722	7,379	2,142	2,375	3,884	32,201
3d period	5,388	3,989	4,694	2,790	7,148	2,085	2,325	4,121	32,540
Monthly average	5,351	3,925	4,606	2,724	7,315	2,070	2,317	4,056	32,364
	JUNE 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,188	3,940	4,578	2,678	6,888	1,905	2,222	3,898	31,297
2d period	5,183	3,893	4,434	2,466	6,860	2,004	2,326	4,192	31,358
3d period	5,112	3,609	3,868	2,054	5,245	2,149	2,480	4,301	28,818
Monthly average	5,161	3,813	4,294	2,400	6,331	2,019	2,343	4,130	30,491
	JULY 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,093	3,734	4,246	2,106	5,725	2,041	2,282	4,166	29,393
2d period	4,448	3,451	4,179	2,441	5,992	1,977	2,383	4,143	29,014
3d period	3,972	3,662	4,028	2,495	6,520	1,924	1,822	4,200	28,623
Monthly average	4,488	3,617	4,147	2,352	6,093	1,979	2,151	4,171	28,998
	AUGUST 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,197	3,787	4,102	2,458	6,274	2,001	2,202	4,191	30,212
2d period	5,246	3,532	4,048	2,234	5,540	1,933	2,439	3,665	28,637
3d period	5,309	3,950	4,564	2,467	6,445	2,205	2,559	4,194	31,693
Monthly average	5,253	3,762	4,248	2,389	6,098	2,051	2,405	4,022	30,228
	SEPTEMBER 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,078	3,982	4,514	2,436	6,108	2,343	2,415	3,957	30,833
2d period	5,025	3,815	4,483	2,596	6,542	2,337	2,572	4,072	31,442
3d period	5,312	3,949	4,519	2,650	6,391	2,330	2,646	4,031	31,828
Monthly average	5,138	3,915	4,505	2,560	6,347	2,337	2,544	4,020	31,366
	OCTOBER 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,371	3,844	4,470	2,264	5,665	2,147	2,576	3,910	30,247
2d period	5,402	3,892	4,400	2,571	6,153	2,046	2,657	3,987	31,108
3d period	5,401	4,149	4,533	2,675	6,709	2,149	2,687	4,204	32,507
Monthly average	5,392	3,968	4,469	2,509	6,193	2,115	2,642	4,039	31,327
	NOVEMBER 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,240	4,134	4,454	2,596	6,308	2,275	2,655	4,238	31,900
2d period	5,456	4,280	4,532	2,722	6,705	2,492	2,776	4,407	33,370
3d period	5,001	4,230	4,622	2,666	6,702	2,421	2,580	4,218	32,440
Monthly average	5,232	4,214	4,536	2,661	6,572	2,396	2,670	4,288	32,569
	DECEMBER 1941								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,501	4,328	4,584	2,689	6,516	2,347	2,568	4,188	32,721
2d period	5,538	4,214	4,846	2,643	6,665	2,419	2,500	4,269	33,094
3d period	5,610	4,124	4,737	2,595	6,809	2,304	2,541	3,991	32,711
Monthly average	5,552	4,219	4,723	2,641	6,668	2,359	2,536	4,144	32,842
Daily average of year	5,282	3,864	4,405	2,564	6,509	2,107	2,356	3,975	31,062

FIGURE 59.—*Japanese Government Railways—Daily carloadings—10-Day averages by divisions (Cont.)*

	JANUARY 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	4,029	2,338	2,782	2,120	4,732	1,526	1,831	2,152	21,510
2d period.....	5,561	3,617	4,185	2,488	6,284	1,764	2,211	3,580	29,590
3d period.....	5,830	3,859	4,436	2,762	6,807	2,018	2,328	3,981	32,021
Monthly average.....	5,162	3,258	3,821	2,467	5,969	1,777	2,130	3,261	27,845
	FEBRUARY 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,473	3,678	4,328	2,658	6,542	1,982	2,165	3,406	30,232
2d period.....	5,451	3,564	4,097	2,648	6,350	1,820	1,918	3,494	29,342
3d period.....	5,211	3,726	4,298	2,746	6,604	2,101	2,071	3,650	30,407
Monthly average.....	5,390	3,651	4,237	2,680	6,491	1,958	2,050	3,507	29,964
	MARCH 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,422	3,746	4,477	2,708	6,559	2,163	2,037	3,921	31,033
2d period.....	5,659	4,083	4,632	2,846	6,817	2,292	2,235	4,053	32,617
3d period.....	5,755	4,181	4,648	2,738	6,730	2,242	2,326	3,777	32,397
Monthly average.....	5,617	4,009	4,588	2,763	6,703	2,233	2,203	3,911	32,027
	APRIL 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,703	3,926	4,418	2,707	6,614	2,084	2,346	3,886	31,684
2d period.....	5,696	3,823	4,584	2,810	6,662	2,197	2,357	4,097	32,226
3d period.....	5,626	3,939	4,586	2,900	6,703	2,230	2,381	4,166	32,531
Monthly average.....	5,675	3,896	4,529	2,806	6,660	2,170	2,361	4,050	32,147
	MAY 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,429	3,803	4,541	2,776	6,665	2,151	2,381	4,164	31,910
2d period.....	5,466	3,975	4,823	2,795	6,756	2,185	2,477	3,925	32,402
3d period.....	5,522	4,106	4,868	2,902	6,727	2,192	2,429	4,207	32,953
Monthly average.....	5,474	3,966	4,748	2,827	6,716	2,177	2,429	4,102	32,439
	JUNE 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,349	3,951	4,856	2,864	6,377	2,154	2,366	4,120	32,037
2d period.....	5,329	3,767	4,752	2,614	6,159	2,129	2,286	3,972	31,008
3d period.....	5,162	3,606	4,690	2,600	5,776	2,174	2,325	4,100	30,433
Monthly average.....	5,280	3,775	4,766	2,693	6,104	2,152	2,326	4,164	31,160
	JULY 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,257	3,663	4,591	2,630	6,111	2,224	2,405	4,038	30,919
2d period.....	5,053	3,584	4,579	2,670	6,013	2,184	2,477	4,134	30,694
3d period.....	5,281	3,620	4,620	2,735	6,107	2,214	2,479	4,184	31,240
Monthly average.....	5,200	3,622	4,597	2,681	6,078	2,208	2,455	4,120	30,961
	AUGUST 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,325	3,629	4,394	2,850	5,810	2,271	2,523	4,171	30,973
2d period.....	5,341	3,684	4,413	2,803	5,278	2,150	2,529	3,613	29,811
3d period.....	5,426	3,870	4,474	2,455	5,277	2,444	2,458	4,058	30,462
Monthly average.....	5,366	3,733	4,428	2,694	5,449	2,293	2,502	3,951	30,416
	SEPTEMBER 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,573	3,898	4,487	2,192	5,873	2,330	2,556	4,170	31,079
2d period.....	5,546	3,930	4,656	2,459	5,837	2,337	2,498	4,022	31,285
3d period.....	5,486	3,808	4,499	2,658	6,049	2,239	2,493	3,968	31,200
Monthly average.....	5,535	3,879	4,547	2,436	5,920	2,302	2,515	4,054	31,188
	OCTOBER 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,457	3,968	4,700	2,847	6,328	2,270	2,451	4,032	32,053
2d period.....	5,496	3,890	4,645	2,736	6,349	2,261	2,553	3,969	31,899
3d period.....	5,643	4,060	4,737	2,865	6,562	2,324	2,560	4,269	33,020
Monthly average.....	5,536	3,975	4,695	2,817	6,418	2,286	2,523	4,096	32,346
	NOVEMBER 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,491	3,975	4,400	2,835	6,492	2,368	2,543	4,121	32,225
2d period.....	5,516	3,967	4,343	2,646	6,658	2,375	2,558	4,067	32,130
3d period.....	5,481	4,013	4,469	2,572	6,646	2,290	2,394	4,078	31,943
Monthly average.....	5,496	3,985	4,404	2,685	6,599	2,344	2,498	4,089	32,100
	DECEMBER 1942								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period.....	5,696	4,039	4,393	2,721	6,423	2,173	2,443	4,075	31,963
2d period.....	5,799	3,977	4,494	2,720	6,518	2,403	2,552	3,587	32,050
3d period.....	5,711	3,858	4,578	2,711	6,660	2,165	2,516	3,671	31,870
Monthly average.....	5,735	3,955	4,491	2,717	6,538	2,244	2,504	3,774	31,958
Daily average of year.....	5,426	3,803	4,492	2,706	6,383	2,188	2,442	3,938	31,378

FIGURE 59.—Japanese Government Railways—Daily carloadings—10-Day averages by divisions (Cont.)

	JANURAY 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	4,147	2,744	2,969	2,224	5,239	1,440	2,197	2,557	23,517
2d period	5,495	3,516	4,126	2,685	6,251	1,625	2,309	3,564	29,571
3d period	5,579	3,790	4,352	2,786	7,062	1,922	2,345	3,643	31,479
Monthly average	5,090	3,364	3,833	2,572	6,213	1,671	2,285	3,267	28,295
	FEBRUARY 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	4,917	3,397	4,115	2,535	6,533	2,079	2,269	3,845	29,690
2d period	5,531	3,807	4,448	2,772	6,969	2,178	2,454	3,579	31,738
3d period	5,503	3,991	4,493	2,807	6,998	2,197	2,452	3,809	32,250
Monthly average	5,304	3,713	4,342	2,697	6,821	2,148	2,387	3,740	31,152
	MARCH 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,393	3,783	4,457	2,857	7,021	2,186	2,400	3,860	31,957
2d period	5,539	3,827	4,616	2,880	7,130	2,313	2,529	3,983	32,817
3d period	5,326	3,715	4,473	2,798	7,177	2,282	2,599	4,007	32,377
Monthly average	5,417	3,773	4,514	2,844	7,111	2,261	2,512	3,952	32,384
	APRIL 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,094	3,564	4,416	2,603	6,278	2,284	2,533	3,878	30,650
2d period	5,321	3,758	4,647	2,839	6,908	2,343	2,795	4,181	32,792
3d period	5,411	3,965	4,727	3,019	7,143	2,453	2,818	4,288	33,824
Monthly average	5,275	3,762	4,597	2,821	6,776	2,360	2,713	4,116	32,420
	MAY 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,148	3,869	4,499	3,058	7,036	2,351	2,587	4,084	32,632
2d period	5,065	3,878	4,689	3,048	6,947	2,401	2,572	3,879	32,479
3d period	5,042	3,831	4,638	2,844	6,717	2,384	2,523	4,019	31,998
Monthly average	5,084	3,858	4,609	2,979	6,894	2,379	2,559	3,995	32,357
	JUNE 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	4,877	3,714	4,580	2,742	6,338	2,170	2,400	3,950	30,771
2d period	4,607	3,643	4,522	2,644	6,194	2,250	2,240	3,831	29,931
3d period	4,937	3,781	4,618	2,761	6,500	2,527	2,645	4,118	31,887
Monthly average	4,807	3,712	4,574	2,716	6,344	2,315	2,428	3,966	30,862
	JULY 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	4,877	3,414	4,341	2,557	6,014	2,532	2,713	4,080	30,528
2d period	4,935	3,622	4,558	2,766	6,422	2,483	2,580	3,973	31,339
3d period	5,107	3,675	4,420	2,452	6,283	2,540	2,616	3,990	31,083
Monthly average	4,977	3,574	4,439	2,588	6,241	2,519	2,636	4,013	30,987
	AUGUST 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,004	3,855	4,486	2,714	6,140	2,539	2,532	3,984	31,254
2d period	4,762	3,765	4,479	2,707	5,725	2,451	2,297	3,595	29,781
3d period	5,203	3,947	4,720	2,773	6,515	2,648	2,526	4,016	32,348
Monthly average	4,997	3,859	4,567	2,732	6,139	2,549	2,454	3,870	31,167
	SEPTEMBER 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,160	3,753	4,571	2,786	6,702	2,495	2,373	3,885	31,725
2d period	5,261	3,858	4,639	2,472	6,122	2,566	2,454	3,649	31,021
3d period	5,063	3,875	4,098	2,339	5,988	2,490	2,488	3,926	30,267
Monthly average	5,161	3,829	4,636	2,532	6,271	2,517	2,438	3,820	31,204
	OCTOBER 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	4,639	3,627	4,634	2,495	6,185	2,458	2,144	3,732	29,914
2d period	4,906	3,868	4,647	2,619	6,605	2,496	2,275	3,928	31,344
3d period	5,024	3,976	4,625	2,576	6,538	2,617	2,407	3,978	31,741
Monthly average	4,861	3,828	4,635	2,564	6,446	2,527	2,280	3,883	31,024
	NOVEMBER 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,010	3,823	4,427	2,502	6,276	2,550	2,435	3,839	30,862
2d period	5,185	3,982	4,605	2,571	6,704	2,643	2,550	3,857	32,097
3d period	5,195	3,953	4,610	2,613	6,854	2,685	2,530	3,832	32,272
Monthly average	5,130	3,920	4,547	2,562	6,611	2,626	2,505	3,843	31,744
	DECEMBER 1943								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period	5,006	3,923	4,656	2,629	6,776	2,526	2,516	3,524	31,556
2d period	5,081	4,071	4,849	2,744	7,083	2,466	2,582	3,785	32,661
3d period	5,181	3,909	4,904	2,734	6,717	2,504	2,592	3,675	32,216
Monthly average	5,092	3,966	4,806	2,704	6,854	2,499	2,564	3,662	32,147
Daily average of year	5,098	3,763	4,509	2,693	6,558	2,365	2,481	3,843	31,310

FIGURE 59.—Japanese Government Railways—Daily carloadings—10-Day averages by divisions (Cont.)

	JANUARY 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,305	3,984	3,964	2,539	6,106	2,069	2,466	2,764	28,197
2d period	4,865	3,977	4,601	2,830	6,996	2,127	2,562	3,208	31,166
3d period	4,935	3,935	4,529	2,802	7,190	2,313	2,428	3,424	31,556
Monthly average	4,709	3,964	4,370	2,726	6,778	2,175	2,483	3,141	30,346
	FEBRUARY 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,848	3,856	4,516	2,644	6,906	2,130	2,382	2,971	30,252
2d period	4,980	3,701	4,505	2,640	7,227	2,143	2,348	2,929	30,473
3d period	4,923	3,815	4,355	2,572	7,038	2,194	2,425	3,156	30,478
Monthly average	4,917	3,789	4,462	2,620	7,058	2,154	2,384	3,014	30,398
	MARCH 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,853	3,763	4,614	2,564	7,200	2,360	2,314	3,704	31,372
2d period	5,047	3,859	4,443	2,617	7,311	2,501	2,205	3,927	31,910
3d period	4,937	3,857	4,619	2,619	7,275	2,518	2,428	3,932	32,185
Monthly average	4,945	3,827	4,561	2,601	7,263	2,461	2,319	3,857	31,834
	APRIL 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,100	3,732	4,677	2,553	6,740	2,364	2,426	3,586	31,178
2d period	5,295	3,965	4,820	2,606	7,057	2,499	2,710	3,942	32,894
3d period	5,223	3,900	4,766	2,668	7,226	2,575	2,545	4,003	32,906
Monthly average	5,206	3,866	4,754	2,609	7,008	2,479	2,560	3,844	32,326
	MAY 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,198	3,727	4,760	2,730	7,243	2,545	2,489	4,068	32,760
2d period	5,313	3,745	4,891	2,704	7,172	2,481	2,502	4,040	32,848
3d period	5,312	3,804	4,882	2,690	7,149	2,421	2,527	4,102	32,887
Monthly average	5,276	3,760	4,846	2,707	7,187	2,480	2,507	4,071	32,834
	JUNE 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,205	3,586	4,662	2,561	6,870	2,450	2,457	4,050	31,841
2d period	5,097	3,640	4,670	2,542	6,358	2,443	2,243	4,008	31,001
3d period	4,899	3,556	4,540	2,465	6,456	2,622	2,425	4,005	30,968
Monthly average	5,067	3,594	4,624	2,522	6,561	2,505	2,376	4,021	31,270
	JULY 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,615	3,521	4,368	2,437	5,957	2,553	2,524	4,087	30,062
2d period	4,786	3,567	4,578	2,458	6,160	2,603	2,315	4,026	30,493
3d period	4,885	2,428	4,493	2,475	6,017	1,781	1,601	4,108	27,788
Monthly average	4,766	5,503	4,480	2,457	6,044	2,295	2,129	4,075	29,749
	AUGUST 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,925	3,451	4,163	2,405	6,048	2,226	2,175	4,143	29,536
2d period	4,971	3,508	4,150	2,371	5,818	2,334	2,126	4,028	29,296
3d period	5,277	5,707	4,189	2,330	5,735	2,451	2,375	4,271	30,335
Monthly average	5,065	3,560	4,168	2,367	5,863	2,341	2,230	4,151	29,745
	SEPTEMBER 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	5,142	3,593	4,472	2,622	5,958	2,383	2,488	4,183	30,841
2d period	5,093	3,509	4,080	2,218	5,229	2,348	2,136	4,125	28,738
3d period	5,440	3,653	4,227	2,223	5,942	2,471	2,391	4,204	30,551
Monthly average	5,225	3,585	4,260	2,355	5,709	2,400	2,338	4,171	30,043
	OCTOBER 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,360	3,223	3,891	2,087	5,662	2,251	2,281	3,898	27,653
2d period	4,882	3,427	3,896	2,272	5,968	2,225	2,323	3,848	28,841
3d period	4,939	3,504	4,353	2,307	6,009	2,167	2,157	3,716	29,152
Monthly average	4,734	3,389	4,056	2,224	5,884	2,213	2,250	3,817	28,567
	NOVEMBER 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,692	3,448	4,229	2,449	5,971	2,236	2,267	3,634	28,926
2d period	5,107	3,557	4,113	2,312	6,096	2,391	2,460	3,467	29,493
3d period	5,097	3,543	4,073	2,365	6,442	2,438	2,290	3,719	29,967
Monthly average	4,966	3,516	4,138	2,375	6,169	2,355	2,339	3,603	29,461
	DECEMBER 1944								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1st period	4,878	3,059	3,731	2,504	6,073	2,235	2,264	3,213	27,957
2d period	4,798	2,781	3,810	2,455	6,183	1,804	1,986	2,940	26,757
3d period	5,065	3,262	4,107	2,610	6,366	1,602	1,734	2,436	27,182
Monthly average	4,918	3,042	3,890	2,526	6,212	1,871	1,986	2,849	27,294
Daily average of year	4,982	3,615	4,383	2,508	6,476	2,310	2,324	3,719	30,317

FIGURE 59.—Japanese Government Railways—Daily carloadings—10-Day averages by divisions (Cont.)

	JANUARY 1945								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period.....	4,242	2,915	5,749	2,424	5,681	1,018	1,752	1,929	28,710
2d period.....	4,939	2,847	3,912	2,476	6,086	1,068	1,763	2,555	25,646
3d period.....	4,857	2,757	3,584	2,373	6,262	899	1,692	2,274	24,698
Monthly average.....	4,685	2,837	3,743	2,423	6,018	992	1,734	2,253	24,685
	FEBRUARY 1945								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period.....	4,509	2,894	3,357	2,176	5,939	939	1,538	2,409	23,762
2d period.....	4,467	3,101	3,721	2,366	6,216	1,311	1,631	2,640	25,453
3d period.....	3,405	3,025	3,563	2,186	5,973	1,259	1,479	2,816	23,704
Monthly average.....	4,178	3,005	3,542	2,247	6,048	1,164	1,555	2,608	24,350
	MARCH 1945								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period.....	4,304	3,178	5,786	2,548	5,886	1,718	1,807	3,092	26,319
2d period.....	4,376	3,151	3,210	2,493	5,843	1,775	1,570	3,324	25,747
3d period.....	4,713	3,371	3,537	2,526	5,992	1,972	1,821	3,612	27,598
Monthly average.....	4,464	3,233	3,511	2,522	5,909	1,827	1,735	3,352	26,589
	APRIL 1945								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period.....	4,229	3,144	3,323	2,475	5,528	1,978	1,814	3,634	26,124
2d period.....	2,961	3,457	3,438	2,408	5,398	2,100	1,781	3,757	25,301
3d period.....	3,508	3,648	3,862	2,433	5,525	2,194	1,996	3,879	27,045
Monthly average.....	3,566	3,416	3,541	2,439	5,483	2,091	1,864	3,757	26,157
	MAY 1945								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period.....	4,453	3,378	4,062	2,512	5,675	2,159	1,905	3,842	27,986
2d period.....	4,552	3,420	3,843	2,480	5,120	2,194	1,961	3,606	27,176
3d period.....	3,293	3,416	3,958	2,451	5,337	2,213	1,942	3,750	26,360
Monthly average.....	4,074	3,405	3,955	2,480	5,376	2,189	1,936	3,733	27,148
	JUNE 1945								
	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sappore	Total
1st period.....	3,895	3,242	2,715	2,398	5,410	2,260	1,912	3,713	25,045
2d period.....	3,657	3,204	2,717	2,351	5,228	2,089	1,791	3,859	24,875
3d period.....	3,709	2,853	2,695	2,333	4,832	2,005	2,080	3,876	24,288
Monthly average.....	3,587	3,099	2,709	2,354	5,158	2,118	1,928	3,818	24,769

JAPANESE GOVERNMENT RAILWAY CARLOADINGS BY DIVISIONS

(10 DAY AVERAGES 1941-1945)

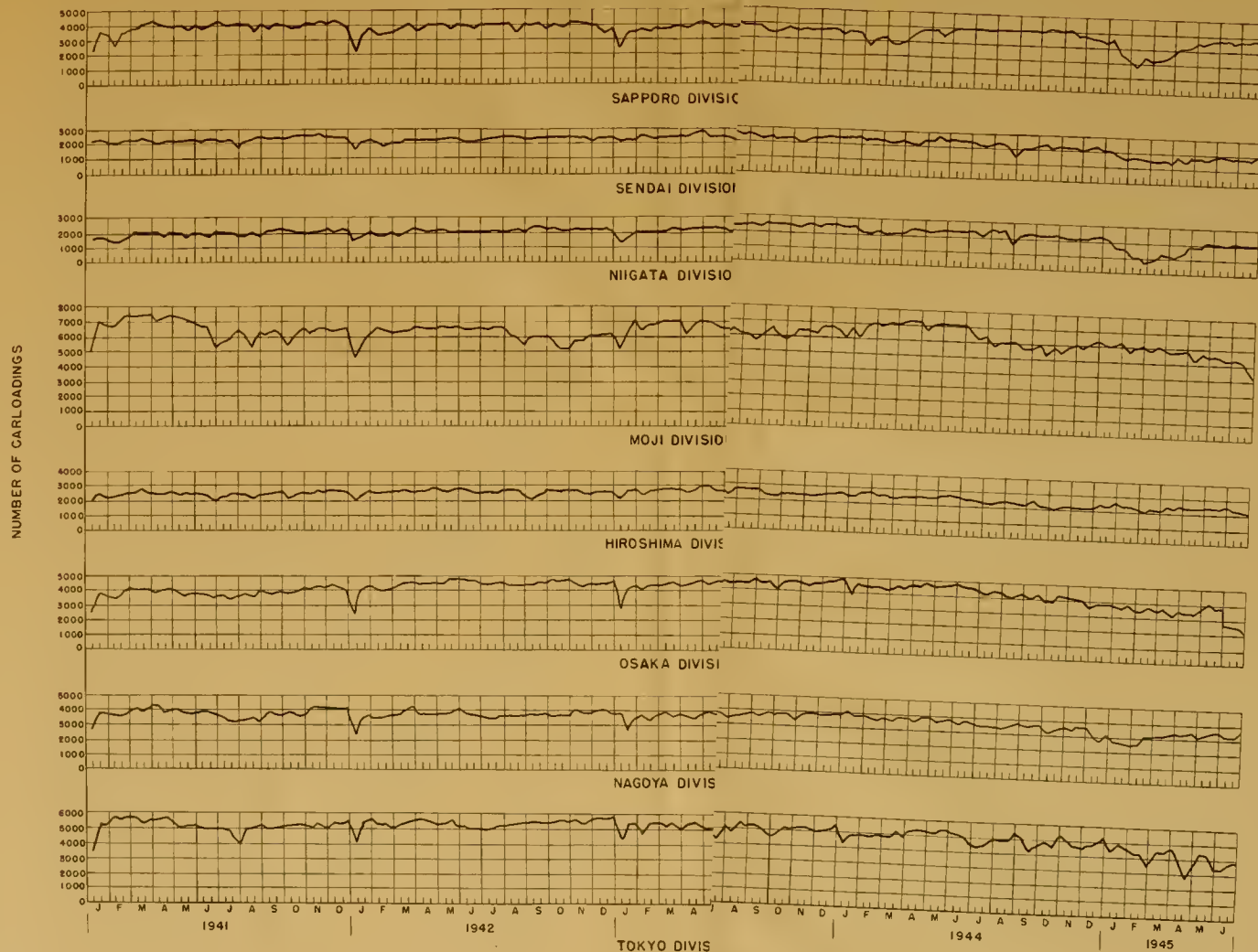


FIGURE 60

CHAPTER VI

TRANSPORTATION IN 1945

The Japanese railroads were operating at virtual capacity on all of their main trunk lines. Some of the secondary lines operated less than their maximum capacity of trains and hence carried less tonnage than they might theoretically have carried. However, these lines do not have any particular bearing on the situation since, obviously, they were not suitable routes for the hauling of goods. The salient point is that the main lines were operating at capacity and would have been unable to carry any more traffic. There was no war damage to the railroads prior to 1945.

Motor transport.—As a result of shortages of steel and rubber, few motor vehicles were manufactured during the war, and these all went to the military. Commercial vehicle operation was handicapped by an acute shortage of spare parts and strict gasoline rationing. By the end of 1944 there were only 57,000 trucks of which 40 percent were operational, and 18,000 buses, of which 45 percent were operational. These, it will be recalled, were employed entirely in urban and local services since no highway system worthy of the name existed.

The Status Quo: January 1

The year 1945 opened with little activity in the Allied attack against transportation. The Philippine campaign had passed the critical stage, and the Army was consolidating its gains. Japanese shipping had been driven from this area. The thin remaining "life line of empire" of the Japanese was a trickle of ships from Formosa along the south China coast to Indo-China and on to Malaya and the Indies. For the most part the Japanese were secure in navigation of the Sea of Japan and the Yellow Sea. Railroad transportation was being utilized to the fullest extent possible and inter-island trade was routed as nearly as possible to use the shortest sea haul and stretch the services of the shrinking merchant marine by increasing tonnage at the expense of ton-miles. On the continent, the tenka system was absorbing as much of the transportation load as could be diverted from ships. No effective interference

with the domestic transportation system had yet been caused by the B-29 raids. Although the railroads as well as the port services suffered to some extent from the nation's ills of growing manpower and material shortages, no significant slowdowns resulted therefrom. It was a brief period of calm before the storm. In six months the Japanese transportation system dissolved into chaos under the heavy blows of the many and varied attacks to which it was subjected.

Early Carrier Raids

The first event of the year came in the middle of January when the greatly reinforced carrier fleets swooped down into the south China Sea. In intense sweeping activity around Formosa, Hongkong, and French Indo-China, carrier planes sank about 280,000 tons of shipping, more than 10 percent of the existing merchant marine and nearly two and one-half as much tonnage as the Japanese built that month (Figure 36). It would seem that this blow would have cut the lifeline to the south completely, but so desperate were the Japanese for the products of this area that even in the face of such catastrophic losses, the attempt to maintain sea communication with French Indo-China, Malaya, and the Indies was continued thereafter. In February there was a lull while the Allies concentrated on the Iwo campaign and preparations for the landing on Okinawa. The Japanese lost only 87,000 tons of ships, less than in any month since 1942. Construction was beginning to fail under the cumulative effect of shortages, but 140,000 tons were delivered in that month, and for the first time since September 1942, the net tonnage afloat made a slight gain. In March came the Okinawa campaign and carriers penetrated for the first time into the east China Sea, sinking over 30,000 tons of shipping (Figure 38). It is interesting to note that the average size of these ships was only 1838 tons whereas the average size of the ships sunk in the raid at Truk 13 months before was 6,439 tons; the interesting preference of submarines for larger ships had considerably reduced the average size of the remaining ships afloat.

The End of the Singapore Run

In March the last attempts to run convoys between Japan and Singapore were discontinued. Careful investigation of the reasons behind this final surrender of the southern empire indicates that the deciding factor influencing the decision to abandon all efforts to maintain contact with the south was the anticipated imminent occupation of Formosa or Okinawa expected by the Japanese before any landings took place. The carrier raids on shipping were considered a very serious menace but were sporadic. It was expected that in spite of the terrific losses sustained from carrier attacks, enough shipping could get through between raids to justify the attempt to maintain communications. Submarine losses on this route had always been heavy, but the various counter-measures adopted were sufficiently successful so that no route as important to the Japanese economy as the Singapore run was ever abandoned on that account. The Japanese campaigns in China had pushed the Fourteenth AF bases back far enough from the sea so that losses from this source had not been serious since May 1944. The newly-established air bases in the Philippines has established constant cover of the south China Sea, but were not considered sufficiently effective by the Japanese to warrant complete cessation of operations. However, the expected occupation of Formosa or Okinawa, either one of which would put Japanese shipping lanes to the south under constant short-range air patrol, decided the matter and no more convoys were run. In the same month communication with Formosa was interrupted on account of the occupation of Okinawa and the institution of short-range air patrol, and the direct route from Japan to Shanghai was abandoned in favor of a more circuitous course

through the coastal waters of southern Korea, the Yellow Sea, and down the coast of China. The occupation of Iwo and Okinawa had contracted Japan's sea sphere to the Sea of Japan, Tsushima Straits, and the Yellow Sea, with a tenuous connection with Shanghai and the Yangtze River.

The City Raids

Early in March began the low-level B-29 raids against the larger cities in Japan. In rapid succession large areas of Tokyo, Nagoya, Osaka, and Kobe were reduced to ashes and confusion. (Yokohama was not bombed until 29 May.) It should be noted that these cities are all on the Pacific coast side of Japan, and their importance as seaports had long since commenced to wane. Tokyo, Yokohama, and Nagoya felt the combined effect of submarine blockade, shrinkage in the merchant fleet, and diversion of traffic to the rails very early in the war. The traffic in the Kobe-Osaka port area, though protected from submarines by the Inland Sea, began to diminish with the increasing shortage of shipping and with the practice of shortening sea lanes by unloading cargoes at the first railhead instead of continuing on by water to the port of ultimate destination. The status of these cities as seaports at the time of the great B-29 raids beginning in March is shown clearly in Figure 61.

In these statistics it can easily be seen that the load of port activity on these cities had so decreased from other causes and as a result of the general shrinkage in the merchant fleet that a very considerable cushion of excess port capacity existed. Although harbor masters describe vividly the conditions of shortage and poor quality of labor, disruption of local transport, the damage to warehouse space, close ex-

FIGURE 61.—Port activity in principal Japanese seaports

(Measured in tons of cargo handled in civilian ships)

	Tokyo		Yokohama		Nagoya		Osaka		Kobe	
		Percent		Percent		Percent		Percent		Percent
Monthly average 1942.....	260,618	100	427,076	100	155,098	100	314,625	100	40,394	100
Monthly average 1943.....	138,808	53.3	258,517	60.5	48,086	31.0	175,445	55.8	34,883	86.4
Monthly average 1944.....	28,391	11.9	90,256	21.1	12,394	8.0	225,448	71.7	60,466	149.7
January 1945.....	1,845	1.7	70,427	16.5	5,150	3.3	146,519	46.6	56,457	139.8
February.....	23,592	9.1	46,919	11.0	4,480	2.9	182,808	58.1	40,756	100.9
March.....	5,947	2.3	49,610	11.6	7,307	4.7	151,359	48.1	28,968	71.7
April.....	12,908	5.0	5,833	1.4	1,396	.9	141,569	45.0	32,999	81.7
May.....	635	1.2	18,427	4.3			93,618	29.8	27,047	67.0
June.....							8,000	2.5	2,664	6.6
July.....							30,000	9.5	4,504	11.2

¹ Estimated; based on tonnage of ship entries.

amination of the facts indicates that in spite of these chaotic conditions the diminished amounts of seaborne freight reaching port were handled at about the normal rate. Certainly the differences, where traceable to the results of the fire raids, are insignificant as compared with other larger forces at work on the shipping situation. (An exception worthy of mention is Osaka, where the heavy B-29 raids early in June damaged the pumping system by which the harbor area, mostly "made" land below the level of the sea, was kept dry. Port activity in this area in relation to the various forces of attack is shown in Figure 64.

The city raids did not destroy railroad track-age or seriously impair the operating capacity still required of the rails. The primary effect on the railroad was the interruption of car unloadings. The damage to warehouses, unloading platforms, and drayage facilities, together with the loss of trucks and carts used for hauling the merchandise from railhead to plant or market greatly retarded car unloadings. In addition to the actual physical damage there was also a resultant labor absenteeism. Railroad officials disclosed that labor did not report promptly after a raid. Many moved to the country for shel-

ter and food. Besides, a certain amount of confusion ensued in getting those laborers that did report for work to proper assignments. It was often necessary to shift the unloading and loading of cars from the normal place to a temporary site. This occasioned a transfer of labor with a consequent delay.

These attacks were partly responsible for reducing the demand for railroad services. The destruction of industries or their evacuation to other areas relieved the strain upon the rails which would have been present had production continued unabated. In short then, the rails were able to meet the demands made upon them during and after these attacks. An examination of the carloadings (Figures 62 and 63) shows no significant correlation between fire raids and the number of cars loaded in those divisions subjected to such attacks.

A byproduct of these city raids which seriously affected the shipping situation was the reduced shipyard activity. To what extent it can be traced directly to the city raids is difficult to determine, but Figure 62 illustrates a dramatic connection between the B-29 raids and shipyard production.

FIGURE 62.—Japanese Government Railways—Daily carloadings—10-day averages by divisions

JANUARY 1945

Day	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1	2,826	3,122	3,481	2,350	4,546	1,062	1,691	1,606	20,684
2	3,417	2,882	3,506	2,376	4,916	963	1,899	1,989	21,948
3	3,631	3,129	3,642	2,491	5,534	934	1,731	1,605	22,697
4	4,432	3,097	3,890	2,517	5,750	1,135	1,935	1,859	24,615
5	4,640	3,236	4,156	2,538	6,439	1,239	1,873	2,095	26,216
6	4,649	3,398	3,998	2,410	5,717	1,189	1,894	1,875	25,130
7	4,646	3,170	3,782	2,391	5,489	887	1,706	1,851	23,922
8	4,828	2,295	3,502	2,353	6,161	742	1,545	1,825	23,251
9	4,672	2,114	3,432	2,373	6,102	968	1,616	2,113	23,390
10	4,680	2,707	4,097	2,440	6,151	1,062	1,631	2,471	25,239
Average	4,242	2,915	3,749	2,424	5,681	1,018	1,752	1,929	28,710
11	4,940	3,214	4,017	2,507	5,835	1,046	1,702	2,648	25,909
12	4,806	3,056	4,218	2,570	6,193	1,198	1,745	2,762	26,548
13	4,696	3,028	4,252	2,657	6,623	1,298	1,759	2,506	26,819
14	4,753	2,948	4,107	2,545	6,445	1,369	1,766	2,833	26,766
15	5,253	3,126	4,158	2,539	6,022	1,413	1,796	2,768	27,075
16	5,042	3,110	4,071	2,426	6,100	1,065	1,828	2,372	26,014
17	5,089	2,747	3,907	2,448	6,013	848	1,850	2,380	25,282
18	5,173	2,582	3,670	2,398	5,834	805	1,629	2,339	24,430
19	4,692	2,163	3,353	2,474	5,686	749	1,645	2,468	23,230
20	4,946	2,492	3,371	2,195	6,113	877	1,910	2,478	24,382
Average	4,939	2,847	3,912	2,476	6,086	1,068	1,763	2,555	25,646
21	5,001	2,910	3,823	2,380	5,923	915	1,825	2,078	24,855
22	5,202	2,939	3,805	2,270	5,903	1,137	1,766	2,342	25,364
23	5,058	2,969	3,704	2,367	6,681	919	1,546	2,030	25,274
24	5,285	2,849	3,768	2,269	6,239	936	1,491	2,120	24,957
25	4,689	2,300	3,315	2,515	6,180	728	1,527	2,030	23,284
26	4,685	2,298	3,179	2,381	6,081	772	1,596	1,971	22,963
27	4,490	2,395	3,395	2,392	6,430	761	1,818	2,193	23,874
28	4,020	2,629	3,394	2,198	6,279	805	1,789	2,404	23,518
29	4,803	2,955	3,572	2,374	6,029	853	1,667	2,544	24,797
30	5,110	3,099	3,855	2,487	6,488	1,002	1,765	2,625	26,431
31	5,085	2,982	3,618	2,471	6,646	1,066	1,822	2,676	26,366
Average	4,857	2,757	3,584	2,373	6,262	899	1,692	2,274	24,698
Daily average of month	4,685	2,837	3,743	2,423	6,018	992	1,734	2,253	24,685

FIGURE 62.—Japanese Government Railways—Daily carloadings—10-day averages by divisions (Cont.)

FEBRUARY 1945

Day	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
1	4,959	3,166	3,970	2,446	5,817	1,061	1,483	2,547	25,449
2	4,227	3,061	3,554	2,300	6,609	1,096	1,533	2,743	24,123
3	4,612	3,129	3,613	2,343	6,431	1,034	1,745	2,150	25,057
4	4,072	2,888	3,046	2,198	5,954	776	1,490	2,079	22,503
5	4,699	2,730	3,145	2,214	5,806	739	1,365	2,004	22,702
6	4,726	2,721	3,189	2,157	5,510	643	1,393	2,442	23,781
7	4,675	2,625	3,317	2,106	5,772	888	1,834	2,648	23,665
8	3,930	2,758	3,045	1,789	5,560	1,051	1,661	2,796	22,590
9	4,366	2,852	3,257	1,995	5,702	1,003	1,493	2,763	23,431
10	4,828	3,012	3,434	2,209	6,230	1,102	1,386	1,915	24,116
Average	4,509	2,894	3,357	2,176	5,939	939	1,538	2,409	23,762
11	4,497	2,874	3,277	2,065	5,733	834	1,486	1,829	22,595
12	4,641	3,036	3,503	2,129	6,160	1,060	1,528	2,595	24,652
13	4,618	2,915	3,674	2,201	6,084	1,138	1,677	2,473	24,780
14	4,979	3,057	3,910	2,394	6,333	1,270	1,545	2,780	26,268
15	4,905	3,166	3,913	2,576	6,484	1,505	1,956	2,724	27,229
16	3,799	3,055	3,910	2,591	6,281	1,617	1,616	2,818	25,687
17	2,867	3,068	3,719	2,574	6,412	1,354	1,539	2,891	24,424
18	4,250	3,084	3,693	2,444	6,105	1,348	1,591	2,958	25,473
19	5,097	3,415	3,912	2,379	6,430	1,483	1,658	2,562	26,936
20	5,015	3,337	3,698	2,307	6,138	1,506	1,713	2,771	26,485
Average	4,467	3,101	3,721	2,366	6,216	1,311	1,631	2,640	25,453
21	5,185	3,345	3,571	2,211	5,887	1,402	1,710	2,722	26,033
22	4,030	3,077	3,872	2,109	5,842	1,499	1,687	2,684	24,800
23	2,594	3,143	3,932	2,439	6,603	1,382	1,776	2,890	24,759
24	3,982	3,214	3,910	2,540	6,352	977	1,270	2,481	24,726
25	3,530	2,921	2,804	1,865	4,276	1,119	1,411	2,641	20,567
26	1,208	2,344	3,242	1,891	6,094	985	1,348	2,871	19,983
27	2,759	2,949	3,544	2,174	6,284	1,223	1,268	3,185	23,386
28	3,937	3,206	3,628	2,256	6,450	1,488	1,362	3,053	25,380
Average	3,403	3,025	3,563	2,186	5,973	1,259	1,479	2,816	23,704
Daily average of month	4,178	3,005	3,545	2,247	6,048	1,164	1,555	2,608	24,350

MARCH 1945

1	4,400	3,214	3,743	2,311	5,830	1,534	1,845	2,949	25,826
2	4,110	2,714	3,656	2,260	5,587	1,573	1,613	3,436	24,949
3	4,370	3,029	3,624	2,288	5,456	1,501	1,734	3,060	25,062
4	4,050	3,042	3,567	2,359	6,096	1,544	1,808	3,282	26,048
5	4,181	3,368	4,004	2,835	6,233	1,714	1,925	2,910	27,170
6	3,718	2,958	3,820	2,684	4,931	1,886	1,795	3,219	25,011
7	4,446	3,256	4,040	2,595	6,206	1,968	1,737	3,021	27,269
8	4,894	3,305	3,698	2,614	6,355	1,726	1,842	2,925	27,358
9	5,185	3,496	3,962	2,625	6,071	1,800	2,008	2,932	28,079
10	3,685	3,395	3,743	2,609	6,096	1,854	1,757	3,188	26,318
Average	4,304	3,178	3,786	2,547	5,886	1,710	1,806	3,092	26,309
11	4,376	3,460	3,782	2,578	5,700	1,532	1,620	3,065	26,113
12	3,608	2,627	3,953	2,634	6,007	1,465	1,560	3,003	24,857
13	4,293	3,121	3,826	2,747	6,271	1,547	1,434	3,163	26,402
14	4,702	3,194	2,697	2,484	6,258	1,684	1,694	3,516	26,229
15	4,579	3,039	2,919	2,373	5,825	1,714	1,602	3,726	25,778
16	4,479	3,229	3,520	2,545	5,597	1,832	1,508	3,291	26,001
17	4,394	3,296	2,815	2,513	5,798	1,927	1,538	3,334	25,615
18	4,523	3,284	2,854	2,313	5,084	2,048	1,523	3,140	24,779
19	4,341	2,683	2,638	2,262	6,084	2,053	1,554	3,423	25,038
20	4,462	3,579	3,088	2,493	5,848	1,950	1,667	3,582	26,669
Average	4,376	3,151	3,210	2,494	5,847	1,775	1,570	3,324	25,748
21	4,225	3,136	3,375	2,382	6,109	1,914	1,811	3,537	26,489
22	4,374	3,128	3,516	2,358	6,084	1,864	1,830	3,563	26,717
23	4,591	3,154	3,579	2,494	5,934	1,937	1,732	3,559	26,980
24	4,816	3,411	3,663	2,872	6,385	1,922	1,788	3,616	28,473
25	4,786	2,993	3,400	2,464	5,891	1,854	1,678	3,466	26,532
26	4,814	3,438	3,658	2,642	5,818	1,964	1,702	3,419	27,655
27	4,863	3,465	3,563	2,540	6,249	2,013	1,961	3,702	28,356
28	4,809	3,639	3,491	2,620	5,825	2,009	1,838	3,661	27,892
29	4,803	3,486	3,678	2,605	5,623	1,976	1,848	3,620	27,639
30	4,872	3,568	3,469	2,742	5,809	2,002	2,026	3,714	28,202
31	4,886	3,687	3,508	2,464	6,089	2,235	1,819	3,878	28,566
Average	4,713	3,372	3,536	2,563	5,993	1,972	1,821	3,612	27,591
Daily average of month	4,472	3,238	3,512	2,535	5,908	1,824	1,735	3,352	26,583

APRIL 1945

1	4,642	3,124	3,326	2,481	5,191	1,889	1,715	3,267	25,635
2	4,668	3,181	3,212	2,649	5,594	1,907	1,606	3,632	26,449
3	4,626	3,225	3,278	2,475	5,614	1,985	1,540	3,535	26,278
4	2,808	2,652	3,332	2,268	5,169	2,061	1,661	3,622	23,573
5	3,003	3,120	3,482	2,509	5,717	1,952	1,682	3,572	25,037
6	3,735	3,377	3,300	2,732	5,454	1,921	1,923	3,705	26,147
7	4,109	2,972	3,323	2,703	5,619	1,999	1,948	3,444	26,117
8	4,665	3,307	3,268	2,284	5,926	1,909	1,927	3,788	27,074
9	5,079	3,337	3,486	2,353	5,809	1,960	1,975	3,860	27,859
10	4,951	3,148	3,224	2,301	5,175	2,195	2,162	3,912	27,068
Average	4,229	3,144	3,323	2,475	5,528	1,978	1,814	3,634	26,124

FIGURE 62.—*Japanese Government Railways—Daily carloadings—10-day averages by divisions (Cont.)*
APRIL 1945

Day	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
11	4,981	3,271	3,375	2,262	5,530	2,070	1,909	3,389	26,787
12	4,522	3,268	3,400	2,458	5,628	2,200	1,840	3,760	27,076
13	5,040	3,706	3,453	2,445	6,133	2,092	1,740	3,845	28,454
14	1,653	3,464	3,285	2,507	5,991	2,198	1,673	3,759	24,530
15	1,749	3,462	3,263	2,494	5,969	2,129	1,725	3,773	24,564
16	1,951	3,543	3,467	2,490	6,289	1,903	1,655	3,813	25,111
17	2,216	3,598	3,526	2,582	2,054	2,211	1,803	3,331	21,921
18	2,487	3,539	3,677	2,469	5,628	1,985	1,809	3,890	25,484
19	2,468	3,432	3,264	1,944	4,999	2,154	1,855	3,749	23,865
20	2,546	3,287	3,673	2,430	5,758	2,053	1,804	3,664	25,215
Average	2,961	3,457	3,438	2,408	5,398	2,100	1,781	3,757	25,301
21	2,828	3,598	3,963	2,551	5,216	2,081	1,866	3,787	25,890
22	2,832	3,577	3,930	2,434	5,473	2,032	1,920	3,809	26,007
23	3,251	3,781	3,920	2,193	5,237	2,140	2,163	3,817	26,502
24	3,355	3,528	3,647	2,351	5,524	2,279	2,038	4,076	26,798
25	3,514	3,593	3,770	2,419	5,994	2,274	2,016	3,993	27,573
26	3,832	3,770	3,707	2,508	5,459	2,175	1,941	3,955	27,347
27	3,913	3,836	3,941	2,484	5,708	2,134	2,066	3,921	28,003
28	4,040	3,490	3,961	2,487	5,774	2,282	2,002	3,722	27,724
29	3,826	3,653	3,861	2,386	5,752	2,284	1,932	3,848	27,542
30	3,686	3,652	3,923	2,516	5,146	2,261	2,015	3,860	27,039
Average	3,508	3,648	3,862	2,433	5,525	2,194	1,996	3,879	27,045
Daily average of month	3,566	3,416	3,541	2,439	5,483	2,091	1,864	3,757	26,157

MAY 1945

1	3,777	3,292	3,982	2,284	5,600	2,131	1,974	3,417	26,457
2	4,037	2,762	3,765	2,380	5,651	1,911	1,781	3,716	26,003
3	4,707	3,030	4,092	2,738	6,051	2,275	1,774	4,008	28,675
4	4,569	3,342	4,067	2,521	5,626	2,101	1,877	3,892	28,085
5	4,460	3,596	4,074	2,794	5,829	2,166	1,865	3,960	28,744
6	4,550	3,565	4,207	2,510	5,673	2,106	2,007	3,947	28,565
7	4,655	3,498	4,315	2,534	5,607	2,169	1,889	3,970	28,637
8	4,674	3,639	3,987	2,476	5,522	2,285	1,971	3,985	28,539
9	4,442	3,448	3,906	2,587	5,654	2,196	1,983	3,824	28,040
10	4,659	3,515	4,229	2,295	5,541	2,248	1,927	3,703	28,117
Average	4,453	3,378	4,062	2,512	5,675	2,159	1,905	3,842	27,986
11	4,666	3,835	3,900	2,074	4,621	2,199	1,974	3,671	26,940
12	4,209	3,580	3,651	2,141	4,590	2,329	1,781	2,972	25,253
13	4,722	3,694	3,717	2,391	4,876	2,410	1,851	3,434	27,095
14	4,753	3,421	3,630	2,424	4,500	2,177	2,051	3,695	26,651
15	4,599	3,514	3,916	2,478	5,227	2,249	2,072	3,788	27,843
16	4,499	3,511	3,958	2,815	5,168	2,138	1,790	3,688	27,567
17	4,535	2,971	3,951	2,675	5,575	2,267	1,849	3,589	27,412
18	4,779	3,301	3,922	2,678	5,575	2,025	2,198	3,693	28,171
19	4,604	3,224	4,020	2,558	5,686	2,099	2,032	3,908	28,131
20	4,156	3,150	3,768	2,562	5,379	2,048	2,013	3,620	26,696
Average	4,552	3,420	3,843	2,480	5,120	2,194	1,961	3,606	27,176
21	4,714	3,256	3,999	2,344	4,889	2,244	2,145	3,844	27,435
22	4,705	3,639	3,952	2,033	4,746	2,268	2,063	3,725	27,131
23	4,229	3,403	3,899	2,523	5,410	2,062	2,042	3,608	27,176
24	3,493	3,477	4,008	2,515	5,642	2,115	2,027	3,770	27,047
25	3,594	3,355	4,058	2,626	5,694	2,276	2,021	3,797	27,421
26	2,673	3,547	3,927	2,403	5,804	2,129	1,854	3,697	26,034
27	2,609	3,136	3,840	2,444	5,211	2,198	1,757	3,744	24,939
28	2,751	3,391	4,028	2,420	5,415	2,268	1,828	3,637	25,738
29	2,259	3,363	3,890	2,371	5,300	2,349	1,766	3,802	25,100
30	2,441	3,399	3,854	2,631	5,300	2,454	1,951	3,857	25,887
31	2,759	3,613	4,080	2,656	5,300	1,982	1,903	3,770	26,063
Average	3,293	3,416	3,958	2,451	5,337	2,213	1,942	3,750	25,361
Daily average of month	4,074	3,405	3,955	2,480	5,376	2,189	1,936	3,733	27,148

JUNE 1945

1	2,814	3,314	2,758	2,431	5,370	2,122	1,894	3,628	24,331
2	3,781	2,843	2,501	2,167	5,436	2,198	1,993	3,805	24,724
3	3,047	3,294	3,523	2,531	5,389	3,039	1,864	3,337	25,924
4	3,196	3,577	3,588	2,592	5,495	2,128	2,131	3,704	26,411
5	3,779	3,639	2,780	2,581	5,965	2,205	2,072	3,692	26,713
6	3,591	3,384	2,877	2,319	5,334	2,153	2,055	3,777	25,490
7	3,731	2,862	2,496	2,344	5,183	2,265	1,734	3,804	24,419
8	3,472	3,281	2,182	2,350	5,046	1,968	1,671	3,977	23,947
9	3,639	2,984	2,230	2,380	5,450	2,257	1,857	3,613	24,410
10	2,905	3,239	2,216	2,282	5,528	2,265	1,851	3,795	24,081
Average	3,396	3,242	2,715	2,398	5,410	2,260	1,912	3,713	25,045
11	3,174	3,226	2,891	2,371	5,709	2,113	1,656	3,660	24,800
12	3,509	2,767	2,430	2,334	5,268	2,121	1,395	3,918	23,742
13	3,635	3,161	2,825	2,111	5,061	2,264	1,682	3,889	24,628
14	3,783	3,580	3,211	2,518	5,296	2,233	1,801	3,892	26,314
15	3,791	3,538	2,141	2,266	6,534	2,054	1,777	3,708	24,809
16	3,431	3,453	2,481	2,320	4,978	2,121	1,914	3,924	24,622
17	3,779	3,392	2,672	2,315	5,528	2,036	1,910	3,849	25,481
18	3,918	3,091	2,689	2,350	4,800	2,013	1,924	4,056	24,841
19	3,923	3,377	2,867	2,377	5,132	1,857	1,831	3,935	25,299
20	3,627	2,450	2,965	2,345	4,970	2,080	2,020	3,759	24,216
Average	3,657	3,204	2,717	2,331	5,228	2,089	1,791	3,859	24,875

FIGURE 62.—*Japanese Government Railways—Daily carloadings—10-day averages by divisions (Cont.)*
JUNE 1945

Day	Tokyo	Nagoya	Osaka	Hiroshima	Moji	Niigata	Sendai	Sapporo	Total
21	3,821	3,044	3,211	2,235	5,148	1,958	2,098	3,855	25,370
22	3,846	2,697	2,551	2,183	4,372	2,060	1,973	4,003	23,685
23	3,790	2,842	2,796	2,372	5,638	2,069	2,003	3,915	25,425
24	3,344	2,489	2,655	2,361	4,659	1,948	1,778	3,731	22,965
25	3,699	2,722	3,086	2,362	5,190	2,008	2,038	4,034	25,145
26	3,735	2,402	2,250	2,555	5,107	1,984	1,965	3,900	23,898
27	3,612	2,823	2,600	2,322	5,082	2,094	2,065	3,825	24,423
28	3,859	2,933	2,717	2,326	4,756	1,959	2,125	3,762	24,467
29	3,857	3,119	2,605	2,360	4,355	1,955	2,405	3,948	24,544
30	3,526	3,452	2,474	2,300	4,075	1,989	2,356	3,786	23,958
Average	3,709	2,853	2,695	2,333	4,838	2,005	2,080	3,876	24,389
Daily average for month	3,587	3,099	2,709	2,354	5,158	2,118	1,928	3,816	24,769

	Deliveries of merchant ships	Tonnage of bombs dropped on Japanese cities
	Tons	Tons
January 1945..	113,419	730
February	140,372	1,490
March	126,729	10,139
April	33,707	5,409
May	66,454	17,988
June	22,481	22,485
July	44,347	33,320

The Beginning of the Mine Campaign

The final phase of the attack on shipping began with the undertaking by the Twentieth AF on 27 March of the laying of mines in Japanese coastal waters by B-29s. This effort increased through May, June, and July, and eventually included all important Japanese and Korean seaports on the Japan Sea and Korean Straits. In April the campaign really began to get underway. The most important target was the Shimonoseki Straits: the western entrance to the Inland Sea, western terminus of the Honshu railroads, northern terminus of the Kyushu railroads, and the most important area of shipping concentration in Japan. In this area 18 ships, 30,917 tons, were sunk or damaged and put out of action for the rest of the war by mines in April (Figure 40).

Apparently this mine-laying campaign took the Japanese completely by surprise. Mine-sweepers were unable to provide any security in mined ports. A combination of ineffective coordination of control of shipping and the great need of Japan for ships to go through regardless of loss resulted in the policy of leaving it to the captain's discretion whether or not to pass through the mine fields. Furthermore, the character of the mines dropped, (sound mines, magnetic mines, pressure mines, and various combinations of these) made effective mine-sweeping an extremely difficult problem. The sweeping in which the Japanese engaged may have reduced the losses somewhat but certainly

did not affect enough to call the effort a success.

In April submarines entered the Sea of Japan and began sinking ships. The total shipping sunk from all causes in that month was not great, only 110,000 tons, the submarines accounting for the lion's share (Figure 40). Army planes picked up a few stragglers along the south China coast, but for the most part the pickings south of Japan were very poor. The remaining ships had been withdrawn, and no more were sent south.

CONSOLIDATION OF ALL SHIPPING: THE WAR POWER COUNCIL

The long-proposed united ship transportation plan went into effect finally in May 1945. Under this plan the operating fleets of Army, Navy, and shipping control association were to be consolidated into a shipping pool under the control of a joint board composed of representatives of Army, Navy, Munitions Ministry, Transportation Ministry and shipping control association. Actually this reorganization came too late to be of any material assistance. The small remaining tonnage was systematically directed by this organization, but the amount out of service on account of damage, and the constant losses by sinking were so great that even with this unified control the results were pitifully small. The total civilian cargo moved under this system is shown in the following table:

	Gross tons of serviceable cargo ships	Metric tons of cargo	Ratio: Cargo tons Ship tons
May 1942 (civilian only)...	1,800,000	2,991,000	1.7
May 1943 (civilian only)...	1,960,000	3,254,000	1.7
May 1944 (civilian only)...	1,300,000	1,945,000	1.5
May 1945 (combined Army, Navy and civilian)	1,290,000	1,050,000	0.8
June 1945 (combined Army, Navy and civilian)	1,200,000	752,000	0.6

At the first meeting of this joint board, the war power council (senryoku kaigi), on 10

JAPANESE GOVERNMENT RAILWAYS EFFECT OF CITY RAIDS ON DAILY CARLOADINGS

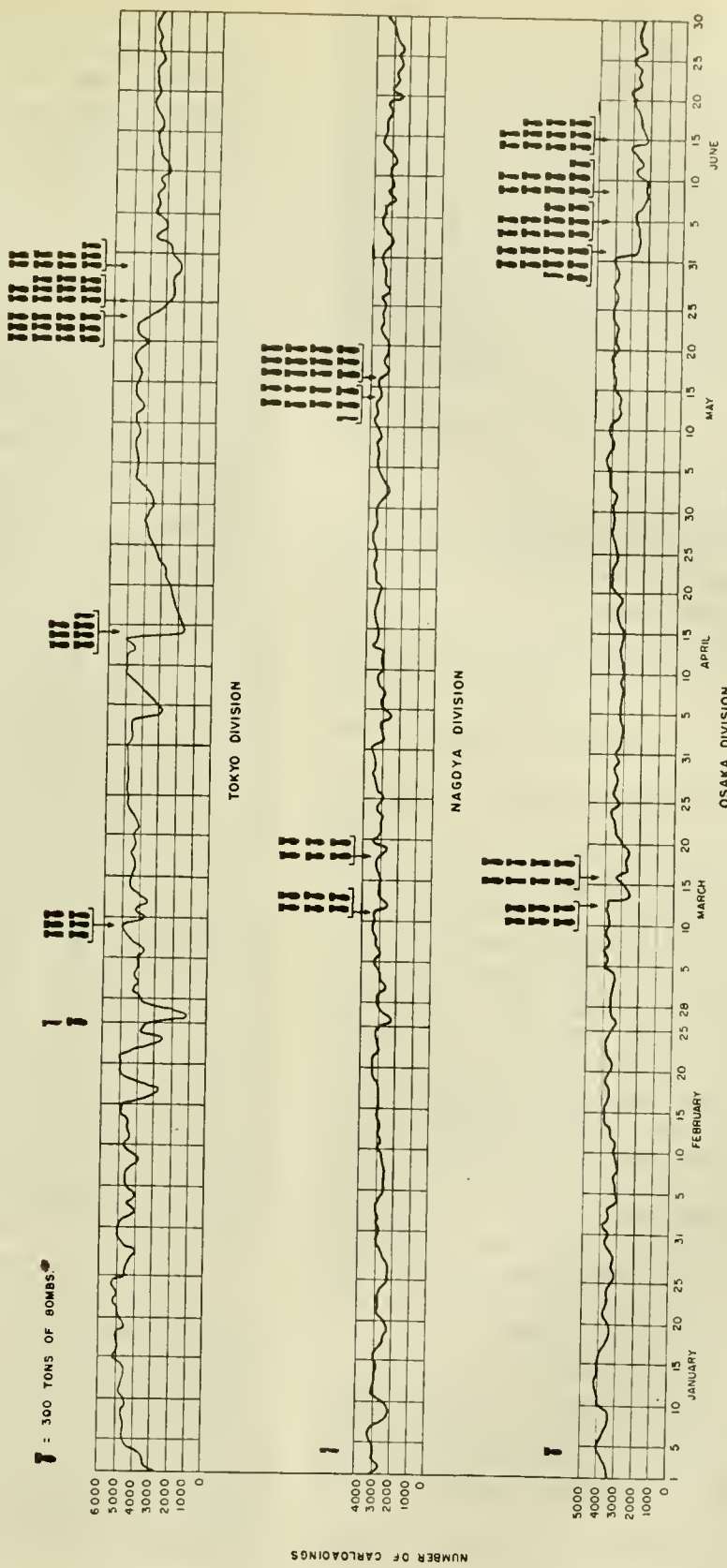


FIGURE 63.

May 1945, the chief activity was to deplore the poor results in snipping in April: 1,100,000 tons in kisen and 534,000 tons in kihansen. This represents all sea transportation under the control of the government, a considerable reduction from April 1942, when over 3,000,000 tons were handled in civilian kisen alone, without counting the contributions of Army and Navy ships and kihansen. The reasons given for the poor showing in April (not counting the simple fact that the combined merchant fleet had been reduced to less than 1,300,000 tons of serviceable cargo ships all told) are here quoted:

(1) Suspension of water transport due to enemy submarines between Japan and Manchuria-north China.

(2) Blockade of water routes by air mining in the Shimonoseki Straits, at Kobe-Osaka, and in the Inland Sea.

(3) Decline of loading capacity for north China salt, alumina, etc.

(4) Reduction of loading capacity for north Korean cereals.

(5) Irregularity in the distribution of fuel oil.

(6) Increase in the percentage of ships needing repairs.

(7) Falling off of cargoes arriving by transshipment from southern Korea (tenka traffic).

The low performance of kihansen was partly due to the poor quality of the vessels produced in the hysterical wooden shipbuilding program; their efficiency was very low, and they gave constant trouble. The chief difficulty at this time, however, was the fuel situation. In April the fuel allocation for kihansen was only 1,104 kiloliters, an all-time low. The council's report cites 3,544 ship-days of delay to kihansen during April while waiting for fuel. This severe fuel shortage for kihansen was in distillate. The April allocation was only 10 percent of the 1943 average. The amount was improved in subsequent months, but did not again reach the level of the March allocation.

The fact that there was an increase in allocation of fuel to kihansen in the late spring in the face of complete stoppage of supply of petroleum from the south underlines the extreme importance attached to their continued operation.

Although the supply of oil bunker fuel for

Allocation of distillate fuel for kihansen

	kiloliters
August 1943	12,881
February 1944	11,018
August 1944	7,918
November 1944	6,016
February 1945	3,692
March 1945	3,282
April 1945	1,104
May 1945	2,611
June 1945	2,472
July 1945	2,614
August 1945	2,385

kisen was somewhat spotty during the spring of 1945, there was not the precipitous drop which occurred in distillate fuel, and although fuel shortage is frequently mentioned vaguely as an explanation for decreasing transport, there is no evidence of any widespread or recurrent delays of kisen on this account. A number of reasons explain this: as between coal-burners and oil-burners, the latter were generally more efficient and had a longer cruising radius. Therefore, they were the first to be requisitioned by the Army and Navy and the first to be sunk. When oil began to be short for ship fuel late in 1944, the remaining oil-burners were whenever possible detailed to service in the southern area, near the oil fields; coal-burners were called home. At the same time the emphasis in production was shifted from oil to coal, and the conversion of ships already in service to the burning of coal was undertaken. There were, therefore, relatively few oil-burning steamships left in Japanese waters by the spring of 1945, and these were the most efficient units of the merchant marine in service; it was unthinkable that they should be allowed to run short of fuel. When civilian stocks ran dry, steamships were even allowed access to the precious, dwindling stocks of the Army and Navy so that they might keep going and bring into Honshu every bushel of rice and every pound of coal possible.

The Beginning of the End: May 1945

In May the conquest of Okinawa had produced the needed air bases, and Navy Privateer planes began extensive shipping patrols over south Korean waters and the Korean Straits, sinking 29 ships of 57,041 tons. Meanwhile the Twentieth AF laid more and more mines in the Shimonoseki Straits and through the whole length of the Inland Sea. In this month mine explosions sank or seriously damaged and put

out of action in Japanese waters 85 ships of 213,000 tons, 9 percent of the remaining Japanese fleet afloat (Figure 41). Heavy mine losses and the confused and disorganized attempts at minesweeping disrupted maritime traffic with the continent. In the middle of May an average of about 80 ships were detained daily on account of mine blockade.

In this month, in spite of the utmost efforts at coordination, shipping shrank a little more. Kisen only brought in about 1,100,000 tons. The outlook for effective performance by kihansen is illustrated by the council's prognostication for May: "The kihansen transportation plans will be similar to those for April, and the actual results will probably show no improvement worth mentioning."

The Japanese merchant marine was really on its last legs. Sinkings and serious damages were proceeding at the rate of 21 percent of servicable shipping a month. Steel shipbuilding was down to about 20 percent of the January 1944 peak and was falling fast. Wooden shipbuilding was down to about 12 percent of the peak, and fuel for those already built was only available at about 10-20 percent of former amounts. The repair problem was beginning to become serious. Over a half-million tons of shipping were in the yards for repair in May, and this did not begin to tell the whole story; on account of the mining of the straits, ships on the west coast needing repairs were denied access to the Inland Sea where the major yards were located.

As the throttling of the Shimonoseki Straits by mines became increasingly effective, more and more attention was paid to the Honshu ports on the Sea of Japan. As described elsewhere, beginning in late 1942, the main ports on this side of the island were developed and intensively used, both to avoid exposing ships to submarine attack in Pacific waters and to shorten the water haul from Hokkaido and Korea wherever possible. To increase the capacity of these ports when a ceiling was reached in the rate of cargo moved through them, a big project of transferring heavy dock machinery from the blockaded Pacific ports to ports on the Japan Sea was begun in the fall of 1944 and continued through the winter and spring of 1945. Over 30 heavy cranes and conveyors were so shifted, and numerous new railroad sidings

were installed. Now with the added difficulties of mines in the straits, adding the Inland sea ports to the list of Pacific ports to which free access was denied, even the increased capacity of the regular Japan Sea ports of Tsuruga, Nanao, Fushiki, Niigata, etc., was inadequate, and small fishing villages where ocean ships had never before entered were used to help funnel in the goods from the continent. Needless to say, the results obtained by last-minute opening of these small ports were insignificant. Even during the period of most intense use, April-June 1945, all these little ports only handled about 15 percent of the traffic coming in (Figure 57).

The large ports in Japan had taken a considerable pounding from the B-29s, a measure of which is indicated in the following table, but as the great bulk of the remaining traffic had been shifted to large and small ports on the Japan Sea, which themselves had not yet been raided, this damage was not a critical factor in the shipping situation.

	Lighters destroyed	Warehouses burned (square yards)
Moji-Shimonoseki.....	353	84,435
Tokyo.....	518	126,842
Yokohama.....	555	247,851
Nagoya.....	273	184,785
Osaka.....	2,408	470,682
Kobe.....	595	255,435

The stevedore problem, which had begun to deteriorate in the late summer of 1944, was about at its worst. Heavy drafting of skilled stevedores by the Army had depleted the ranks considerably since that time. Replacements had been made by importing Chinese and Koreans, enlisting parttime help from patriotic societies, using school children, convicts, and prisoners-of-war, and finally calling on the Army to furnish labor battalions. In the large port cities on the Pacific and in the Inland Sea, where efficiency was reduced 70 percent in one year, this situation would have constituted a serious bottleneck if traffic had continued at the 1942 rate, but in all these places port activity declined on account of (1) re-routing to avoid submarines and to shorten sea lanes, (2) general shrinkage of the merchant fleet, and (3) the increasing effectiveness of the mine blockade, all these factors serving to lower port activity faster than the decline of the supply and efficiency of stevedores. The various factors

tending to reduce the usefulness of the Kobe-Osaka port area are illustrated in Figure 64.

In the Japan Sea ports there was an entirely different story. These ports normally handled a comparatively small amount of traffic, and when activity was artificially increased in 1943, a manpower shortage was immediately felt. Attempts were made to transfer highly skilled and organized stevedore gangs in units from Osaka to these ports, but the usual immobility of labor plus housing shortages limited the success of this expedient. Foreigners were brought in, and over 8,500 Chinese and Koreans were employed in this work in Niigata, Tsuruga, Fushiki, Sakata and Funakawa.

By the middle of May the mine-laying in the Shimonoseki Straits had begun to bear real fruit. For four days no ships passed through at all, and the total traffic through this gateway in May was only 404,000 tons of shipping, less than half the April traffic (Figure 65). The introduction of more and more complicated mines made effective sweeping well-nigh impossible, and the Japanese had the difficult choice of sending ships through regardless of danger (about every third ship navigating this strait in May was put out of action), or waiting in hopes that the channel would eventually be cleared, meanwhile losing precious ship-time when every ton of imports was worth its weight in gold.

The outlook of the war power council for shipping in June was gloomy. Fuel was still a critical item; in the Shimonoseki area alone there were 779 ship-days' delay of "E" ships (830-tonners) waiting for fuel, and 4,266 of kihansen. In spite of the consolidation of all shipping, Army and Navy ships were still getting first priority on fuel. The council gravely decided to put all ships on an equal footing in fuel supply, to expedite the reconversion to coal of 235 "E" type ships (only 78 were expected to be finished by September), and to see what could be done about using tar as a fuel.

The percentage of cargo ships in need of repair had risen during May from 33 percent to 35 percent; labor troubles in the shipyards resulting from the B-29 raids, increasing material shortages, and the inaccessibility of the major yards east of the mine barrier at the straits combined to make a solution of this problem difficult.

The interference with ship repair caused by the mining of the Shimonoseki Straits was serious. Eighteen of Japan's 21 major yards were located in the straits area, the Inland Sea, or on the Pacific coast of Honshu. Only 2 in Hokkaido, 1 in Nagasaki, and 1 in Dairen were freely accessible. While all Japanese yards were overwhelmed with repair work as the war moved closer in 1945, those behind the mine barrier averaged but 59 percent more repair business per month after the beginning of the mine campaign than in the year preceding it. The four big yards and three small ones accessible without passing through the mine fields received an increase of 126 percent in their monthly average of repair business. Ship repair at the little yard at Toyama, the only one on the Japan Sea coast of Honshu, increased 50-fold (Figure 66).

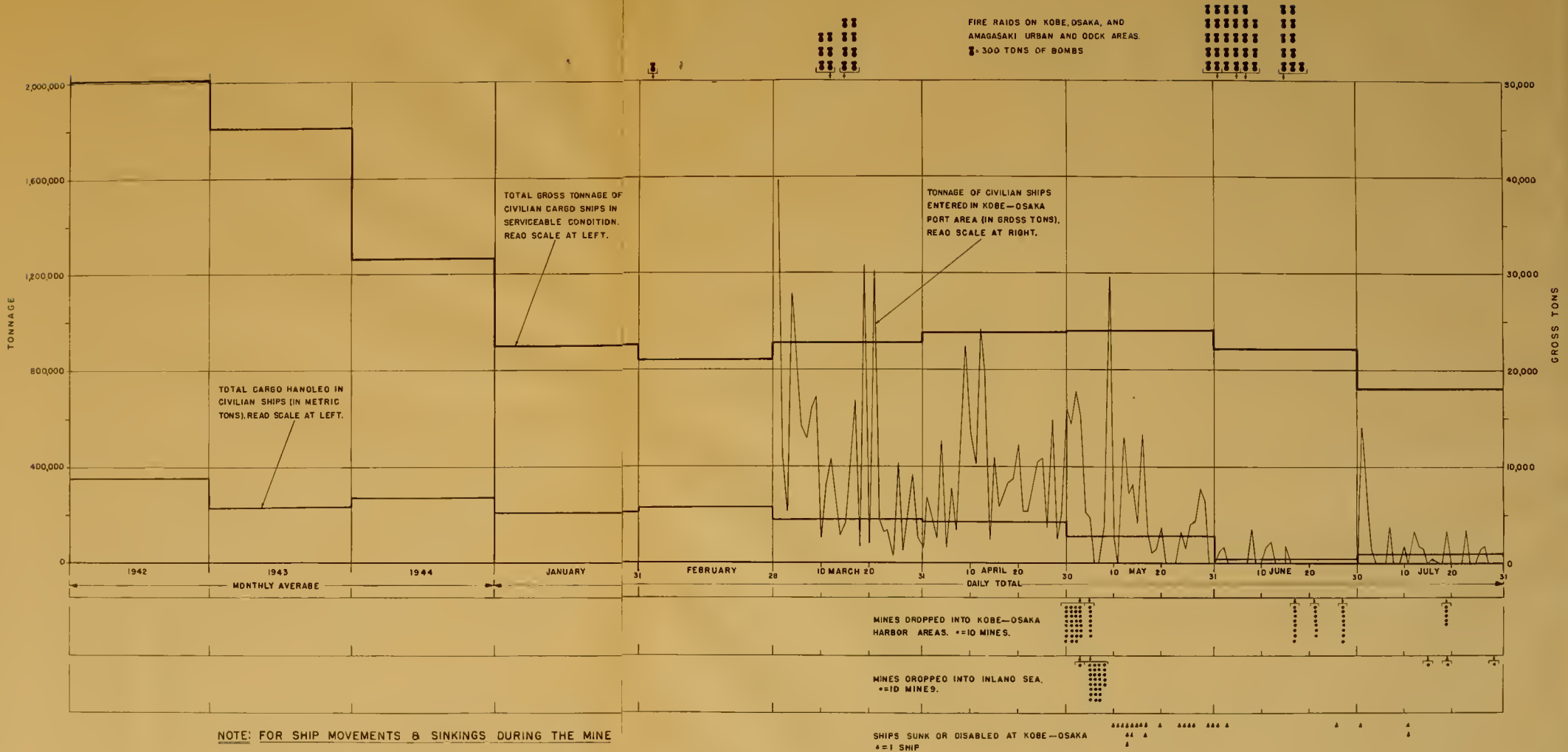
The council belatedly undertook to transfer repair facilities to the Japan Sea coast (nothing ever came of the plan), to activate more repair ships, to coddle shipyard workers, and to give top priority to the shipment of ship-repair materials. Ship repair was given top priority over construction in the shipyard industry. Oddly enough, the question of food and clothing for seaman now assumed critical importance; ships were being delayed while these items were being secured, and the council decided "to give these necessities the same status as munitions and to arrange it so they can be gotten immediately whenever they are wanted."

In the minutes of the 31 May meeting of the council is recorded the decision: "We will give priority to the transportation of cereals and salt; other necessary materials controlled by the material mobilization plan will be shipped as far as possible along with cereals and salt." This clear statement of policy had apparently been developing unofficially for some time under the squeeze of the parallel shortages of food in the home islands and ships on the high seas. The increasing importance of these items is shown in Figure 67.

During June 1945, submarines, mostly operating in the Sea of Japan, and even entering Nanao Bay, sank 92,000 tons of shipping. Aircraft, patrolling the Korean coast and making an occasional foray into the Inland Sea, sank or put out of action for the rest of the war 56,000 tons (a 1 June B-29 raid accounted for over

PORT ACTIVITY IN THE KOBE-OSAKA HARBOR AREA

RELATED TO VARIOUS PHASES OF THE WAR



NOTE: FOR SHIP MOVEMENTS & SINKINGS DURING THE MINE CAMPAIGN OF 1945 IN THE SHIMONOSEKI STRAITS REFER TO GRAPH 65

FIGURE 64

SHIP MOVEMENT THROUGH THE SHIMONOSEKI STRAITS
DURING THE MINE CAMPAIGN OF 1945.
(IN GROSS TONNAGE OF SHIPS PASSING THROUGH)

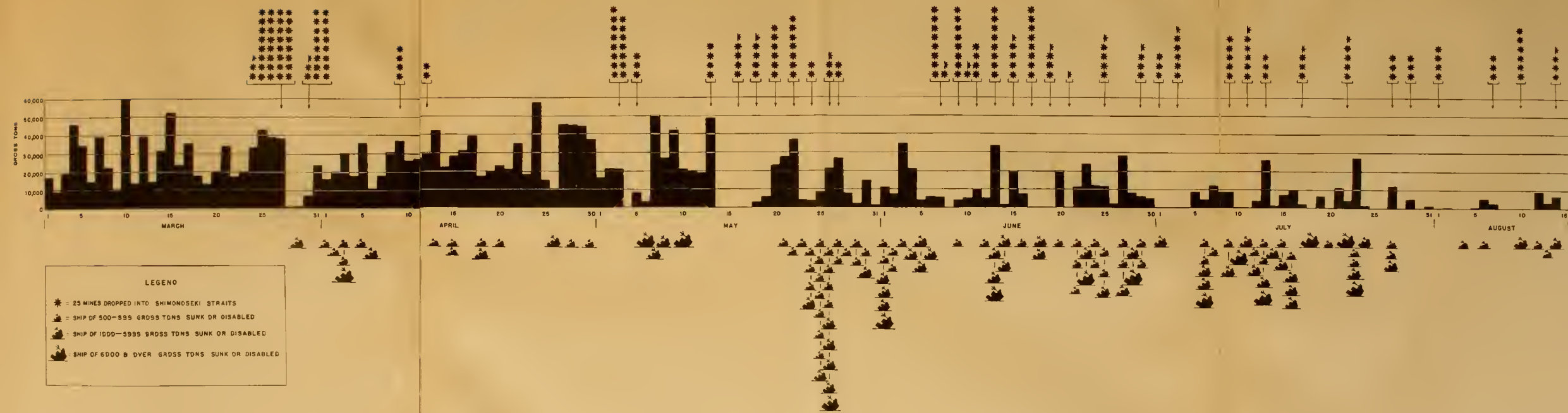
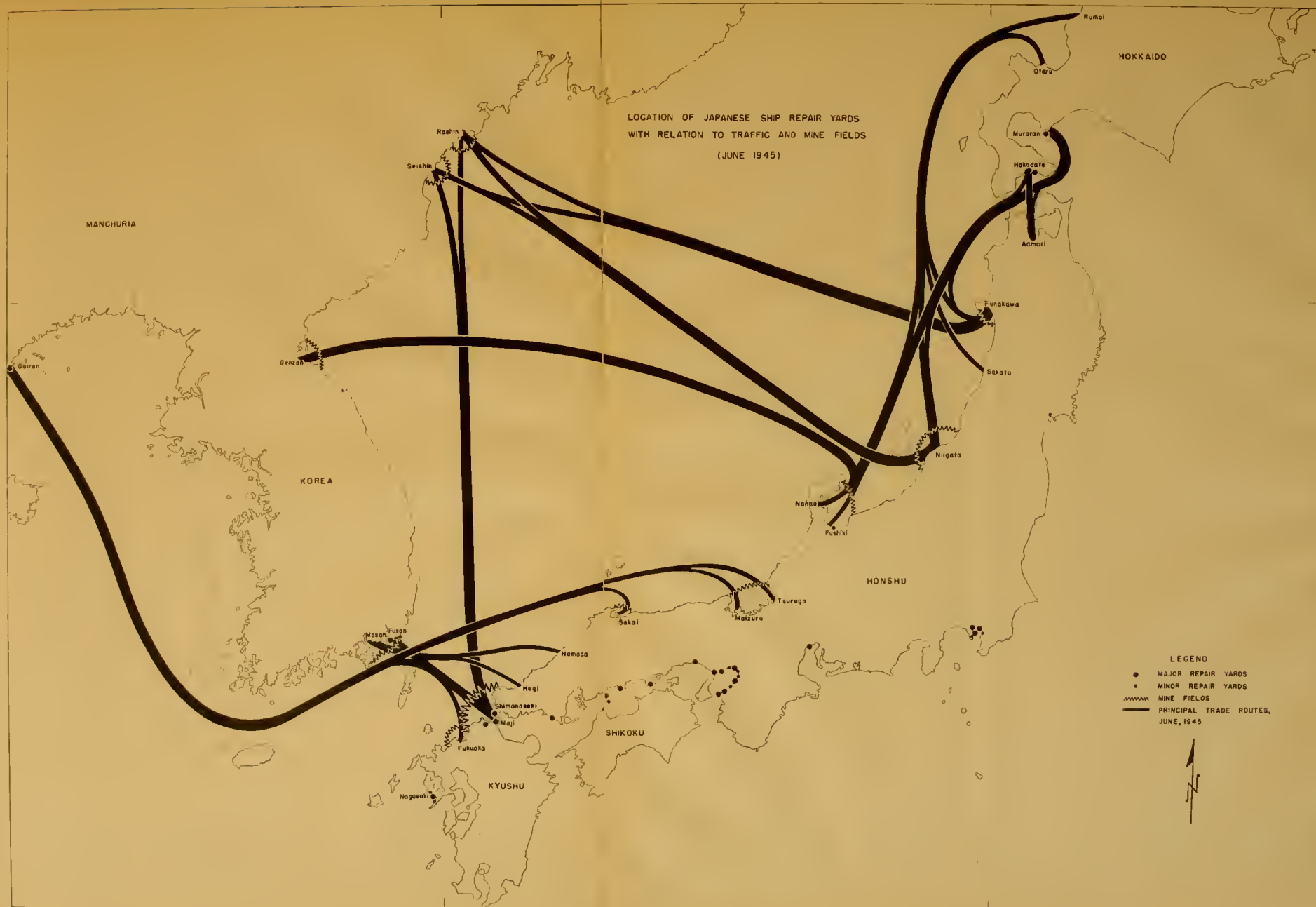


FIGURE 65



was to be increased, and the establishment of "an appropriate shipping section having cognizance of this matter" was to be expedited.

(14) The separate Army and Navy anti-mine headquarters were to negotiate to accomplish a unification under the command of the Navy.

Under the surface of all this pantomine the shipping people knew they were powerless to avert complete and total stoppage of water transportation and were just going through the motions of dealing with the manifold troubles arising on all sides.

In the light of the above it is interesting to examine in Figure 68 the complicated arithmetical processes whereby the council, starting

FIGURE 68.

Computation chart for transport capacity for July 1945

[Kisen only—figured in units of 1,000 dead-weight tons]
12 June 1945

	Army	Navy	Civilian	Total
June:				
Total capacity (1 June)	306.4	215.8	1,910.5	2,432.7
Damaged in action (long repairs)	-68.9	-4.9	-144.1	-217.9
Special	-9.0	-3.5		-12.5
Ships in southern area	-24.5	-45.1	-32.3	-101.0
E-type ships repairing in China			-8.0	-8.0
E-type ships converting to coal burners			-17.6	-18.5
Fishing in northern waters			-48.6	-48.6
Total subtractions	-102.4	-53.5	-250.6	-406.5
Capacity for civilian shipping	204.0	162.3	1,659.9	2,026.2
Estimated loss (at 28 percent of net)				-567.3
Possibility for general use				1,458.9
July:				
Assigned to direct military operations				-85.0
Net for civilian use				1,373.9
New construction				+95.8
Ships returned from northern fishing				+8.1
Net for civilian use				1,477.8
Estimated loss (at 30 percent of "net")				-443.3
Possibility for general use				1,034.5
Estimate for repairs (at 43 percent of "general use")				-444.8
Available for general works (dead-weight tons of ships)				589.7
Kakoritsu factor (tons of cargo that can be moved in one month per dead-weight ton of ship)				×1.0
Transport capacity (in tons of cargo in one month)				589.7
Munitions to be handled for Army and Navy				-80.0
Transport capacity for "mobilizing of goods"				509.7

with a figure of 2,432,700 dead-weight tons (roughly 1.5 times gross tonnage) of shipping afloat at the beginning of June, finally arrived at a figure of only 509,700 tons of cargo capacity available for "mobilizing of goods."

July 1945: Air Attack Reaches All Japanese Waters

In July the Japanese lost 40 percent of their remaining serviceable merchant fleet. Half of these were sunk and half damaged so as to be out of service for the rest of the war; a grand total of 478,000 tons of ships was put out of action (Figure 43). Half of these were accounted for by aircraft attack, now that the war had moved so close to the Japanese homeland that no part of Japan's sea lanes was beyond the reach of planes.

Although it only accounted for about one-fourth of the Japanese tonnage put out of action during the month, the most spectacular event was the carrier raid on the 14 July against Hokkaido and the Tsugaru Straits between Hokkaido and Honshu. In this raid 46 vessels over 500 tons, 110,000 tons of shipping, were put out of action, plus some 150 of the smaller kihansen engaged in the shuttle trade in moving coal from Hokkaido to Honshu. Ten of the 12 large railroad ferries which figured so prominently in the Hokkaido-Honshu coal movement were sunk or disabled in this attack, reducing the capacity of the railroad at this important bottleneck in one stroke to 18 percent (40,000 tons a month) of the pre-attack capacity.

Attempts were made to make up the depletion by bringing two ferries from Shimonoseki, one from Karafuto, and one from the Inland Sea. However, these were not railroad ferries, and their efficiency was considerably less than that which could have been secured by use of vessels designed for the service. The condition of the shipbuilding industry was such that had new ferries been ordered immediately following the attack, delivery could not have been made before the following May.

Assuming the bulk of the cargo ships put out of action were engaged in the coal trade, the lost capacity to move coal from Hokkaido to Honshu as a result of this raid would have been about as follows:

Capacity:

	Tons lost per month
Railroad-ferry	180,000
Kisen	70,000
Kihansen	120,000
Total	370,000

¹ About 24 percent of Hokkaido supply.

The lost kisen and kihansen coal-carrying capacity could, of course, be replaced from ships in service elsewhere, but only at the expense of other vital commodity movements. The excess rail capacity between Aomori and Tokyo created by the reduction in ferry capacity could not be utilized in moving coal from other ports, as the shipping bottleneck and mine blockade precluded any increase in these other channels of Hokkaido-Honshu coal movement.

Later in the month the carriers returned and attacked the Inland Sea area, sinking and disabling some 42,000 tons of shipping. It is interesting to note that large ships had been removed from this area and concentrated in offshore deep water service. In the Inland Sea raid, two-thirds of the ships hit were under 1,000 tons; in the earlier raid on the Hokkaido area, 80 percent of the ships hit were over 1,000 tons.

In these July raids, British aircraft carriers also participated in the attack against shipping and sank and disabled a number of ships in the ports on the Japan Sea north of Osaka.

Army aircraft, operating from their newly-established bases in Okinawa, began a substantial attack in the Korean Straits area and around northern Kyushu, sinking and disabling 17 ships of 35,000 tons.

From these bases also, attacks against rail installations on Kyushu began about the first of July. These attacks were tactical in concept, designed to prevent troop movements. They were all centered around the southern half of the island, particularly around Kagoshima. The first attacks were secondary bombings and strafings of trains and rail installations by fighters and fighter-bombers. On 27 July and 31 July, Kagoshima yards and station were attacked, and the damage was severe. In these two raids the station, coal loading hoist, much of the track in the yard, 180 freight cars, and 120 passenger cars were destroyed. Six locomotives, the roundhouse, and other buildings were damaged. On 30 July the Sendai river bridge north of Sendai on the Kagoshima main line was cut by a high-explosive bomb. The bridge was out of operation for 43½ days as a result of the attack. While it was inoperative, Japanese Army engineers built an emergency truck bridge adjacent to the damaged structure. By means of this temporary span the railroad was able to get an average of six carloads a day across the cut.

Because of the reduced volume of traffic moving in Japanese waters, the passive attack of mines achieved somewhat smaller results in July than in previous months. Seventy-eight ships of 198,000 tons were sunk or disabled. Some ships were put out of action in most of the ports along the Japan Sea and Inland Sea, particularly Niigata, Maizuru, and Osaka, but 55 percent of the total tonnage lost to this attack was in the Shimonoseki Straits. The blockade of this passage had become extremely effective. During July there were nine days on which no ships passed through and eight more days when traffic amounted to three ships or less. The total daily traffic since March, before the straits were mined, is shown in Figure 65. The accumulating effect of the blockade of the straits was disastrous on the Japanese shipping industry, built as it was around the hub of the Inland Sea. As described elsewhere, the major repair yards were in the Inland Sea, but although the number of damaged ships had increased to a point of major concern to the war council, access to shipyards was so limited that the number of ships in repair in all Japanese yards fell from 550,000 tons in April to 370,000 tons in July. The combined port activity of Kobe-Osaka, previously reduced by the diminishing size of the merchant fleet and the various subterfuges to transfer freight to the railroads from a monthly average of 720,000 gross tons of shipping in 1942 to 320,000 tons in March 1945, had been further reduced by the Shimonoseki and Kobe-Osaka mine blockade and the 1 June B-29 raid on Osaka to 44,000 tons (28 ships), a minuscule 6 percent of the 1942 activity.

The Last Meeting of the Council

The war power council at its last meeting, the 18 July imperial headquarters shipping conference, presented a picture of ineffectual indecision. The business transacted at this meeting is summarized as follows:

(1) Shipping schedule for August (Figure 69) "The August schedule will be followed as outlined in this plan; however, efforts will be made to increase amounts shipped and if such efforts are successful, the added shipping will be given to salt and cereals."

(2) Emergency measures in the Aomori-Hakodate area. Various agencies were adjured to consult with the inspectorate general of na-

val transportation to develop ways and means to patch up the demoralization of the Hokkaido coal trade, and particularly of the railroad ferries, caused by the 14 July carrier raid.

(3) The Navy and the imperial Japanese railroad were directed to consult and come to an agreement as to the method of operating a certain two railroad ferries.

(4) Six different government agencies were directed to consult on ways and means to utilize for the "mobilization of goods" certain fishing vessels returned from northern waters.

(5) Special arrangements were to be made to expedite the transportation of food to Kyushu by ship and railroad.

In Figure 69 the increasing allotment of shipping to the import of food on account of the

FIGURE 69.—Shipping schedule for August, 1945

[Kisen only]

Commodities	Home waters	North waters	South Korea	North Korea	Total	Percent
Coal	91,300	191,050	1,500	17,800	301,650	36.0
Iron and steel	2,960	9,000		3,450	15,410	1.9
Nonferrous metals	12,300	2,900	14,910	15,940	46,150	5.5
Salt			64,500	85,450	149,950	17.9
Food	4,800		66,450	196,300	267,550	32.0
Miscellaneous	4,200	28,800	15,650	7,400	56,050	6.7
Total	115,660	231,750	163,010	326,340	836,760	100.0
Percent	13.8	27.7	19.5	39.0	100	

desperate food situation in the country is plainly shown (31.9 percent for August). The dependence on railroad transportation, supplemented by the use of kihansen wherever possible in coasting service is shown by the scant allotment, 13.8 percent of shipping, for service in "home waters." The effort to avoid the air coverage of southern Korean waters where only 19.5 percent of shipping was allotted, is clearly shown by the allocation of 39 percent of the remaining shipping to service through the northern Korean ports of Genzan, Joshin, Seishin, and Rashin, the nearest of which is 750 miles from the Okinawa airfields.

August 1945: Surrender

Events in August were fast-moving and chaotic. Complete disintegration marked the shipping situation. The rapidly expanding air coverage in the last few days of the war resulted in the sinking and disabling of 42,000 tons of ships. By the 15 August, from all causes, 183,000 tons of shipping had been lost (Figure 43).

The atom bombing of Hiroshima, on 6 August 1945 caused relatively little damage to the rail-

roads. Communications were cut for 48 hours and a 56-hour delay ensued in the main-line operation. There was no appreciable damage to the track and small damage to the roadbed. The latter consisted of a fissure 900 meters long by 1 meter wide. Forty-six freight cars and 5 passenger cars were destroyed and 198 railroad personnel were killed and 140 missing. The lack of railroad damage sustained is attributed to two causes: first, to the fact that the railroad is between two and one-half and three kilometers from the reported center of the strike of the bomb; secondly, the railroads in themselves are not particularly susceptible to damage unless struck directly.

The atomic bombing of Nagasaki on 9 August 1945 resulted in negligible damage to the railroads. About 30 feet of the track in the station area was damaged and some of the station buildings burned.

On 14 August 1945, the Twentieth AF employing 115 aircraft, attacked the yard and installations at Iwakuni on the Sanyo main line. As a result of this strike, the only purely strategic railroad attack by our air forces in Japan, service on all Sanyo railroad tracks east and west was suspended for 102 hours. The yard tracks and main-line tracks and yard buildings were destroyed.

The atomic bombing of Hiroshima and Nagasaki caused no direct or indirect damage to shipping. On the 8 August Russia entered the war, and her far eastern air force quickly sank and disabled 50,000 tons of shipping, chiefly in the northern Korean ports hitherto out of range of Allied air power other than mining aircraft (Figure 43).

The Status of the Shipping Industry at the End of the War

The surrender on 15 August found the Japanese merchant marine reduced to a total tonnage of 1,818,071 tons of kisen over 100 tons. Of these, 1,657,194 tons were in the Inner Zone (north of Shanghai). Japan had at her disposal in this area 329 steel ships over 500 gross tons in a serviceable condition, amounting to 650,000 gross tons, only 12 percent of the fleet with which she began the war (Figure 70). (Of this small remainder, 13 percent were tankers, useless without access to the oil fields.) The cargo fleet was engaged almost entirely in trade be-

FIGURE 70.—Japanese Merchant Marine at the end of the war.

Kisen															Kihansen		
Condition	100-500 tons		500-1,000 tons		1,000-3,000 tons		3,000-6,000 tons		6,000-10,000 tons		Over 10,000 tons		Total			Number of ships	Tonnage
	Number of ships	Tonnage	Number of ships	Tonnage	Number of ships	Tonnage	Number of ships	Tonnage	Number of ships	Tonnage	Number of ships	Tonnage	Number of ships	Tonnage	Per cent		
Inner Zone (north of Shanghai):																	
Damaged and beached			31	27,022	22	41,541	3	11,643	9	67,790	1	10,241	66	158,237	9.5		
Damaged heavily	2	761	37	31,435	22	44,486	4	14,228	20	143,163	2	20,650	87	254,723	15.4		
Damaged slightly (but serviceable)			47	41,193	26	54,556	7	26,581	15	102,174	3	38,855	98	263,359	15.9		
Damaged (extent unknown, but serviceable)	17	4,671	128	109,431	26	58,210	4	18,526	10	67,584	3	30,524	188	288,946	17.4		
Total damaged	19	5,432	243	209,081	96	198,793	18	70,978	54	380,711	9	100,270	439	965,265	58.2		
Total serviceable	141	38,781	194	161,146	78	136,543	20	73,689	33	240,059	4	41,711	470	691,929	41.8		
Total afloat	160	44,213	437	370,227	174	335,336	38	144,667	87	620,770	13	141,981	909	1,657,194	100.0	3,105 241,413	
Outer zones (south of Shanghai):																	
Damaged and beached											1	10,240	1	10,240	6.4		
Damaged heavily			2	1,755	2	5,375	1	3,252	3	21,361			8	31,743	19.7		
Damaged slightly (but serviceable)			1	873	2	4,817							3	5,690	3.6		
Damaged (extent unknown, but serviceable)	1	297	4	3,528	6	11,242	4	21,655					15	36,722	22.8		
Total damaged	1	297	7	6,156	10	21,434	5	24,907	3	21,361	1	10,240	27	84,395	52.5		
Total serviceable	14	4,341	27	21,203	17	31,519	5	19,419	3	21,361	1	10,240	63	76,482	47.5		
Total afloat	15	4,638	34	27,359	27	52,953	10	44,326	3	21,361	1	10,240	90	160,877	100.0		
Grand total:																	
Total damaged	20	5,729	250	215,237	106	220,227	23	95,885	57	402,072	10	110,510	466	1,049,660	57.7		
Total serviceable	155	43,122	221	182,249	95	168,062	25	93,108	33	240,059	4	41,711	533	768,411	42.3		
Total afloat	175	48,851	471	397,586	201	388,289	48	188,993	90	642,131	14	152,221	999	1,818,071	100.0		

tween the Japan Sea coast on Honshu and Korea and Hokkaido. Their distribution was approximately as shown in Figure 71.

FIGURE 71.—Distribution of serviceable surviving Japanese cargo ships over 500 tons in Inner Zone as of 15 August 1945.

	Vessels	Gross tonnage
Japan seaports	84	140,825
Korean trade and ports	26	50,414
Hokkaido trade and ports	55	141,170
Kyushu trade	37	56,125
Kanmon area	24	46,599
Inland Sea	9	30,759
Tokyo area	2	2,750
Somewhere in inner zone	17	47,235
Coasters and ferries	36	45,380
North China-Manchuria	10	20,861
	300	582,118

Port activity had declined to approximately 33 percent of the March rate. Figure 72, listing the relative activity in gross tons of entries for March and August in 22 of the most important Japanese ports, shows the shifts and declines which had taken place in the last five months of the war. It will be noted that the ports fronting the Pacific and the east China Sea were completely idle, the ports in the Inland Sea and the Shimonoseki area had suffered heavy decline in traffic because of the mine blockade, while in Hokkaido and along the back side of Honshu, results varied from port to port, although the general decline was very considerable.

FIGURE 72.—Port activity in March and August 1945. (Gross tons of vessels entered.)

SELECTED PORTS		March	August
Tokyo ^{1, 2}		5,429	(³)
Yokohama ^{1, 2}		44,497	(⁴)
Shiogama ¹		50,601	(⁵)
Shimizu ^{1, 2}		1,563	(⁶)
Nagoya ^{1, 2}		8,660	(⁷)
Osaka ^{8, 2}		224,153	6,095
Kobe ^{8, 2}		94,893	6,341
Shimonoseki-Moji ^{8, 2}		140,394	56,757
Wakamatsu ^{8, 2}		264,209	17,480
Wakata ^{8, 2}		27,668	(¹)
Miike ¹⁰		43,183	(¹¹)
Tsuruga ⁸		16,742	4,382
Naneo ⁸		27,715	47,573
Fushiki ⁸		127,914	62,025
Naoetsu ¹²		(¹³)	14,690
Niigata ⁸		164,054	94,969
Sakata ¹²		31,391	20,098
Funakawa ¹⁴		51,924	67,625
Hakodate ¹²		13,391	23,964
Muroran ¹		215,874	2,877
Otaru ¹²		156,481	152,208
Rumoi ¹²		32,478	9,755
Total tons		1,743,214	586,839

¹ Submarine blockade.

² Subjected to area bombing.

³ Nothing since 27 May.

⁴ Nothing since 23 May.

⁵ Nothing since 29 June.

⁶ Nothing since 14 May.

⁷ Nothing since 27 April.

⁸ Heavily mined.

⁹ Nothing since 18 July.

¹⁰ Within easy reach of Okinawa.

¹¹ Nothing since 21 July.

¹² Not mined, not exposed to submarines.

¹³ Nothing until 26 April.

¹⁴ Lightly mined.

In the Shimonoseki Straits, the best barometer of the Japanese shipping picture, activity had declined to a scant 7 percent of the March level; during the first 15 days of August only 30 ships, 29,954 tons, passed through.

Shipbuilding was almost at a standstill. In August only 5 steel ships were delivered, 11,801 tons, 10 percent of March deliveries. Only 9 kihansen, 1,650 tons, were delivered, again 10 percent of March deliveries.

In August total seaborne traffic in kisen amounted to only 312,000 tons, 27.4 percent of the traffic in March 1945, and only 7.8 percent of October 1942, the peak war month in seaborne traffic.

Motor transport in Japan at the end of the war.

By August 1945 bus and truck operation was negligible. There were only 17,000 trucks and 4,000 buses in operation. Of these a large percentage were charcoal burners. To supplement their poor motor vehicle situation the Japanese had resorted to extensive use of horse and ox-drawn carts and sleighs.

Summary of Rail Attacks

Aside from the raids directed against the Aomori - Hakodate car ferries, and yards at Kagoshima and Iwakuni, the few attacks sustained by the rails were the result of spillage or opportunity bombing and were not a part of any planned bombing offensive directed against the railroads specifically.

Not one of the many vulnerable and accessible line-cut points on the main trunk lines had been attacked in planned aerial assault. Incalculable damage could have been done to the railroads and in turn to the Japanese economy by one or two line cuts on the Tokaido and Sanyo main lines over which moved the bulk of the freight traffic transported between Tokyo and Shimonoseki and intermediate industrial areas (Figure 3).

Classification yards, which in themselves are

a poor alternate to line interdictions, were the object of only two attacks by the USAAF. They were the previously mentioned Kagoshima and Iwakuni yards, neither one of which was of critical importance to the rail system. The IGR railroad equipment damaged by bombing was considerable in total during the war period but the peak of the damage did not occur until the closing months of the war. The most extensive damage occurred to passenger car equipment burned in area raids on the large cities. The final inventory revealed that approximately 12.3 percent of the total passenger car equipment, steam and electric, was damaged beyond repair. This loss accentuated the shortage of rail passenger transportation and caused the use after the war ended of box and gondola cars for short-haul and suburban service to augment the depleted passenger car fleet.

Air raids did not substantially increase the shortages of locomotives or freight cars. Approximately 5.3 percent of the total number of locomotives and 3.1 percent of the freight cars were destroyed. Based upon the best obtainable data it is probable that at no time were there more than 2 percent IGR locomotives out of service as a result of air-raid damage and the percentage of freight cars unusable for the same reason was much less. There were delays to traffic in areas raided as a result of bombings, but the delays were of short duration, and the quantity of the equipment destroyed or damaged was too little to have a sustained crippling effect on the whole system.

Bombing damage to equipment began growing about the same time that traffic began to diminish, and therefore the impact of the lost equipment was less severe than under continuing heavy movement.

CHAPTER VII

THE ECONOMIC EFFECTS OF THE ATTACK ON TRANSPORTATION

General Considerations

An attempt to evaluate the effect of strategic bombing on the economic life of Japan presents two major difficulties. First, it is impossible to break down the over-all effect into easily distinguishable shares of the disturbance attributable to attack on transportation and the shares attributable to other causes that took place simultaneously, namely, loss of territory, urban area attacks, and attacks on production facilities. Second, it appears equally difficult to isolate the share of the result of the attack on transportation attributable to strategic bombing from that attributable to submarine or surface-vessel attack, or purely tactical air attack and mine blockade. It is the responsibility of this Survey only to report on the effects of strategic bombing. However, the problem is obviously less simple than the statement of a conclusion, for instance, to the effect that since 30 percent of the total shipping lost was sunk by aerial bombing, 30 percent of the reduction of imports or industrial output decline can be thus attributed.

For want of a better solution, the following conclusions relate to the effect of the attack on Japanese transportation, regardless of attacking agent. It is necessary to keep in mind that in the effect on shipping, in particular, only the smaller share is the specific result of air attack, and that this air attack was mainly tactical in concept. As for the distinction between economic effects due to attack on transportation and those due to other causes, it is made only when the available evidence appears to justify it. In most instances it must be recognized that any single effect is the product of two or more of the causes, results of which fail to group themselves conveniently into neat compartments.

Actually the presentation consists of two stories that unfold simultaneously; first, the story of the prosecution of the war with its program of attack of all types and occupation of enemy territory, and second, the story of the

enemy's economic structure. The close paralleling of the two, step by step and item by item, though admittedly desirable, is impossible.

The ultimate purpose of strategic attack is to weaken the enemy at the fighting front. This is accomplished through the more immediate purpose of the attack, namely, the weakening of the enemy on the economic front. Such an attack eventually means a less well-supplied and consequently a less strong, active, and effective fighting front.

Attack on transportation affects the delivery of finished goods to the front and the receipt of raw materials in the industrial homeland. In both of these Japan found herself particularly vulnerable. The occupation of southeastern Asia and the far-flung islands of the western Pacific resulted in the establishment of literally hundreds of scattered military units, most of them largely dependent and many of them wholly dependent on the uninterrupted flow of waterborne supplies for their maintenance. The dependence of the industries of insular Japan on overseas raw materials is likewise familiar and has been discussed in an earlier chapter.

Characteristics of the Attack on Transportation

Attack on the stream of transportation into the industrial heart of a country has two general characteristics. It is primarily an attack on raw materials. The effect on industrial output is, therefore, delayed. The quantity of material in stockpiles and in partial process (goods-in-process), may be sufficient to introduce a lag of several months between the time of loss of raw material and the first appreciable decrease in output of finished products. An exception may be found in the case of fuels for which no substitute exists and which cannot be readily stored in sufficient quantities.

Such an attack leaves with the enemy the decision as to where the final impact is to fall. Assuming no great inflexibility in interchange of carriers, the impact can be made to fall upon the imports whose utility for war purposes is

lowest, and weakening of the war potential can thus be postponed or avoided entirely if losses are not too severe or of too great duration.

Frequently the effect of such an attack is the imposition of a blockade, in which case the threat of loss of shipping is of as great concern as the actual loss of shipping. Such a condition of blockade provides an extremely important exception to the second characteristic described above in that the enemy no longer maintains the initiative in determining the direction of the impact. Except for the unlikely possibility that numerous widespread sources of equally high quality raw materials are at the enemy's disposal, by selective blockade he can be made to bear the impact where it hurts most. Restriction of the area in which the fleet can operate may be just as effective as the physical disabling or destruction of the fleet. However, it must be emphasized that in this war the conditions of blockade were not attained until well into 1945.

Failing the imposition of blockade, the next alternative is to secure a decline in imports by attrition of the merchant marine and interference with the free and efficient use thereof. As stated earlier, the beginning of this reduction preceded the outbreak of war with the United States and hence any attack on shipping. Maximum imports on a tonnage basis were reached in 1937; on a value basis in 1940. A number of factors contributed to the steady decrease in imports following these peak years, some of them effective before the outbreak of war, others dependent on and concurrent with the existence of a state of war.

The Decline in Imports

The total result was continual decrease (at an increasing rate) of imports from 1940 to

the end of the war. Although total tonnage figures are not available, Figure 73, giving the figures for many of the bulky products involving the largest tonnages from year to year, illustrates the trend. Imports of the 16 commodities included fell from 20 million metric tons in 1941 to 10 million in 1944 and 2.7 million in the first six months of 1945. Figures of the total value of all imports (Figure 74) likewise illustrate the trend showing a steady reduction from 1940 to 1942. (The slight increase in the 1943 figure is a product of the change in value of the yen rather than increase in volume, as in some cases, e.g., cotton, coal, dolomite and magnesite, an increased value is shown in spite of a decreased tonnage, and in others the increased value is out of proportion to the increase in tonnage, or had decreased less than the tonnage figures.)

Among the first influences was a presumable voluntary reduction in the importation of non-essential goods of all types as the nation prepared for war. Somewhat similar was a decline in the import of goods, a large part of which eventually entered the export market after processing. This became necessary with gradual loss of foreign markets because of the European war, credit freezing, and the general restriction of world trade preceding the war, and of course the further loss of markets with the outbreak of the war. A conspicuous example is the loss of the huge Indian market for cotton textiles resulting in a sharp decrease in the need for foreign cotton, formerly the largest single import. In addition to cotton, the imports of similarly destined products—wool, lumber, rayon pulp, paper and wheat, all suffered steady declines after 1940. Presumably this reduction in imports of materials not contributing to the war might have been offset in volume by the

FIGURE 73.—*Japanese imports of bulk commodities*

	1940, metric tons	1941, metric tons	1942, metric tons	1943, metric tons	1944, metric tons	1945, metric tons
Coal	7,011,000	6,459,000	6,388,000	5,181,000	2,635,000	548,000
Iron ore	6,073,000	6,309,000	4,700,000	4,298,000	2,153,000	341,000
Bauxite ...	275,000	150,000	305,000	909,000	376,000	15,500
Iron and steel	621,000	921,000	993,000	997,000	1,097,000	170,000
Scrap iron	2,104,000	246,000	50,000	43,000	21,000	12,000
Lead	100,100	86,530	10,990	24,500	16,810	4,000
Tin	10,500	5,500	3,800	26,800	23,500	3,600
Zinc ...	23,500	7,900	8,500	10,100	6,100	2,500
Phosphorite and phosphate	710,400	396,500	342,100	236,700	89,600	23,000
Dolomite and magnesite	409,600	506,300	468,700	437,500	287,100	65,900
Salt	1,728,300	1,438,900	1,499,800	1,425,100	989,700	386,900
Soybean cake	333,900	337,700	449,500	304,500	384,700	163,400
Soybeans	648,500	572,400	698,800	590,600	728,800	606,900
Rice and paddy	1,694,000	2,232,700	2,629,200	1,135,800	783,200	151,200
Other grains and flours	269,300	267,400	823,300	750,100	506,600	231,400
Raw rubber	27,500	67,600	31,400	42,100	31,500	17,900
	22,039,600	20,004,430	19,402,090	16,411,880	10,129,610	2,743,200

FIGURE 74.—Imports

Quantity and value in units		1936	1937	1938	1939	1940	1941	1942	1943
Rice and paddy	Picul	923,237	557,622	378,275	729,441	20,815,523	24,014,888	23,034,184	12,539,152
	Yen	5,098,071	4,032,976	2,807,791	6,286,329	196,006,260	265,481,235	242,625,231	126,347,776
Beans and peas	Picul	12,445,184	12,321,144	13,884,618	13,727,012	8,120,562	8,576,096	10,812,637	4,645,449
	Yen	82,601,112	92,547,363	102,175,975	123,575,994	112,756,842	119,489,724	154,150,813	126,505,392
Seeds, oil-yielding	Picul	5,413,458	4,792,176	3,167,080	2,660,999	2,564,990	3,977,730	1,645,688	2,357,928
	Yen	44,873,079	43,612,048	28,790,494	31,981,686	44,317,128	59,234,406	29,255,471	127,973,191
Salt	Picul	22,039,941	28,148,491	23,805,966	31,408,378	28,578,090	24,142,090	23,245,452	20,087,966
	Yen	17,761,167	28,910,743	30,290,099	41,515,318	63,861,315	52,988,267	55,162,243	50,877,282
Hide and skins	Picul	512,714	489,511	507,473	504,125	624,334	445,402	485,402	264,095
	Yen	24,835,752	44,571,498	27,826,209	30,573,244	32,759,036	43,595,919	38,373,939	22,212,363
Oil, hydrocarbon	Picul								
	Yen				253,625,063	352,460,219	336,247,149	23,988,918	83,950,996
Cotton, raw	Picul	15,211,168	13,764,913	9,378,454	10,093,418	7,758,441	5,967,811	2,020,709	1,544,678
	Yen	850,451,600	851,162,644	436,834,585	462,006,980	504,070,899	392,261,861	224,305,572	266,300,592
Wool, sheep's	Picul	1,640,636	1,953,835	881,889	801,688	770,089	906,924	142,006	58,863
	Yen	200,898,493	298,406,862	94,425,569	72,590,259	105,251,143	124,066,572	25,883,717	7,211,811
Fibre, vegetable	Picul	2,158,219	1,866,653	1,261,597	1,415,946	1,433,331	938,531	645,814	876,227
	Yen	37,300,937	40,994,972	27,305,564	38,266,314	40,688,364	27,756,899	27,525,194	38,813,750
Fibre, waste of old	Picul	332,141	288,226	277,435	296,186	243,694	211,927	142,996	138,290
	Yen	8,130,911	7,835,771	6,371,001	12,073,929	13,187,995	16,973,272	18,667,778	9,305,869
Pulp	Picul	5,528,532	7,901,727	2,434,819	2,834,939	2,933,167	958,133	167,234	31,134
	Yen	67,107,057	116,719,852	42,131,502	56,537,329	16,107,816	23,717,784	3,797,357	708,813
Phosphorite	Picul	13,830,204	15,371,942	9,402,824	13,049,847	11,840,882	6,608,702	1,741,499	1,862,528
	Yen	22,392,699	30,810,382	19,281,443	25,411,705	41,867,628	21,983,387	5,042,850	5,894,184
Coal—coke	L. Ton	4,134,352	4,356,465	3,682,531	3,794,710	5,085,013	5,187,771	5,162,826	4,416,636
	Yen	51,055,577	59,224,254	67,217,482	78,363,522	116,731,648	143,025,556	159,556,151	162,386,289
Dolomite and magnesite	Picul	2,564,224	3,588,032	4,501,293	6,498,341	6,296,345	7,223,182	6,561,126	6,042,582
	Yen	2,349,204	3,484,491	6,067,067	9,711,790	18,818,151	19,846,654	22,436,397	26,455,408
Ores	L. Ton				5,228,274	5,584,189	5,572,895	3,440,605	4,568,187
	Yen	374,891,804	901,130,824	661,894,693	158,715,007	204,044,034	197,029,434	126,082,883	143,147,966
Iron	Picul	49,529,815	76,517,602	45,448,162	59,679,967	42,461,185	17,013,195	15,037,040	8,149,471
	Yen	192,039,892	563,840,508	321,294,638	360,659,437	385,780,864	157,930,662	161,841,452	118,172,591
Lead	Picul	1,598,533	1,645,410	1,013,149	1,683,350	1,534,834	1,308,865	12,006	53,010
	Yen	26,873,028	41,975,913	17,618,496	29,140,404	32,417,539	29,783,117	423,051	2,449,666
Tin	Picul	115	14,163	1145,753	132,738	181,147	91,342	37	161,756
	Yen	15,425	27,228,830	29,165,741	30,579,243	47,102,841	25,315,783	33,363	41,419,905
Zinc	Picul	1,029,569	1,080,164	778,165	1,012,457	391,223	105,315	56,811	57,358
	Yen	16,427,760	24,569,452	16,061,772	17,137,561	12,604,929	4,738,083	3,562,988	4,058,414
Manures	Picul	10,085,783	9,545,378	11,638,347		7,765,088	7,675,591	8,768,196	5,087,682
	Yen	44,028,171	48,120,841	62,712,748	108,095,527	76,864,554	66,994,509	81,139,368	68,439,442
Other	Picul	694,549,738	554,042,056	663,166,579	950,819,724	985,025,366	770,105,050	347,782,254	491,709,647
	Yen								
Total exports	Yen	2,763,681,477	3,783,222,280	2,663,439,448	2,917,666,365	3,402,724,571	2,898,565,323	1,751,636,990	1,924,350,227

increased need for various war materials had not other factors interfered.

A second factor contributing to the reduction of imports and operative before the date of effective attack was the progressive loss of sources of supply attributable in turn to (1) the outbreak of the European War and consequent loss of many of the goods from the belligerent countries, (2) the export embargoes imposed by several nations, principally the United States and Britain, (3) the freezing of Japanese credits in the United States, British, French and Dutch areas, and finally (4) the beginning of war with the United Nations. Among the many import commodities experiencing declines as a result of the foregoing were petroleum, scrap iron, copper metal, lead, bauxite, phosphorite and rubber. There was partial or entire recovery of many of these as formerly Allied-controlled territories became Japanese-controlled.

At the outbreak of war other factors became important in contributing to the steady decline in imports. Among them was the loss of available shipping space. Three factors in turn contributed to this loss. For some time preceding the war there had been a gradual reduction in

the amount of foreign shipping available for charter. In 1937, 46 percent of Japan's foreign trade was carried in foreign bottoms, 54 percent in Japanese bottoms. By 1941 the percentage carried by foreign ships had been reduced to 35 percent. Much of this change may represent a conscious attempt to achieve national independence in shipping, but undoubtedly the European war "froze" much tonnage as far as Japan's trade was concerned, and ahead of Japan's plans. The declaration of war meant the immediate loss of practically all foreign shipping space.

A loss of shipping available to import trade occurred with the increasing allocation of space to military needs after Guadalcanal. In spite of all logic in the case, such ships, assigned to supply the fighting fronts on the continent and in the islands, frequently made the return trip without cargo. This may have also been true in the prosecution of the Sino-Japanese war for some years preceding Pearl Harbor, but was certainly the case after the allocation of shipping space to "A" "B" and "C" interests in the summer of 1941. As the war progressed, military demands continued to take a large share of the total space.

Finally, there was a reduction in available space through actual physical loss. Allied attack on shipping began with the first day of war and continued at an increasing tempo for the duration. In spite of a vastly enlarged shipbuilding program and considerable tonnage acquisition by conquest, the serviceable cargo tonnage available for civilian use increased slowly after Pearl Harbor and reached a crest in September 1942. Thereafter losses consistently surpassed additions to the merchant fleet. The total tonnage of imports (on the basis of the incomplete information available) appears to have increased and decreased from 1941 to 1945 at almost exactly the same rate as the size of the merchant fleet (Figure 2).

Of equal importance in explaining the declining imports is the blockade effect of the increasing attack on the life line to the south. Japanese penetration to the south had brought under their control the vast wealth of the southern area—Indo-China, Siam, Malaya, the Philippines and the Netherlands East Indies. This wealth was exploited to the fullest extent possible with the shipping available until the growing strength of Allied sea and air power presented an impossible threat to Japanese shipping in the area. This tightening blockade culminated with the occupation of the Philippines after which imports from the south were reduced to a mere trickle. Only small quantities of the most vitally needed materials were imported in 1945.

It is important to note that shortage of shipping alone was not sufficient to bring about reduction in the volume of imports of all items. The determination of the direction of impact remained with the enemy. More important items continued to be imported in the same or even greater amounts at the expense of less important items. Such southern area products as bauxite, manganese, tin, copper ore, chrome ore, nickel ore, copra and Manila hemp showed maximum imports in 1943. In 1944, however, the intensification of Allied attack against merchant shipping resulted in the decline of imports of all southern area products. Iron ore, coal, phosphorite and rice imports for that year were less than half of those for 1942. In 1945 the only shipments getting through were very small quantities of iron ore (27,000 tons), bauxite (15,500 tons), tin (3,600 tons), rubber (16,

500 tons) and rice (200 tons).

Petroleum.—The story of Japan's efforts to import petroleum from the East Indies is the story of the waxing and waning of the pulse of the lifeblood of her air force, her Navy, and her merchant marine, the three most critical arms of her defense. With insignificant oil resources at home, Japan had to secure maximum returns from the conquest of the southern oil fields or her war effort would collapse. The wartime history of the tanker fleet and oil imports from the south are summarized in Figure 75.

In the early months of the war during the period of conquest and subsequent rehabilitation, the oil import program was quiescent. Except for the considerable tonnage servicing the fleet, Japan's tankers were idle. Because of this large idle tonnage, augmented by the capture of some 75,000 tons of foreign tankers, construction of tankers was neglected. Merchant shipbuilding, stifled in 1941 and early 1942 by naval priorities, and just beginning to be pushed in the latter part of 1942, was directed almost entirely at increasing the cargo fleet, where a severe shortage existed from the start of the war. In the entire 12-month period after Pearl Harbor, only 9,000 tons of tankers were built.

By May of 1942, the rehabilitation of southern oil fields had proceeded to the point where substantial shipments could be made to Japan, and some 250,000 tons of tankers were engaged in that service. During the ensuing twelve months, while the total Japanese tanker tonnage (excluding fleet oilers), increased 26 percent, the proportion devoted to importing oil into Japan from the Indies jumped from 42 percent in May 1942 to about 90 percent in May 1943. Tanker sinkings were negligible during this period; except for a brief flurry of activity during the late spring of 1943 in which some 75,000 tons were sunk, the tanker fleet was singularly free from serious attack until the winter of 1943-44.

In this favorable atmosphere imports increased by leaps and bounds and were coming in at the rate of over a million barrels a month by the end of 1942. Meanwhile, the large losses of cargo vessels resulted in the establishment in early 1943 of convoying on the Japan-Singapore run. The inefficiency of this system and the lost motion resulting from the reorgan-

WARTIME HISTORY OF JAPANS TANKER FLEET & OIL IMPORTS

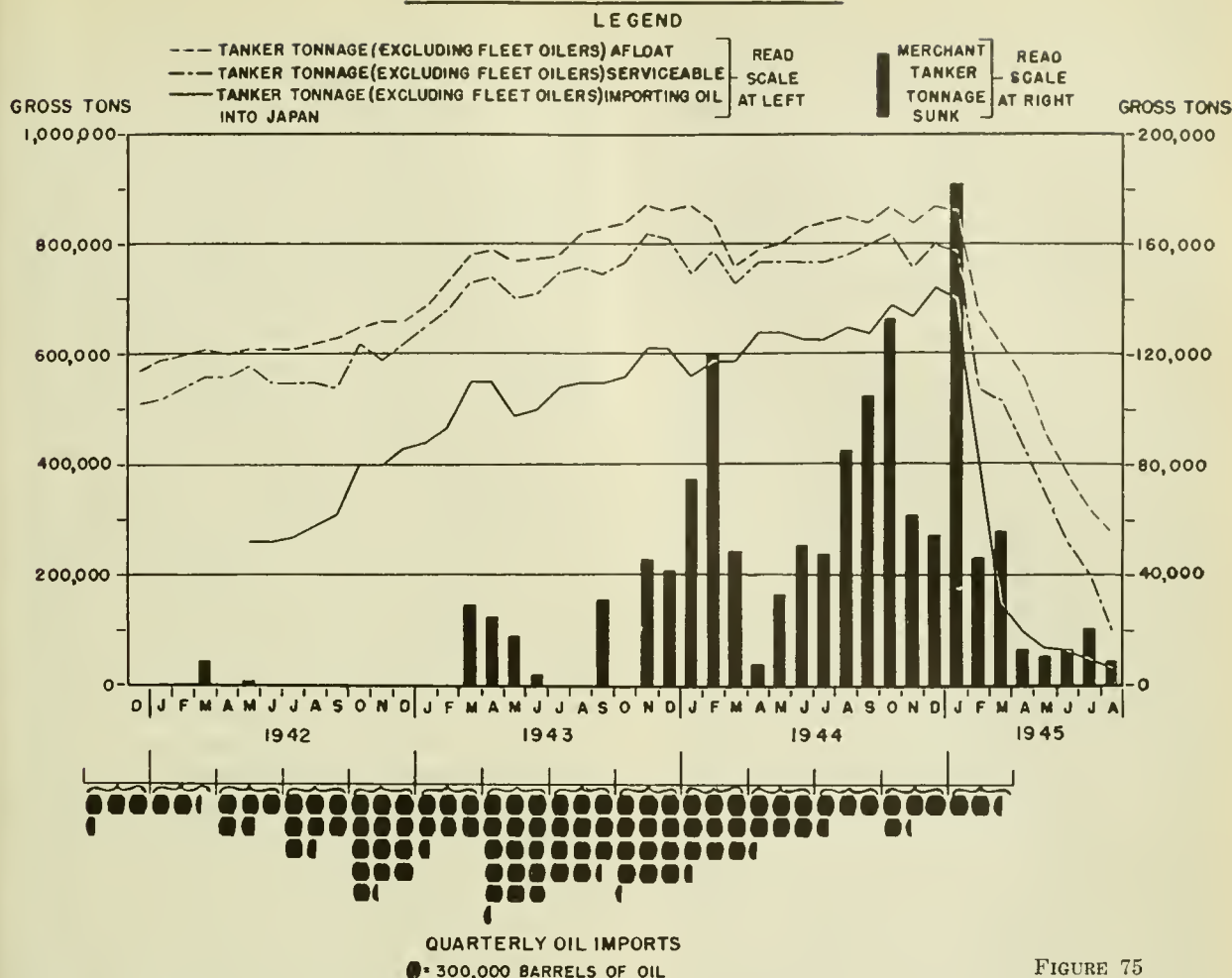


FIGURE 75

ization of the entire shipping industry around this unplanned-for necessity disrupted the smooth flow of oil imports in the first half of 1943. The tanker tonnage allocated to oil imports increased 15 percent during the first six months of 1943; imports increased only moderately, to an average of about a million and a half barrels a month.

After the initial hesitation in setting up the convoy system, the flow began to rise again as the system began to work. In July and August imports rose rapidly, reaching a peak of $1\frac{3}{4}$ million barrels. This favorable result coincided with the peak in cargo shipping efficiency at about the same time. The Singapore convoy route was at its peak of effectiveness.

Then Allied submarines moved in—in earnest. Although tanker losses in the fall of 1943

were not serious (only about 3 percent of the total afloat each month), and these losses were more than offset by a construction rate of about 30,000 tons a month, the damage to the cargo fleet was serious; total submarine sinkings in the last four months of 1943 amounted to 637,000 tons, an increase of 65 percent over the previous four months. In the face of such losses the convoy system was tightened up, and every evasive technique possible was employed. The most noticeable result was to reduce efficiency; submarine sinkings in general continued to increase, while the kakoritsu factor for the Singapore run, which had risen from 0.426 in spring 1943 to 0.470 in the summer, declined precipitously to 0.349 in the fall. Imports of oil from the south suffered accordingly, and had declined by the end of the year to a little over a million barrels a month.

The year 1944 opened with a determined effort by the Japanese to move oil in quantity from the southern fields and refineries into the home islands. The accelerated tanker construction in the latter half of 1943 (186,000 tons in six months) and the relatively insignificant sinkings had boosted the total fleet to an all-time high as of 1 January of 837,000 tons. Three-fourths of the serviceable tanker tonnage was engaged in the main job of hauling oil home. Intensive efforts to speed up oil movement resulted in a fitful burst of energy, and in February imports nearly equaled the peak reached in August 1943. It is interesting to note that the ratio of imports to tanker tonnage engaged in the service in February 1944 was nearly the same as in the month of August 1943, and it is evidence of the attention focussed on oil imports that in the same period the over-all efficiency of shipping on the Singapore run had declined 36 percent. In this month the disastrous carrier raid at Truk so decimated Navy tanker strength that the total tanker fleet decreased 13 percent in the first two months of the year. Meanwhile tankers assigned to hauling oil home continued to increase; on 1 March 80 percent of the total serviceable tonnage was in this essential service.

As a result of the failure to achieve a full uninterrupted flow of oil from the southern fields, Japan began early in 1944 to revive attention to her synthetic oil industry, neglected since the occupation of the rich oil lands in the south. The entire Inner Zone was searched for new oil resources which would at once be a safeguard for the future and a tremendous saving of transportation.

The tremendous tanker losses in the Truk and Palau raids so alarmed the Japanese that new emphasis was also placed on tanker construction. During 1942 and 1943 only about 25 percent of the product of the shipyards had been tankers, but in early 1944 emphasis was shifted and tanker production increased rapidly, reaching a peak of 78,000 tons in March. During the last ten months of the year tanker deliveries constituted 37½ percent of the output of the shipyards.

Coincident with the intensified tanker building program came a very great increase in the convoy fleet. This multiplied evasive tactics and delays, and although total tanker tonnage and

tonnage devoted to imports began to climb again after the slump produced by the Truk raid (tanker sinkings did not again exceed construction until August 1944) the efficiency of the system deteriorated greatly. By midsummer the submarine offensive had driven convoys into hugging the China coastline and anchoring at night in sheltered harbors. These restrictive practices, although they held tanker losses to a minimum (less than 8 percent of the total fleet afloat each month in June, July, and August), played havoc with shipping efficiency. By July a one-way convoy trip to Singapore took over three weeks. In this month, although only 48,000 tons of tankers were lost, imports into Japan hit an all-time low of 360,000 barrels.

In August came another rally in imports of a million barrels, the last time this figure was reached. The tonnage of tankers devoted to this service continued to rise, reaching 690,000 tons on 1 October. Thereafter, the climax came rapidly. In the tremendous confusion of the Philippines campaign during the fall of 1944, when carriers and submarines sank 350,000 tons of tankers in four months, and when in the attempt to reinforce the Philippines the Singapore convoy system was thrown into hopeless confusion, oil imports into Japan were pushed aside; in October and November they averaged less than 300,000 barrels. In spite of heavy losses the intensive tanker construction during the year supplemented by a heavy conversion of cargo ships to tankers in the fall of 1944, maintained the total tanker tonnage afloat, and on 1 December serviceable tanker tonnage was still about 800,000 tons.

At about this time the urgent need for more dry-cargo bottoms again took precedence over the need for tankers, and the construction of tankers was side-tracked in favor of cargo vessels. Tanker deliveries tapered off gradually thereafter, reaching zero in April 1945. Reconversion of converted cargo ships was pushed through the winter and spring of 1945.

The last act of the drama of oil imports had not yet been played, however. At the end of the year the report of the total mobilization bureau to the cabinet stated: "The preservation of liaison between the southern occupied territories and Japan is an absolute necessity for the fastening and maintenance of national material strength. It is recognized that if the

resources of the south, especially petroleum, are abandoned, with the passage of time we will gradually lose our ability to resist attack."

Again a determined attempt was made to bring in a supply of oil, this time to implement a last-ditch defense of the homeland. In the face of terrific losses in February from carrier raids into the south China Sea which wiped out whole convoys, and when half the tanker tonnage remaining afloat was sunk, convoy after convoy was pushed through. Where only about three convoys a month started for Singapore in 1944, in early 1945 the number had increased to 8.

The typical experience of these convoys is recited by the captain of the *Sarawak*, a tanker which left Japan for Singapore on the last day of 1944. The convoy consisted of five tankers, five cargo ships, and eight escorts. Off Formosa, one tanker was sunk by submarine. In Takao harbor three tankers were sunk by carrier planes; one escort broke down and dropped out of the convoy. On the way down the coast of Hainan Island news of the approach of carriers again caused the convoy to put back into Hong Kong harbor, where it was nevertheless attacked the next day by carrier planes. Four of the remaining cargo ships were sunk; the last one dropped out of the convoy and stayed in Hong Kong. Three escort ships were damaged so badly that they had to drop out. The reduced convoy, now consisting of four escort ships and one tanker, proceeded down across the Gulf of Siam. Off Malaya, one of the escort ships was damaged by submarine attack and dropped out. On 27 January, 28 days after leaving Japan, the convoy arrived at Singapore. The *Sarawak*, the sole remaining merchantman, hit a mine in the channel and had to be beached.

By such heroic efforts over 900,000 barrels of oil were brought back to Japan in January, but that was the end of the enterprise. The whole effort collapsed in March in the face of the expected invasion of Formosa or Okinawa. By that time the serviceable tanker tonnage was down to about 520,000 tons, and only about 30 percent was assigned to the impossible task of bringing oil into Japan. The measure of their success was 156,000 barrels in February. In March the last tankers to reach Japan from the south brought in about 350,000 barrels. By the first of April all traffic with the south had ceased.

The effect in Japan, where stocks had long

since reached rock bottom and where all oil consumers were on a hand-to-mouth basis, quarreling over the meager proceeds from the south was immediate. Oil for fuel for ships, although next in importance to aviation fuel in urgency to the nation, began to dry up. Smaller, less efficient vessels felt the pinch first. In April kihansen lay-days (on account of fuel) were 3,544; in May 4,266 at the Shimonoseki Straits alone. In the same month small kisen began to feel the shortage; there were 799 lay-days of E-type ships at Shimonoseki, waiting for fuel.

Changes of Sources of Imports

Simultaneous with the reduction in total volume of imports came a succession of significant changes in the areas of origin. Again beginning with the effects of pre-attack influences, the usual commodity import history included (a) the elimination of non-Asiatic sources following the embargoes, the freezing of Japanese credits, and finally the outbreak of war, (b) reliance on the wealth of the southern area after its conquest, and (c) with increasing stringency of shipping and final blockade of the southern area, eventual sole dependence on the resources of the Inner Zone (Figure 18).

A few examples will illustrate the trend. In 1940, 81 percent of the phosphorite imports came from distant sources, 17 percent from the southern area and about 2 percent from the Inner Zone. In 1943 the distant sources had disappeared, and southern area deposits were being exploited to provide 76 percent of the supply, the remainder originating in the Inner Zone. In 1945 only the Inner Zone sources were drawn upon. Similar trends are noticed in the imports of lead, zinc and scrap iron. In the cases of rice and iron ore, the southern area provided the largest share of 1940 imports, followed by the Inner Zone and distant sources. Imports from the distant sources disappeared after 1941, leaving the Inner Zone countries essentially the only source. Such commodities as tin, bauxite and rubber, the only source of which was the southern area, continued to be imported, although in reduced amounts, even in 1945, presumably at the expense of other southern area products which could be obtained in the Inner Zone. Another group of commodities—soybeans, soybean cake, salt, iron and steel, magnesite, dolomite and coal—the only or the major source

of which was the Inner Zone likewise continued to be imported even in 1945. It is significant that the reduction in the volume of the non-edible products was far greater than in that of the foodstuffs.

A final stage in the effective blocking-off of territories and restriction of shipments is represented by the conquest or re-conquest and actual occupation of the territory. Obviously, after the occupation of the Philippine Islands and Okinawa, imports from these (Philippine ores, hemp, sugar and copra, and Okinawa sugar) had to cease.

Planned Self-Sufficiency Within the Inner Zone

The continuing threat to all lines of contact with the southern area focussed attention on programs of self-sufficiency within the Inner Zone, the "yen bloc" of northeastern Asia. The steady decline in her merchant tonnage and its growing operating inefficiency gave additional impetus to Japan's attempts to develop the self-sufficiency of the Inner Zone and thus to improve her defensive position while at the same time cutting her shipping needs. In early 1945 stock was taken of the current dependence on continental raw materials in the light of the rapidly-worsening shipping situation. This resulted in recommendations designed to lessen such dependence and to utilize to best advantage the alarmingly small pool of shipping still available. The report of the research section, general affairs office, Greater East Asia department, reveals a recognition of the fact that the situation was becoming desperate.

It was concluded that the two products for which there was the most urgent need for a guaranteed supply were salt and soybeans. Of secondary importance, due to lack of substitutes in Japan proper, were phosphorite, alumina shale (for abrasives and fire brick), magnesite, graphite, manganese and other ferro-alloys. A third group of continental materials described as "necessary" were iron ore, coal, pig iron, alumina shale (for aluminum), raw cotton, fats and oils, asbestos and mica.

Conclusions were made with regard to the use of these materials in Japan, the comparative importance of continental sources, and the policy with regard to the future.

Salt: Domestic production of salt was only 400,000 metric tons per year, or 20 percent of

annual requirements, the remainder coming from China and Manchuria. As well as being considered indispensable in the diet, salt was the foundation of the chemical industry and a requirement in such essential industries as oil refining and light metals and explosives manufacture. In addition to attempting to remedy the situation responsible for the piling up of salt at the sites of manufacture due to lack of transport, thereby interfering with the creation of stockpiles in Japan, it was recommended that (1) technology be revised to economize the use of salt in industry, (2) the minimum requirements for human subsistence be established definitely, and (3) domestic production be increased above its former 20 percent of annual requirements figure.

Soybeans: Annual imports of soybeans increased during most of the war period with the increasing dependence on them as a food (the protein content compensating for the lack of animal food products) and as a source of oil for lubricants and various industrial uses. Total imports reached 728,000 metric tons in 1944, the bulk from Manchuria. Imports were to be maintained at the highest possible figure.

Phosphorite: After the loss of the Pacific islands, phosphorite was obtained, in smaller quantities, from the seaboard provinces of central China. The peak figure of 66,000 tons for 1944 was only about one-quarter of the amount formerly obtained annually from the Pacific islands. Phosphorus was one of the essential fertilizers on which maintenance of Japan's intensive agriculture was dependent, and a product with countless vital uses in industrial chemistry. As current supplies were far below needs, it was declared essential that the maximum amount of phosphorite ore obtainable be shipped from China for storage in Japan.

Alumina Shale: North China alumina shale and Foochow clay were required in large quantities in the manufacture of abrasives and fire brick materials, both essential in the maintenance of the wartime metal industries. As no satisfactory substitute was available in Japan, it was demanded that imports be continued to build up a stockpile of one year's supply within the country. It was recognized that the deteriorating shipping situation would probably not allow the delivery of sufficient shale to meet the above needs and those of the metallic indus-

try. The recommendation was to sacrifice a portion of the latter, if necessary. The aluminum program, based on shale, had proved disappointing due to delay in conversion of the Japanese plants, and lack of shipping to transport the increased production of continental shale. It was recommended that the aluminum industry search for (1) methods of producing alumina from Japanese materials, (2) techniques which did not require the use of soda, and (3) substitutes for aluminum in the aircraft industry.

Magnesite: Magnesite found its principal uses in the manufacture of magnesia brick for electric steel furnaces, and the manufacture of metallic magnesium. To lessen dependence on shipping space for continental magnesite, plans were made (1) to develop techniques enabling the substitution of domestic dolomite for magnesite, and (2) to emphasize the refining of metallic magnesium in Korea and Manchuria, thus eliminating the need for shipping bulky raw materials.

Graphite: Graphite of a grade sufficiently high for use in electrodes was not found in Japan, but came entirely from Manchuria. As there was no surplus of pitchcoke for artificial graphite electrodes, there was immediate need for transportation and storage of continental graphite.

Iron ore: In 1940 the ore for Japan's iron and steel industry came largely from the southern area. In 1942 and 1943 China was the principal source of supply. Japanese ore was becoming important in 1944. The sources of the ore used in Japan in 1943 were as follows:

Source	Metric tons	Percent of total
Japan	660	0.0
Korea	2,411	.3
Manchuria	9,054	1.2
China	700,085	90.3
Southern Area	63,622	8.2
Total	775,832	100.0

In view of this overwhelming dependence on continental materials, it was planned (in addition to the importation and storage of as much high-grade Chinese ore as possible) (1) to increase production of domestic ore, (2) to revise methods of steel production (principally by increasing electric steel capacity), and (3) to increase the salvage of domestic scrap. At the same time considerable effort was put into

the Mo-San mines near Seishin, which, though of such low grade as to require development of a concentration process, afforded the closest large scale source.

Manganese: As a countermeasure against the reduction in quality of iron ore, it became increasingly important to maintain supplies of manganese to insure high quality steel. This involved the import and storage of ore from central China and endeavors to improve the quality of domestically-produced manganese.

Oils and fats: It was flatly admitted that continuation of the war would be impossible without a supply of oil and fats for food, glycerine, lubricating oil and various industrial uses. Before the war domestic sources had provided 50 percent of the annual requirements of 340,000 metric tons. In 1944, not only did the total supply drop to 125,000 tons, but domestic production fell to 14,000 tons or 11 percent. Of the remainder, about 67,000 tons came from Manchuria, 16,000 tons from China, and 28,000 tons from the southern area. There was complete interruption of petroleum and vegetable oil shipments from the southern area in 1945 requiring an urgent speed-up of continental import and of domestic production.

Coking coal: Chinese coal provided the basis for the production of coke in Japan and constituted 50 percent of all coal imports. In 1943, 2,500,000 tons of Chinese coking coal was imported, representing about 88 percent of the total consumption of hard coking coal for that year. Frequently coal import tonnage was equal to as much as 70 percent of all imports from north China. In spite of the importance of the iron and steel industry, and the dependence of the industry on north China coal, it was felt that this tie-up of 70 percent of the decreasing shipping total was unwarranted in view of the equally great need for the other strategic continental materials named above, particularly food. A radical departure from earlier policy was made in the decision to sacrifice imports of coking coal.

The following recommendations were made to the hamstrung steel industry:

1. Investigate methods of iron and steel production which would make the industry independent of north China coal.

2. Investigate methods of production which would assure production of "tar" without de-

pendence on coke ovens.

3. Prepare steel manufacturing methods which would enable the industry to be independent of coke oven gas.

4. Increase home production of coking coal.

5. Attach more importance to the operation of small and medium furnaces in Japan (based on domestic coal).

6. Construct small blast furnaces in Japan (mainly in Hokkaido).

7. Strengthen and scatter electrically-operated plants.

Anthracite Coal: Formerly anthracite coal was imported from Indo-China. With the curtailment of shipments from the south, increasing amounts were shipped from Korea and Yangchuan, China, the total reaching 280,000 metric tons in 1943. In order to reduce this shipping requirement and to avoid suffering in case of stoppage of supply, it was declared imperative that measures be taken to substitute locally produced anthracite, charcoal, coke and coalite.

Cotton: China remained as practically the only source of raw cotton which was required in large quantities for clothing, guncotton, automobile and airplane tires. It was advised that every effort be made to reach maximum imports of Chinese cotton and to increase recovery of old cotton in Japan.

In conclusion, it was admitted that "should there ever come a time that supplies of raw material from the Asia continent are cut off, we cannot but predict that the continuation of this modern war will become almost impossible." The decision was made to continue at all expense the importation of salt and soybeans, even abandoning, if necessary, the former principle of emphasising the shipment of materials for the iron and steel industry which normally made up 60-70 percent of all imports.

The urgent demand for the acquisition of stocks of strategic continental materials, the frantic search for substitute materials and techniques, and above all the abandonment of the traditional "iron and steel first" policy in favor of the simple element, food, speak eloquently of the far-reaching effect that shortage of shipping had introduced in the Japanese economy at the beginning of the last year of war. In the first six months of 1945, imports of salt and foodstuffs, for the first time since Japan's in-

dustrialization, exceeded in total tonnage that devoted to basic industrial materials.

Endeavors to impose blockade conditions on the Inner Zone necessarily took place much later than the attack against the life line to the southern area, and the situation is reflected in the imports. Shipments of salt, soybean cake, and grains, all Inner Zone products, held up fairly well through most of 1944. Soybeans, exclusively an Inner Zone product, were imported in larger amounts in 1944 than in any preceding year, and in 1945 showed a still greater rate of increase.

Final collapse was threatened toward the end of the war when bombing and mining disrupted shipping routes from the continent, and the mining of ports in Japan proper interfered seriously with the ability of the reduced fleet to deliver continental goods to Japan. The reduced merchant fleet was probably sufficient to carry the required imports had their efficiency and field of operation not been so restricted. Complete demoralization of shipping at the heart of the empire rather than total loss of merchant fleet, dominated the last few months of distress.

Decline in Industrial Output

A second major effect on the economy of Japan resulting from the attack on shipping is found in the declining quantity and quality of industrial output. The relationship between this decline and the decline in receipts of raw materials is apparent. It is, however, necessary to avoid overemphasis on this simple cause and effect. As was true of the reduction in imports, reduction in industrial output in many instances preceded the outbreak of war. Factors quite unrelated to the loss of the merchant fleet or the approach to blockade conditions effected material reduction.

The actual peak in production for Japanese industry was reached in 1939 under the stimulus of the Sino-Japanese war and before the general restriction of world trade. Total industrial output fell after that year with loss of raw material sources and markets, following the general restriction of world trade, and the specific restriction of Japan's foreign trade due to the several factors mentioned earlier. Larger percentage decreases in the production of all cotton, wool, rayon and silk textiles, wood and paper products, pottery and porcelains were

experienced in the year immediately preceding and the first few years of the war. (On the other hand this same period witnessed large increases in the output of many industries producing necessary war materials, steel, cement, electrical goods, shipbuilding, synthetic oil, ordnance and munitions, and in addition, the birth of new industries such as aluminum, and magnesium.)

The productivity of industry was further reduced by the loss of manpower to the armed forces and the general upset accompanying the phenomenal disorders that characterized Japan's wartime economy. Progress in the Allied prosecution of the war to the point where direct attack by bombing of industrial facilities and urban areas was possible obviously represents another factor in the decline of output that is not associated with overseas transportation problems.

With these many factors at work it is not easy to assess the effect of transport difficulties on the reduction of industrial output. However, when the output of an industry, essential enough to enjoy high priorities in labor and other requirements, experiences serious decline preceding attack on the plant or city itself—a decline which parallels the decline in receipt of raw materials—it is not out of order to relate the two. Such instances are numerous.

Reduced imports resulted in severe shortages in basic raw materials and in fuels, each of which in turn contributed to the declining output of Japan's industrial machine.

Iron and steel, basic to the Japanese wartime industry, enjoyed top priority throughout most of the war period. In spite of this, however, its great dependence on huge quantities of imported coal and ore meant a vulnerability to shipping attrition that ultimately resulted in reduced output. The earliest losses, United States scrap iron, and Philippine and Malayan iron ore, were partially overcome by increased domestic production of ore, increased use of Chinese and Korean ores, scrap drives, and the use of accumulated stocks. Although coal imports declined throughout the war, the effect on this industry was postponed by placing emphasis on the import of coking coal and by the increased use of domestic coals. As a result of these measures, output of pig iron and steel was maintained through 1943. However, with

increased shipping difficulties and consequent reduced receipts of coal and ore and the dwindling of stocks, the effect on output eventually became apparent.

Coke production fell from its peak of 8,000,000 tons in 1943 to 538,000 tons in the first quarter of 1945. Pig iron production declined after March 1943 from a maximum monthly production of 100,000 tons to 10,000 tons in June 1945. Ingot steel production after reaching a peak of 700,000 tons in December 1943, fell to under 300,000 tons in June 1945. The relative position of imported raw materials and products of the industry during the war are shown in the table which follows. (It can be seen that the increased importation of pig iron following the expansion of blast furnace capacity on the continent, aided in postponing steel output decline long after ore imports had been seriously curtailed.)

[In metric tons]

Fiscal year	Coking coal imports	Iron ore imports	Pig iron imports	Scrap iron and steel imports
1941	3,417,000	5,058,000	784,000	203,000
1942	4,025,000	4,880,000	878,000	39,000
1943	2,939,000	3,686,000	1,134,000	25,000
1944	1,435,000	1,668,000	924,000	74,000
1945 (1st quarter)	116,000	143,000	51,000	1,000

Fiscal year	Coke production	Pig iron and iron production	Ingot steel production
1941	6,853,000	5,957,000	6,837,000
1942	7,994,000	6,376,000	7,099,000
1943	8,085,000	6,148,000	7,821,000
1944	6,378,000	4,612,000	5,911,000
1945	538,000	414,000	803,000

Aluminum.—Perhaps there is no better example of the effect of shipping attrition upon the quantity of industrial output than in the case of aluminum. Since ninety percent of aluminum production in 1941 was based on the use of bauxite from Malaya and the Netherlands Indies, the precarious dependence of the industry on a continuous inward flow of raw materials is apparent. At the outbreak of the war, capacity of aluminum plants in Japan and Formosa was increased, adding further to the requirements of bauxite from the south. Though imports of bauxite had fallen to a low of 146,711 tons in 1941 because of the embargo, they rose after the conquest of the Indies, reaching 820,534 tons in 1943. At this point stocks were again at prewar levels.

The terrific shipping losses were felt in reduced bauxite imports in 1944, when there was

a precipitate drop of almost 500,000 tons from the preceding year. In the face of this trend, the Japanese government made every effort to construct new shale plants on the continent and to convert Japanese plants to the use of shale. Shale production and imports increased but large amounts accumulated at mines, railheads, and harbors due to inadequate shipping and handling facilities.

Despite the utilization of shale, alunite, and clay from the Inner Zone, total alumina production in 1944 dropped to 70 percent of the production figure in 1943. By the last quarter of 1944, bauxite imports were sporadic, ceasing entirely after January 1945. Reflecting this shortage of raw materials, the rate of production of aluminum in the first quarter of 1945 was only 24 percent of that of the preceding year.

Imports and stocks of bauxite and aluminous shale in Japan proper, Korea, and Formosa (in metric tons) :

Fiscal year	Bauxite		Aluminous shale	
	Imports ¹	Stocks ²	Imports ¹	Stocks ²
1941	146,711	191,174	44,965	6,520
1942	450,134	209,607	47,358	11,855
1943	820,534	238,471	50,499	20,692
1944	347,335		147,411	
1945 (1st quarter)	1,800		37,614	55,168

¹ In terms of wet weight, 1941; dry weight 1942-45.

² Stocks pertain to end of period.

Production of alumina and aluminum in Japan proper, Korea and Formosa (in metric tons) :

Fiscal year	From bauxite	Other than bauxite ¹	Total alumina	Aluminum ingot
1941	136,837	15,046	151,883	70,740
1942	212,558	13,623	226,181	103,075
1943	305,734	13,757	318,491	141,084
1944	190,585	34,626	225,211	110,398
1945 (1st quarter)	1,621	14,598	16,219	6,647

¹ Includes production from aluminous shale, alum-clay, alunite, and scrap.

Production of magnesium in Japan declined in 1945 after transport problems curtailed the imports of brine, salt, magnesite, and magnesium clinker from Korea and Manchuria. Lead refining fell after the last quarter of 1944 with the failure of shipping to deliver Korean crude metal. Similar experiences were met in the zinc, tin, chemical fertilizers, rubber, leather, and many other industries as imports of raw materials dwindled or ceased altogether. At a later stage in the production cycle, shortages of

these basic capital goods were eventually reflected in decreased output of the end-product industries.

In 1944 Army ordnance saw the appearance of excess capacity in ammunition following the shortage of several raw materials, especially copper and minor metals, and lacking adequate stocks, the industry experienced actual stoppages of production due to sporadic deliveries. The reduction of raw materials was reported to be in the neighborhood of 50 percent to 70 percent. Navy ordnance reported shortages of steel, copper, and alloys. Shipbuilding suffered a shortage of steel and copper, the steel shortage becoming so acute in 1945 that cutbacks were made in the schedule. Shortages in nickel, aluminum, tungsten, rubber, iron, steel, non-ferrous metals, coke and coal, and petroleum products affected the motor vehicle industry, resulting in decreased output after 1942. The optical equipment industry faced a shortage of copper. The aircraft industry experienced a shortage of many materials toward the end of the war, and by the spring of 1945 even the end of the aluminum supply was in sight. The reduced aircraft-engine production became critical after April 1944.

In addition to the shortages of basic materials used in the finished product, many industries suffered from shortages of other materials necessary in the earlier processing. The aluminum industry felt shortages of salt (soda ash and caustic soda), and pitch coke for electrodes. The iron industry suffered from the reduced imports of refractory materials. Trouble followed a decline of prefabricated linings in 1941 to 1943, becoming critical at the end of 1943. Insufficient graphite for electrodes was a limiting factor in the production of all ferroalloys. The chemical industries suffered a shortage of maintenance materials, especially steel for pressure tanks. Both shipbuilding and Navy ordnance reported that the shortage of oxygen for steel-cutting created a bottleneck.

A severe decline in the production of coal in Japanese mines in 1944 in part was due to shortage of materials, steel, cement, rubber and lumber, especially steel. Somewhat similar was the decline in the yields of rice and other food-stuffs due to shortage of imported fertilizers.

Reduction in the imports of coal were felt not only in the iron and steel industry where

coal functions in dual capacity as fuel and raw material, but many other industries using coal primarily as fuel suffered serious shortages. Domestic coal production increased for a time and then fell precipitously when other material shortages were experienced.

Imports declined continuously after 1942. Less dependent on foreign sources for general-purpose coal than for coking coal, Japanese industry still required shipping for the receipt of supplies, the bulk of which originated in Kyushu or Hokkaido. With the upset of inter-island transport, Honshu receipts of outer island coal were reduced to a fraction of the former totals. Japan Sea ports were unable to handle the volume formerly entering Pacific ports.

A shortage of coal caused a decline in domestic copper output, hindered the manufacture of optical equipment during the last two years of the war, and after November 1944, became a serious factor in the shipbuilding industry. By the end of July 1945, domestic coal production had fallen 65 percent from the peak of 1940, inter-island transport was almost at a standstill, and imports had ceased because of the acute shipping shortage and the top priority given to food and salt. Practically all fuel-consuming industries that had not ceased operation as a result of other factors were faced with a critical coal shortage.

Countermeasures of Japanese Industry

The anticipation and the later materialization of the shortages of overseas materials brought forth a number of countermeasures designed to alleviate the losses. The following examples will suffice to illustrate the various reactions of industry to the ever-tightening effects of loss of shipping. (More detailed histories of the wartime experience of individual industries are presented in the reports of other sections of the Survey, specifically, the reports on basic materials, civilian supplies, capital equipment, military supplies, oil and chemicals, and aircraft.)

The most obvious of these measures designed to counterbalance the effect of loss of foreign materials was the use of domestic materials for the creation or expansion of domestic industries producing materials heretofore obtained overseas. For example, domestic coal production in-

creased 50 percent from 28,000,000 tons in 1931 to 42,000,000 tons in 1936, and the production of domestic iron ore increased 230 percent from 1937 to 1941 and an additional 100 percent from 1941 to 1943. With the loss of Indian manganese ore, domestic production increased from 196,000 tons in 1941 to 400,000 tons in 1944. Lead production in the home islands continued to increase through 1944.

As the southern area sources of bauxite became unavailable, there was an attempt to base the aluminum industry on domestic clays and other bauxite substitutes.

Where domestic resources could not supply the needed materials, recourse was made to near-by overseas sources, thus reducing the ship time and hazards involved in utilizing the more distant overseas sources. In 1941 embargoes affected the importation of iron ore resulting in smaller quantities being imported from the Philippines and Malaya and larger quantities from China and Korea. Ore imports from the south began to decline in 1941. China imports increased during 1941-42 but did not offset the loss of Philippine and Malaya ores. In the final stages of the war, southern area ore imports almost stopped, China supplies dwindled, and Korea was the only reliable source.

In 1941 the embargo cut off the foreign supply of copper metal and forced reliance on domestic and Korean blister copper and ore from China, Formosa, and the Philippines. In the early phases of the war Japan lost access to Indian manganese ore and depended in part on lower grade Philippine ore.

In a further attempt to shorten shipping routes and lessen the need for shipping space, some industries were relocated nearer the raw materials, thus eliminating the need for shipping bulky raw materials. In the early stages of the war, when the iron production schedule was threatened, a proposal was made to establish a small blast furnace program near the materials on the continent. Nothing came of this. In March 1945 a plan was approved to move some of the Japanese iron and steel plants and mills to Manchuria, north China, Korea, and Inner Mongolia. This was done partly to conserve transportation, but also to avoid bombing. Only three were nearing completion at the end of the war. The precarious position

of the aluminum industry based on materials from the south was recognized early, and there was attempted construction of new aluminum shale plants on the continent. The Korean magnesium industry, near the source of magnesite, had expanded by the end of the war to have a capacity almost equal to that of the Japanese industry. Paper mills were established in outlying possessions to convert bulky pulp into paper, thus saving shipping space.

In many instances, in anticipation of loss of overseas sources or difficulty in transport, there were attempts to build up large stocks of materials while the situation permitted. In June 1936 the Japanese Iron Manufacturing Company was directed to build up a stockpile of 55 percent Fe iron ore of 3,000,000 tons. In the early stages of the war, pig iron output was maintained by drawing down this stockpile. In June 1939 the company was ordered to build and maintain a stockpile of 115,000 tons of high-grade manganese ore above its own requirements. But at the end of August 1945, existing stocks of ferro-alloys were equal to only one to three months' supply.

Bauxite stocks in 1941 were 250,000 tons (six to nine months' supply). These were rapidly reduced after the outbreak of war but with the conquest of the south, stocks again reached the prewar level. The tin shortage resulted from postponing an adequate stockpile until too late to effect the shipment. Petroleum stock in 1941 was equal to a two-year supply but storage was low by the end of 1943. Rubber stockpiles were going down rapidly toward the end of the war. By early summer 1944, aircraft producers had to dig into their stockpiles and by midsummer all reserves were exhausted.

A common experience in the metal industries was the increased use of scrap when imports of metal ore fell below requirements. The iron scrap drive commenced as early as the middle thirties. In 1939 it reached an all-time peak of 5,800,000 tons. The drive was intensified from time to time when the production schedule was threatened. There were frequent copper scrap drives eventually resulting in deteriorating quality with the increased use of secondary metal. The lead industry announced a special scrap drive in 1944. By the last quarter of 1944 scrap aluminum accounted for 80 percent of the supply available to the aircraft industry.

Reflecting the desperate situation faced by many industries as other countermeasures failed, the use of a great variety of substitute materials characterized Japanese industry towards the end of the war. Substitutes for copper included aluminum in wire cables, steel for cartridge cases, bamboo for containers and steel for copper alloy parts in shipbuilding and ordnance. In the optical equipment industry, iron and aluminum were frequently substituted for copper. The aluminum industry attempted to use alunite for bauxite with limited success. In the chemical fertilizer industry a product derived from a primitive process of wood ash leaching was used in place of potash.

In the aircraft industry steel parts and fittings were substituted for dural parts; steel and brass rivets were used to make up the joints. By the spring of 1945 the end of the aluminum supply was in sight and designers turned their attention to all-wood construction. Wood was substituted for wing tips, tail surfaces and whole tail assemblies. There were a few examples of all-wood replacement, but production was not extensive. Wood or glass was used in place of plastics. Substitutes in the petroleum industry included pine root oil, fish oil and vegetable oils; alcohol used for aviation gasoline; and lubricating oil made from rubber.

In spite of all effort to offset the effect, the destruction of shipping and the establishment of blockade reduced the flow of imports at a pace greater than could be overcome by all the foregoing attempts. Stockpiles and the possibilities of scrap recovery disappeared, domestic resources proved inadequate, and substitute measures failed. The inevitable result was a decline in industrial output.

As the all-important iron and steel industry, particularly dependent on waterborne raw materials, began to feel the pinch, every industry, more or less dependent on iron and steel, suffered likewise. There were a few apparent exceptions, as was true for a time in the qualitative control of reduced imports, the enemy maintaining some degree of control of the direction in which the impact would fall. Production in the most essential war industries was maintained until quite late in the war, but always at the expense of another phase of production. Chemicals for explosives were always available in sufficient quantities, an accomplishment,

however, made possible only by the sacrifice of the chemical needs of many other products.

The shrinkage of all Japanese industry gave rise to another type of apparent exception to the general shortage. In spite of vastly curtailed output of sulphuric acid, industry generally, and hence demands for the product, had declined so much further that no shortage was experienced, and it could be maintained that actual overcapacity had appeared.

In the last few months of the war the small fleet remaining to Japan was so restricted in its field of operations that imports, already dwindling rapidly, began to fall at a precipitous rate. Industrial raw materials, even coal, were required to give way to foodstuffs. Industry unable to cushion the shock at this late stage was faced with collapse.

Decline in quality—Accompanying the decline in total output was a decline in quality of product of many industries, the price paid for use of poorer grade domestic or near-by raw materials, makeshift substitute processes, and unsatisfactory substitute materials.

By the last quarter of 1944 scrap aluminum accounted for 80 percent of the supply available to the aircraft industry, resulting in a serious deterioration in quality. The industry likewise faced a deterioration in quality of duralumin because of the shortage of copper and other alloys. As the use of domestic iron ore increased, the iron content decreased. There was also a higher sulphur content. The quality of coke decreased as a higher percentage of domestic coal was used. Certain chemicals declined in quality with the reduction in the quality of imported coal.

Many instances of quality decline are found in the ferro-alloys industry. As early as 1939 only 30 percent of the cobalt and nickel requirements could be obtained. This resulted in a reduction in the cobalt content of higher speed and magnet steel and the elimination of nickel from structural steel. High speed steels, formerly 16 percent cobalt, were often produced with no cobalt. Nickel-chrome stainless steel was made without nickel and molybdenum structural steel was made without molybdenum. The nickel content of gun barrels and armour plate was reduced. The quality of ferro-manganese deteriorated with greater dependence on Philip-

pine and domestic ores after the loss of Indian manganese.

Industry was not the only segment of the Japanese economy to feel the effects of the dwindling overseas trade. Civilian supplies and services, almost without exception, suffered likewise. Outstanding was the effect on food. Obviously, all phases of the war effort depended on an adequate supply. As stated earlier, 20 percent of normal requirements was shipped from overseas, although largely from the Inner Zone.

As the war progressed Japan found herself faced with the unhappy situation of an increased demand for food meeting a decreased domestic supply. Several factors contributed to the diminishing local supply. All food-producing industries had lost manpower to the services. Various agricultural products were suffering rapidly declining yields partly from lack of the fertilizers formerly imported in large quantities. The fishing industry not only lost boats to the military, but the attack on shipping or threat of attack, restricted the fishing waters. In addition, the hazards of shipping from the southern area caused severe shortages of fuel for the fishing fleet and of Manila hemp for fishnets. The catch declined from 4,800,000 tons in 1939 to 2,080,000 tons (estimate for the entire year) in 1945. Imports dropped sharply after 1941 and disappeared entirely after 1943. In spite of the cessation of exports and of the use of fish for fertilizer and feed, the total quantity available for food decreased 35 percent during the war.

The resulting increased demand for foodstuffs from abroad was curbed somewhat by a reduction in the civilian ration. However, in 1944 10 percent of the reduced basic ration (grains only, excluding sugar and bean products) still had to be imported.

Before the war Japan normally imported 20 percent of her rice requirements or about 2,000,000 tons, 60 percent from Korea and 40 percent from Formosa. After the failure of the Korean crop in 1940, imports were largely from the southern area, Siam, Indo-China, and Burma. Until 1944, the southern area exceeded the Inner Zone as a source of Japan's rice. A peak figure of 1,500,000 tons was reached in 1942. This was reduced in the following year by nearly 50 percent as the rice-producing areas

suffered a shortage of bag materials and transport difficulties due to flood conditions, and as it became necessary to devote more space to southern area raw materials for the munitions industries. In 1944 the shortage of shipping and tightening blockade of the southern area caused rice imports to fall to a mere 75,000 tons. In that year the Inner Zone again became the leading source of Japan's imported rice, supplying ten times the quantity coming from the southern area. In 1945 the southern area supplied no rice, Formosan imports had dwindled to 9,000 tons, and Korean to 142,000 tons or about 15 percent of the requirements for the period.

A momentary brightening of the picture occurred in the spring of 1945 as food imports from the remaining available sources in the Inner Zone began to rise. The decision in April to devote practically all shipping space to foodstuffs reflected not only the importance of the food supply, but the desperateness of the general situation. In the second quarter of 1945, rice and soybean receipts exceeded those of the first quarter of the year, and receipts of salt had dropped but slightly. Soybean receipts in

June were twice as great as those of any previous month of the entire war period.

This was short-lived, however, as the ever-tightening blockade prevented the continuation of adequate receipts even of these vital commodities. Soybean shipments fell from 265,400 ton in June to 176,000 tons in July. Manchurian cereal imports, which totaled 48,173 tons in June were reduced to 21,568 tons in July and to 11,490 tons in August. The last Formosan shipments of rice were received in April 1945; the last from Korea, a mere 373 tons, in September.

Faced with the threat of complete cessation of food imports at an early date, a drastic but necessary 10 percent cut in the basic ration was imposed in July as the only possible means of survival. However, in the face of increasing losses of stored food supplies by bombing attacks and the inevitable disruption of internal food distribution accompanying the Allied invasion, it appears probable that even this emergency measure would have proved ineffective and that the loss of the merchant fleet and the consequent loss of overseas food supplies would have proved decisive.

APPENDIX A.—Submarine Sinkings of Merchant Tankers

Month	Merchant ships sunk by submarines			Merchant tonnage afloat			Submarine offensive	
	Total tonnage all merchant ships ¹	Merchant tankers only ²	Percent of total ³	All merchant ships ⁴	Merchant tankers only ⁵	Percent of total ⁶	Number days on offensive patrol per month ⁷	Number of torpedoes expended per month ⁸
December 1941 through February 1943.....	717,708	9,538	1.3	6,076,553	629,404	10.4	425	132
1943								
March.....	109,447	25,251	23.1	5,771,398	780,944	13.5	442	299
April.....	105,345	24,915	23.7	5,732,762	788,162	13.7	448	263
May.....	122,319	17,569	14.4	5,630,243	768,197	13.6	437	237
June.....	101,581	4,189	4.1	5,536,304	772,670	14.0	659	389
July.....	82,764			5,487,600	785,151	14.3	532	297
August.....	80,799			5,465,238	817,022	14.9	858	387
September.....	157,002	13,458	8.6	5,430,804	832,387	15.3	697	461
October.....	118,847			5,320,196	844,706	15.9	648	423
November.....	231,684	44,912	19.4	5,262,937	870,205	16.5	572	454
December.....	131,531	21,032	16.0	5,034,778	863,953	17.2	407	251
10 months total.....	1,241,319	151,326	12.2			⁹ 14.9		
1944								
January.....	240,840	63,661	26.4	4,947,815	873,070	17.6	824	460
February.....	256,797	63,274	24.6	4,723,696	839,576	17.8	593	383
March.....	106,529	10,536	9.9	4,320,802	760,507	17.6	689	370
April.....	95,242	8,103	8.5	4,352,240	793,833	18.2	775	292
May.....	264,713	32,785	12.4	4,308,427	798,822	18.5	1063	493
June.....	195,020	29,602	15.2	4,189,319	835,358	19.9	824	362
July.....	212,907	47,923	22.5	4,041,711	837,326	20.7	1275	635
August.....	245,348	84,352	34.4	3,902,700	852,735	21.8	1056	581
September.....	181,363	38,336	21.1	3,710,446	835,882	22.5	850	436
October.....	328,843	103,903	31.6	3,474,008	872,333	25.1	1306	799
November.....	220,476	38,779	17.6	3,095,820	838,947	27.1	1317	775
December.....	103,836	49,215	47.4	2,847,534	868,962	30.5	1128	506
Annual total.....	2,451,914	570,469	23.3			¹⁰ 20.9		

¹ Compiled from USSBS ship sinking list.

² Same source as (1). Does not include fleet oilers or other combatant vessels not ending in "maru".

³ Column 3 is column 2 divided by column 1.

⁴ Column 4 equals column 1, appendix B plus column 1, appendix C.

⁵ Column 5 is column 1, appendix C.

⁶ Column 6 is column 5 divided by column 4.

⁷ Column 7 is from U. S. Navy action summaries.

⁸ Same source as (7).

⁹ Ten months' average.

¹⁰ Annual average.

**APPENDIX B.—Consolidated Recapitulation of the Japanese Merchant Ship Situation
Monthly During the War (Tankers Excluded)**

Month	Total tonnage afloat ¹	"A" ships in service of the Army ²	"B" ships in service of the Navy ³	"C" ships, Shipping Control Association		A, B, C Consolidated Fleet		Changes during the month		
				Afloat ⁴	Serviceable ⁵	Inner zone serviceable ⁶	Unserviceable or cut off in southern area ⁷	Captured or salvaged ⁸	Built ⁹	Con- verted to tankers ¹⁰
<i>1941</i>										
December	5,421,143	2,150,000	1,556,600	1,714,543	1,513,600			96,101	4,929	
<i>1942</i>										
January	5,464,992	2,109,176	1,610,194	1,745,622	1,518,604			89,468	23,894	
February	5,503,083	2,108,020	1,597,907	1,797,156	1,595,875			54,243	16,638	
March	5,540,051	2,092,523	1,607,274	1,840,254	1,612,063			54,489	21,250	
April	5,544,877	2,015,044	1,573,714	1,956,119	1,659,893			77,722	5,896	
May	5,591,077	1,959,010	1,564,555	2,067,512	1,788,398			34,598	16,242	
June	5,544,248	1,715,403	1,530,796	2,298,049	1,957,938			38,867	23,081	4,000
July	5,569,169	1,550,856	1,522,234	2,496,079	2,111,683			39,424	12,895	5,000
August	5,547,609	1,275,958	1,504,292	2,767,359	2,305,210			19,778	33,958	
September	5,507,167	1,220,549	1,464,471	2,822,147	2,370,603			56,490	22,879	15,000
October	5,524,025	1,199,717	1,463,063	2,861,245	2,466,393			12,722	21,779	
November	5,390,402	1,156,789	1,434,983	2,798,630	2,387,231			16,218	7,753	
December	5,252,201	1,223,523	1,409,042	2,619,636	2,260,746			19,091	33,478	12,000
<i>1943</i>										
January	5,219,547	1,414,695	1,462,243	2,342,609	1,953,736			15,845	7,309	30,000
February	5,087,659	1,342,832	1,434,604	2,310,223	1,993,722			7,889	29,945	40,000
March	4,990,454	1,376,614	1,400,253	2,213,587	1,846,132			5,976	91,778	20,000
April	4,944,600	1,380,477	1,383,160	2,180,963	1,803,666			14,612	16,838	5,000
May	4,862,046	1,168,525	1,339,364	2,354,157	1,963,367			8,498	14,238	5,000
June	4,763,634	1,152,767	1,286,364	2,324,503	1,971,179			14,518	31,322	
July	4,702,449	1,173,323	1,274,552	2,254,574	1,839,732			5,969	32,095	
August	4,648,216	1,188,966	1,310,485	2,148,765	1,742,648			3,888	47,118	
September	4,598,417	1,161,378	1,270,765	2,166,274	1,789,342			1,893	45,417	
October	4,475,490	1,160,438	1,261,192	2,053,860	1,682,111			10,835	54,913	
November	4,392,732	1,112,941	1,272,526	2,007,265	1,607,819			4,828	47,857	
December	4,170,825	1,019,164	1,212,194	1,939,467	1,545,755			8,080	95,328	
<i>1944</i>										
January	4,074,745	1,004,454	1,151,233	1,919,058	1,508,380			6,675	72,342	
February	3,884,120	911,916	1,089,918	1,882,286	1,487,006				84,053	
March	3,560,295	825,977	918,436	1,815,882	1,454,521			4,394	178,419	4,000
April	3,558,407	835,946	897,493	1,824,968	1,412,525			4,281	73,075	3,000
May	3,509,605	874,050	895,112	1,740,443	1,300,110			830	95,852	3,000
June	3,353,961	795,437	843,985	1,714,539	1,275,617				93,322	4,000
July	3,204,385	705,154	743,086	1,756,145	1,280,230				51,184	8,000
August	3,049,965	625,131	689,426	1,735,408	1,270,319			4,303	73,200	40,000
September	2,874,564	603,810	664,953	1,605,801	1,167,417			9,082	103,497	60,000
October	2,601,675	483,033	590,192	1,528,450	1,181,492				75,520	30,000
November	2,256,873	399,137	499,736	1,358,000	995,414				87,536	30,000
December	1,978,572	260,568	406,017	1,311,987	896,087				86,913	
<i>1945</i>										
January	1,925,436	253,638	386,455	1,285,343	892,028				82,404	
February	1,789,097	243,255	367,831	1,178,011	845,812			5,880	99,642	
March	1,908,236	254,638	374,333	1,279,265	908,278				112,823	
April	1,902,734	232,372	325,333	1,345,029	934,795	1,217,706			33,707	
May	1,924,799	223,449	302,417	1,398,933	935,886	1,198,378			66,544	
June	1,857,926	197,952	293,163	1,366,811	892,528	1,139,292			22,481	
July	1,733,627	175,320	272,284	1,286,023	733,033	923,905			44,337	
August	1,587,236	150,000	255,737	1,181,499	594,294	743,286	956,558		12,064	
August 15	1,547,418					590,860				
Total								747,487	2,307,655	

¹ Beginning with a figure representing USSBS appraisal of the Japanese Merchant Fleet on Pearl Harbor Day, subsequent monthly figures are arrived at by adding algebraically columns 8, 9, 10, 11, and 14.

² Beginning with tonnage known to be in service of the Army on Pearl Harbor Day, this column is arrived at by adding and subtracting known requisitions, releases, and losses by the Army, adjusted slightly to reconcile differences in information.

³ Same for the Navy.

⁴ Column 1 minus columns 2 and 3.

⁵ Column 4 minus a figure for tonnage under repair or out of service and in need of repair computed by USSBS from various Japanese sources.

⁶ Beginning with the known situation at war's end from Japanese sources, working backward from USSBS sources or ship damage, an approximate reconstruction of total tonnage.

⁷ USSBS compilation of situation as of war's end.

⁸ USSBS compilation of information from various sources. Where exact date of recommissioning unknown (about 20 percent) ships were apportioned in proportion to known dates of recommissioning of other ships.

⁹ USSBS Military Supplies Division, Shipbuilding Section. Included are only cargo, cargo-passenger, passenger and some few special types. Fishing vessels and tugs and barges are not included.

¹⁰ Estimates based on changes in the tanker situation.

¹¹ Same source as 10.

¹² Sum of Japanese Army and Navy reports of ships requisitioned.

¹³ Sum of Japanese Army and Navy reports of ships released to civilians.

¹⁴ USSBS Ship Sinking List expended by 2 percent to reconcile discrepancy between Pearl Harbor tonnage, war's end tonnage, and other contributing factors, together with belief that Ship Sinking List is only somewhere between 95 and 98 percent complete.

¹⁵ Total tonnage of bombs, mines, and torpedoes from Appendix 5.

Recon- verted to cargo ¹¹	Requi- sitioned of Army and Navy ¹²	Released by Army and Navy ¹³	Sunk ¹⁴	Total weight of ammu- nition expended by U. S. against shipping ¹⁵	Principal war developments affecting shipping
	64,936	973	57,181	22	
	26,343	544	75,271	26	
	26,172		33,913	42	
	6,838	973	70,913	56	
	4,605	85,157	37,418	29	
	7,905	202,233	97,669	71	
	11,225	152,539	33,027	27	Battle of the Coral Sea
	23,543	263,618	68,879	32	Battle of Midway
	31,997	51,965	94,178	80	
	18,592		47,511	48	Guadalcanal landing
	30,467	10,420	168,124	102	
	192,170	17,111	162,172	248	
	292,201		73,223	286	
	18,519	534	125,042	280	
	67,407	4,422	95,039	211	
	87,997		123,608	180	
	525	181,321	109,004	291	"Battle of the Bismark Sea"
			116,148	121	
	77,390		107,025	198	Reconquest of Attu
	96,144		92,297	387	
	24,199	28,337	100,085	289	
	89,890	4,394	170,957	304	Submarine offensive stepped up
	53,334		148,506	416	
	45,668		274,592	517	
	50,621	10,262	199,488	691	
	60,046	1,361	269,642	848	
	81,434	993	407,878	689	Carrier raid on Truk
	152,890	3,044	180,701	688	Carrier raid on Palau
	126,940	3,576	123,158	789	
	57,071	1,522	249,326	316	
	19,492	509	238,898	579	Invasion of the Marianas
	23,301	5,289	197,604	707	
	51,750		212,904	441	
	19,087	7,961	325,468	997	
	5,131	2,274	390,322	1616	Preinvasion carrier raids around Philippines
	11,056	9,905	335,837	1411	Carrier support of Leyte landings
	47,000	5,935	140,049	402	Carrier screen of Philippines
30,000	50,531		248,743	962	Carrier raid—South China Sea
55,000	28,861	887	41,383	256	Iowa Jima landing
15,000	12,271		133,325	2068	Large scale city raids
89,000	3,084		100,642	1333	B-29 minelaying campaign Okinawa landing
71,000	1,746		204,327	3052	Navy privateer planes Korean waters
40,000		4,879	186,780	3222	Submarines in the sea of Japan
18,000		547	208,728	3747	Carrier raids Japanese home waters
		12,361	51,882	1958	Atom bombs—Russia in war—complete air cover
			6,928,867		

**APPENDIX C.—Recapitulation of Japanese Merchant Tanker Situation Monthly
During the War (Tankers Excluded)**

Year and month	Tonnage afloat first of month ⁽¹⁾	In service—able condition—1st ⁽²⁾	Importing oil into Japan ⁽³⁾	Servicing the Army—Overseas ⁽⁴⁾	Servicing the Navy, (not counting fleet oilers) ⁽⁵⁾	In local use around Japan ⁽⁶⁾	In need of repairs, repairing or converting (estimate) ⁽⁷⁾	Converted during month ⁽⁸⁾	Built during month ⁽⁹⁾	Captured or salvaged ⁽¹⁰⁾	Sunk during month ⁽¹¹⁾	Tonnage afloat at end of month ⁽¹²⁾
<i>1941</i>												
December	575,464	510,464		13,480	160,000	336,984	65,000		975	10,806		587,245
<i>1942</i>												
January	587,245	516,116		13,480	160,000	342,636	71,129			10,778		598,023
February	598,023	539,070		13,480	160,000	365,590	58,953			8,014		606,037
March	606,037	560,647		13,480	160,000	387,167	45,390			7,601	8,653	604,985
April	604,985	556,976		13,480	160,000	383,496	48,009		1,186	1,158		607,329
May	607,329	579,285	256,140	13,480	160,000	149,665	28,044				904	606,425
June	606,425	554,170	256,140	13,480	160,000	124,550	52,255	+ 4,000		1,458		611,883
July	611,883	552,793	272,313	13,480	160,000	107,000	59,090	+ 5,000		7,981		624,864
August	624,864	554,117	294,637	13,480	160,000	86,000	70,747		6,446			631,280
September	631,280	544,828	306,348	13,480	160,000	65,000	86,452	+ 15,000		2,088		648,368
October	638,368	618,560	402,080	13,480	160,000	43,000	29,808		572	13,416		662,356
November	662,356	594,895	402,080	13,480	160,000	19,335	67,461					662,356
December	662,356	622,335	428,855	13,480	160,000	20,000	40,021	+ 12,000	12,142			686,498
<i>1943</i>												
January	686,498	650,029	444,549	13,480	172,000	20,000	36,469	+ 30,000	5,240	6,197		727,935
February	727,935	677,210	471,730	13,480	172,000	20,000	50,725	+ 40,000	13,009			780,944
March	780,944	728,972	534,492	13,480	161,000	20,000	51,972	+ 20,000	16,666		29,448	788,162
April	788,162	740,783	533,833	12,950	174,000	20,000	47,379	+ 5,000			24,965	768,197
May	768,197	701,921	493,971	12,950	175,000	20,000	66,276	+ 5,000	17,077		17,604	772,670
June	772,670	712,185	501,235	12,950	178,000	20,000	60,485		16,678		4,197	785,151
July	785,151	747,285	536,335	12,950	178,000	20,000	37,866		31,871			817,022
August	817,022	756,300	551,350	12,950	172,000	20,000	60,722		15,365			832,387
September	832,387	753,131	547,181	12,950	173,000	20,000	79,256		43,388		31,069	844,706
October	844,706	770,560	563,610	12,950	174,000	20,000	74,146		25,499			870,205
November	870,205	815,491	614,541	12,950	168,000	20,000	54,714		39,421		45,673	863,953
December	863,953	811,220	606,270	12,950	172,000	20,000	52,733		30,713		21,596	873,070
<i>1944</i>												
January	873,070	753,769	558,819	12,950	162,000	20,000	119,301		35,874	6,079	75,447	839,576
February	839,576	787,497	594,547	12,950	160,000	20,000	52,079		40,849		119,918	760,507
March	760,507	728,146	588,196	12,950	107,000	20,000	32,361	+ 4,000	78,031		48,705	793,833
April	793,833	767,539	643,589	12,950	91,000	20,000	26,294	+ 3,000	10,108		8,119	798,822
May	798,822	768,625	644,675	12,950	91,000	20,000	30,197	+ 3,000	66,387		32,851	835,358
June	835,358	770,647	627,697	12,950	110,000	20,000	64,711	+ 4,000	49,060		51,092	837,326
July	837,326	766,127	633,177	12,950	100,000	20,000	71,199	+ 8,000	55,428		48,019	852,735
August	852,735	777,957	645,007	12,950	100,000	20,000	74,778	+ 40,000	28,688		85,541	835,882
September	835,882	762,640	640,690	12,950	89,000	20,000	73,242	+ 60,000	81,724		105,273	872,333
October	872,333	806,533	693,583	12,950	60,000	20,000	65,800	+ 30,000	69,155		132,541	838,947
November	838,947	759,881	667,241	2,640	70,000	20,000	79,066	+ 30,000	62,295		62,280	868,962
December	868,962	803,019	716,379	2,640	64,000	20,000	65,943		46,691		54,682	860,971
<i>1945</i>												
January	860,971	787,911	700,000	2,640	60,000	25,271	73,060	- 30,000	31,015		182,002	679,984
February	679,984	541,245	388,605	2,640	50,000	100,000	138,729	- 55,000	40,730		46,966	618,748
March	618,748	522,606	150,000	2,640	35,000	334,966	96,142	- 15,000	13,906		55,518	562,136
April	562,136	441,028	100,000	2,640	30,000	308,388	121,108	- 89,000			13,059	460,077
May	460,077	351,758	1270,000	2,640	27,000	252,118	108,319	- 71,000			11,237	377,840
June	377,840	255,893	1265,000	2,640	27,000	161,253	121,947	- 40,000			13,058	324,782
July	324,782	204,247	1250,000	2,640	25,000	126,607	120,535	- 18,000			31,257	275,525
August	275,525	101,196	1235,000	2,640	25,000	38,556	174,329				8,577	266,948
15 August	266,948	86,287	1225,000									

¹ Beginning with tonnage available at Pearl Harbor, adding algebraically columns 8, 9, 10, and 11.

² Column 1 minus column 7.

³ From the Shipping Control Association in Tokyo, adjusted to correct discrepancies, to preserve a reasonable relation to column 1.

⁴ From Shipping Section, Japanese Army, Tokyo.

⁵ From Shipping Section, Japanese Navy, Tokyo.

⁶ From Shipping Control Association, Tokyo.

⁷ Estimates.

⁸ Estimates.

⁹ USSBS Military Supplies Division, shipbuilding section.

¹⁰ Shipping Control Association, Tokyo.

¹¹ USSBS Ship Sinking List, expanded by 2 percent.

¹² Cut off in the southern area.

APPENDIX D.—WEIGHT OF ATTACK AGAINST SHIPPING

PART 1.—Summary

Whole war	Total sorties flown	Sorties against merchant shipping	Percent of total	Tons of bombs on merchant shipping and mines laid
(a) USAAF (excluding twentieth).....	475,783	7,250	1.5	9,118
(b) U. S. Navy and Marine land-based air.....	(1)	8,024	.....	1,987
(c) Combined U. S. land-based air (excluding twentieth).....	(1)	15,274	.....	11,105
(d) U. S. carrier-based air.....	(1)	17,633	.....	5,159
(e) Combined U. S. Navy and Marine land and carrier air.....	258,109	25,657	9.9	7,146
(f) Twentieth AF.....	28,826	1,424	4.9	9,875
(g) Combined U. S. air effort (incl. twentieth).....	762,718	34,331	4.5	26,139
	Days of offensive patrol	Attacks on merchant shipping	Ratio —(attack per day)	Tons torpedoes expended ²
(h) U. S. submarine.....	31,571	4,112	13.0	4,916

¹ Not available.

² Calculated at an arbitrary one-third-ton per torpedo warhead.

PART 2.—U. S. Army Air Forces (excluding Twentieth)

Year	Total sorties flown	Sorties against merchant shipping	Percent of total	Tons of bombs dropped on merchant shipping
1941-42.....	7,447	186	2.5	351
1943.....	102,092	1,316	1.3	2,159
1944.....	195,879	2,932	1.5	3,263
1945.....	170,365	2,786	1.6	3,345
Whole war.....	475,783	7,250	1.5	9,118

PART 3.—U. S. Navy and Marine Land-based Air

Year	Total sorties flown	Sorties against merchant shipping	Percent of total	Tons of bombs dropped on merchant shipping
1941-42.....	(1)	384	.....	140
1943.....	(1)	753	.....	323
1944.....	(1)	4,408	.....	960
1945.....	(1)	2,479	.....	564
Whole war.....	.....	8,024	.....	1,987

¹ Breakdown not available.

PART 4.—Combined U. S. Army-Navy-Marine Land-based air (exclusive Twentieth)

Year	Total sorties flown	Sorties against merchant shipping	Percent of total	Tons of bombs dropped on merchant shipping
1941-42.....	(1)	570	.....	491
1943.....	(1)	2,099	.....	2,482
1944.....	(1)	7,340	.....	4,223
1945.....	(1)	5,265	.....	3,909
Whole war.....	.....	15,274	.....	11,105

¹ Breakdown not available.

PART 5.—U. S. Carrier-based air

Year	Total sorties flown	Sorties against merchant shipping	Percent of total	Tons of bombs dropped on merchant shipping
1941-42.....	(1)	204	.....	88
1943.....	(1)	267	.....	91
1944.....	(1)	11,801	.....	3,237
1945.....	(1)	5,361	.....	1,743
Whole war.....	.....	17,633	.....	5,159

¹ Breakdown not available.

PART 6.—U. S. combined Navy-Marine Air

Year	Total sorties flown	Sorties against merchant shipping	Percent of total	Tons of bombs dropped on merchant shipping
1941-42.....	3,023	588	19.5	228
1943.....	16,132	1,020	6.3	414
1944.....	128,942	16,209	12.6	4,189
1945.....	110,012	7,840	7.1	2,307
Whole war.....	258,109	25,657	9.9	7,138

PART 7.—Twentieth Air Force

Year	Total sorties flown	Mine-laying sorties	Percent of total	Mines—tons
1944.....	2,102	.....	.....	.....
1945.....	26,724	1,424	5.3	9,874.5
Whole war.....	28,826	1,424	4.9	9,874.5

PART 8.—Combined U. S. air effort (including Twentieth Air Force)

Year	Total sorties flown	Sorties against merchant shipping and mine laying	Percent of total	Tons of bombs dropped on merchant shipping and mine laying
1941-42.....	10,470	774	7.4	579
1943.....	118,224	2,366	2.0	2,573
1944.....	326,923	19,141	5.9	7,452
1945.....	307,101	12,050	3.9	15,527
Whole war.....	762,718	34,331	4.5	26,131

PART 9.—United States Submarines

Year	Days of offensive patrol	Attacks on merchant shipping	Attacks per day	Tons torpedoes expended ¹
1941-42.....	5,448	570	0.105	503
1943.....	6,682	1,049	.157	1,312
1944.....	11,700	1,648	.141	2,031
1945.....	7,741	845	.109	1,070
Whole war.....	31,571	4,112	.130	4,916

¹ Calculated at an arbitrary one-third-ton per torpedo warhead.

APPENDIX E.—STATISTICAL SUMMARY OF THE ATTACK ON TRANSPORTATION¹

PART 1.—Fifth AF Operations Against Transportation²

	Total sorties	Sorties, mer- chant ship	Per- cent- age of total	Total tonnage	Tonnage, mer- chant ship	Per- cent- age of total
<i>1942³</i>						
November	2,297	62	2.7	576	131	22.7
December	4,650	124	2.7	800	220	27.5
Subtotal	6,947	186	2.7	1,376	351	25.5
<i>1943</i>						
January	3,535	62	1.8	743	152	20.5
February	2,188	54	2.5	522	77	14.8
March	3,676	25	.7	654	51	7.8
April	2,737	79	2.9	466	190	40.8
May	2,730	19	.7	636	32	5.0
June	3,294	38	1.2	712	36	5.1
July	4,685	118	2.5	1,677	134	8.0
August	7,330	37	.5	2,151	91	4.2
September	9,458	82	.9	2,461	114	4.6
October	8,337	134	1.6	1,636	251	15.3
November	7,906	95	1.2	2,242	182	8.1
December	12,510	237	1.9	6,973	387	5.5
Subtotal	68,386	980	1.4	20,873	1,697	8.1
<i>1944</i>						
January	12,928	288	2.2	4,773	381	8.0
February	10,809	116	1.1	4,719	182	3.9
March	10,377	134	1.3	5,945	186	3.1
April	9,735	220	2.3	7,163	577	8.1
May	10,681	87	.8	6,489	72	1.1
June	9,909	294	3.0	4,086	250	6.1
July	7,897	103	1.3	4,110	243	5.9
August	7,542	12	.2	4,049	10	.2
September	6,745	28	.4	5,264	36	.7
October	6,417	250	3.9	3,742	311	8.3
November	8,405	166	2.0	3,589	87	2.4
December	9,246	60	.6	3,671	60	1.6
Subtotal	110,691	1,758	1.6	57,600	2,395	4.2
<i>1945</i>						
January	11,774	42	.4	4,467	39	.9
February	13,300	29	.2	8,394	28	.3
March	15,721	196	1.2	12,991	444	3.4
April	17,024	287	1.7	14,771	733	5.0
May	16,617	54	.3	15,214	57	.4
June	12,968	204	1.7	12,140	482	4.0
July	5,102	435	8.5	3,807	438	11.5
August	2,718	519	19.1	1,622	505	31.1
Subtotal	95,224	1,766	1.9	73,406	2,726	3.7
Total	281,248	4,690	1.7	153,255	7,169	4.7

¹Reports from this AF indicate 49,296 tons of unidentifiable bombs dropped, which have been prorated to all target identities. Sorties flown were prorated in same manner.

²The AAF statistical data used is from the Headquarters, AAF Statistical Control Unit, and the tabulation section of the USSBS. These figures were made up from AAF Form 34 and are complete only from January 1943 to end of the war.

The Navy-Marine air effort statistical data used is from Office of the Chief of Naval Operations, Assistant Chief, Air Branch, Office of Naval Intelligence. Area tabulations were not made for years 1942-1943, but are available for years 1944-1945.

In the 1944 figures, a plane attacking two or more targets on one flight is counted once for each target; in 1942, 1943, and 1945 it is counted once, and classified according to the principal target of the entire flight of which it was a part.

Submarine statistical data is from Office of Chief of Naval Operations.

³No figures available prior to this date.

PART 2.—Seventh AF operations against merchant Shipping

	Total sorties	Sorties, mer- chant ship	Per- cent- age of total	Total tonnage	Tonnage, mer- chant ship	Per- cent- age of total
<i>1942¹</i>						
December	27			35		
Subtotal	27			35		
<i>1943</i>						
January	40	3	7.5	9	3	33.3
February	6			10		
March						
April	31			51		
May	11			10		
June	14			4		
July	20			58		
August						
September	39	2	5.1	58		
October	3					
November	288			310		
December	693	52	7.5	710	77	10.8
Subtotal	1,145	57	5.0	1,220	80	6.6
<i>1944</i>						
January	1,232	109	8.8	962	133	6.8
February	965	1	.1	1,092	2	.1
March	1,050	11	1.0	1,118	9	.8
April	1,371			1,681		
May	1,086			1,589		
June	878			892		
July	2,517			1,653		
August	1,733	19	1.1	1,770	30	1.7
September	1,205	13	1.1	1,355	18	1.3
October	2,046	47	2.3	1,007	61	6.1
November	2,743	17	.6	1,353	18	1.3
December	4,368	1	.02	2,531	1	.03
Subtotal	21,194	218	1.0	17,003	272	1.6
<i>1945</i>						
January	3,416	1	.03	2,354	3	.1
February	2,866			2,079		
March	4,086	15	.4	1,265	4	.3
April	2,721	23	.8	1,158	17	1.5
May	2,949	28	.9	975	12	1.2
June	5,443	70	1.3	570	39	6.8
July	8,983	255	2.8	3,675	193	5.3
August	4,469	31	.7	2,593	12	.5
Subtotal	34,933	423	1.2	14,669	280	1.9
Total	57,299	698	1.2	32,927	632	1.9

¹No figures available prior to this date.

PART 3.—Eleventh AF operations against merchant shipping

	Total sorties	Sorties, merchant ship	Per-cent- age of total	Total tonnage	Tonnage, merchant ship	Per-cent- age of total
<i>1943¹</i>						
June.....	201			129		
July.....	524			442		
August.....	603			568		
September.....	17			13		
October.....	1					
November.....						
December.....	10					
Subtotal.....	1,356			1,152		
<i>1944</i>						
January.....						
February.....	11					
March.....	19			3		
April.....	38			6		
May.....	79			11		
June.....	83			17		
July.....	33			3		
August.....	69			30		
September.....	108	2	1.9	49	1	2.0
October.....	96			33		
November.....	58			34		
December.....	22			8		
Subtotal.....	616	2	.3	194	1	.5
<i>1945</i>						
January.....	55			26		
February.....	30			19		
March.....	54			43		
April.....	78			37		
May.....	84	39	46.4	94	42	44.7
June.....	70	18	25.7	92	24	26.1
July.....	51	4	7.8	56	1	1.8
August.....	25			39		
Subtotal.....	447	61	13.6	406	67	16.5
Total.....	2,419	63	2.6	1,752	68	3.9

¹No figures available prior to this date.

PART 4.—Thirteenth AF operations against merchant shipping

	Total sorties	Sorties, merchant ship	Per-cent- age of total	Total tonnage	Tonnage, merchant ship	Per-cent- age of total
<i>1943¹</i>						
March.....	371			1		
April.....	1,964			59		
May.....	1,945	5	0.3	149	4	2.7
June.....	1,992	12	.6	190	18	9.5
July.....	3,541	35	1.0	778	61	7.8
August.....	2,457	37	1.5	531	13	2.4
September.....	2,410			567		
October.....	2,343	14	.6	1,237	11	.9
November.....	3,745	60	1.6	1,782	123	6.9
December.....	3,020	5	.2	1,614	1	.06
Subtotal.....	23,788	168	.7	6,908	231	7.9
<i>1944</i>						
January.....	2,456	3	.1	1,062	6	.6
February.....	2,681	10	.4	2,604	3	.1
March.....	3,158	16	.5	2,909	37	1.3
April.....	2,343			1,986		
May.....	4,029	74	1.8	3,571	41	1.1
June.....	2,963	32	1.1	2,976	27	.9
July.....	1,366	15	1.1	1,575	15	1.0
August.....	1,935	6	.6	834	14	1.7
September.....	3,250	27	.8	2,502	12	.5
October.....	3,067	77	2.5	1,568	123	7.8
November.....	3,550	99	2.8	3,461	126	3.6
December.....	3,767	17	.5	3,857	16	.4
Subtotal.....	33,565	376	1.1	28,905	420	1.5
<i>1945</i>						
January.....	3,701	12	.3	3,328	10	.3
February.....	2,904	22	.8	3,122	18	.6
March.....	3,808	1	.02	4,530	1	.02
April.....	3,863	6	.2	4,399	7	.2
May.....	4,072	37	.9	3,679	35	1.0
June.....	4,363	58	1.3	4,014	56	1.4
July.....	2,731	30	1.1	2,278	25	1.1
August.....	984	10	1.0	1,106	10	.9
Subtotal.....	26,426	176	.7	26,456	162	.6
Total.....	83,779	720	.9	62,269	813	1.3

¹No figures available prior to this date.

PART 5.—Fourteenth AF operations against merchant shipping

	Total sorties	Sorties, merchant ship	Percentage of total	Total tonnage	Tonnage, merchant ship	Percentage of total
<i>1942¹</i>						
November	262			263		
December	211			177		
Subtotal	473			440		
<i>1943</i>						
January	237			205		
February	84			64		
March	81			70		
April	60			47		
May	637			121		
June	379	6	1.6	64	12	18.8
July	606	46	7.6	182	66	36.3
August	492	15	3.0	122	22	18.0
September	737	38	5.2	151	30	19.9
October	885	7	.8	294	1	.3
November	1,161	16	1.4	309	3	1.0
December	2,058	13	.6	426	17	4.0
Subtotal	7,417	141	1.9	2,055	151	7.3
<i>1944</i>						
January	616	19	3.1	146	15	10.3
February	1,043			273		
March	1,066	1	.1	145	1	.7
April	942	12	1.3	205	20	9.8
May	2,068	4	.2	483	7	1.4
June	2,786	146	5.2	621	16	2.6
July	3,629	59	1.6	895	7	.8
August	3,636	61	1.7	1,102	41	3.7
September	4,510	81	1.8	1,050	28	2.7
October	3,545	37	1.0	932	19	2.0
November	2,967	47	1.6	1,209	11	.9
December	3,005	111	3.7	804	10	1.2
Subtotal	29,813	578	1.9	7,865	175	2.2
<i>1945</i>						
January	2,413	8	.3	819	12	1.5
February	1,126	34	3.0	232	17	7.3
March	2,135	19	.9	1,093	6	.5
April	2,446	26	1.1	990	6	.6
May	1,586	6	.4	454	6	1.3
June	1,344	52	3.9	484	18	3.7
July	1,852	215	11.6	563	45	8.0
August	433			162		
Subtotal	13,335	360	2.7	4,797	110	2.3
Total	51,038	1,079	2.1	15,157	436	2.9

¹No figures available prior to this date.

PART 6.—All air forces—Except Twentieth AF operations against rail transportation—China and Japan ¹

	Total sorties	Sorties RR Japan and China	Percentage of total	Total tonnage	Tonnage RR Japan and China	Percentage of total
<i>1943²</i>						
January	237			205		
February	84			64		
March	81			70		
April	60			47		
May	637	12	1.9	121	2	1.6
June	379			64		
July	606			182		
August	492	8	1.6	122	4	3.2
September	737	35	4.7	151	19	1.3
October	885	11	1.2	294	25	8.5
November	1,161	14	1.2	309	10	3.2
December	2,058	80	3.9	426	110	2.6
Subtotal	7,417	160	2.2	2,055	170	8.3
<i>1944</i>						
January	616	42	6.8	146	58	4.0
February	1,043	26	2.5	273	58	2.1
March	1,066	20	1.9	145	11	.8
April	942	16	1.7	205	16	.8
May	2,068	20	.9	483	6	1.2
June	2,786	31	1.1	621	18	2.9
July	3,629	57	1.6	895	64	7.2
August	3,636	99	2.7	1,102	84	7.6
September	4,510	52	1.2	1,050	67	6.4
October	3,545	11	.3	932	5	.5
November	2,967	47	1.6	1,209	85	7.0
December	3,005	38	1.3	804	46	5.7
Subtotal	29,813	459	1.5	7,865	518	6.6
<i>1945</i>						
January	2,413	51	2.1	819	14	1.7
February	1,126	11	1.0	232	5	2.1
March	2,135	246	1.6	1,093	529	48.3
April	2,446	67	2.7	990	56	5.6
May	1,586	29	1.8	454	15	3.3
June	1,344	102	7.6	484	62	12.8
July	15,937	429	2.7	8,045	476	6.0
August	8,604	196	2.3	5,483	260	4.7
Subtotal	35,591	1,131	3.2	17,600	1,417	8.0
Total	72,821	1,750	2.4	27,520	2,105	7.6

¹All figures are Fourteenth AF only, until July 1945; thereafter they include the Fifth, Seventh, and Thirteenth AF.

²No figures available prior to this date.

NOTE—All operations to July 1945 were in China. Japanese operations began in July 1945, from Okinawa.

	Sorties	Railroad tonnage
China	1,341	1,477
Japan	409	628

PART 7.—Combined AAF (excluding Twentieth operations against merchant shipping)

	Total sorties	Sorties, merchant ship	Percentage of total	Total tonnage	Tonnage, merchant ship	Percentage of total
<i>1942¹</i>						
November.....	2,559	62	2.4	839	131	15.6
December.....	4,888	124	2.5	1,012	220	21.5
Subtotal	7,447	186	2.5	1,851	351	19.0
<i>1943</i>						
January.....	3,812	65	1.7	957	155	16.2
February.....	2,278	54	2.4	596	77	12.9
March.....	4,128	25	.6	725	51	7.0
April.....	4,792	79	1.6	623	190	30.5
May.....	5,323	24	.5	916	36	3.9
June.....	5,880	56	1.0	1,099	66	6.0
July.....	9,376	199	2.1	3,137	261	8.3
August.....	10,882	89	.8	3,372	126	3.7
September.....	12,661	122	1.0	3,250	144	4.4
October.....	11,569	155	1.3	3,167	263	8.3
November.....	13,100	171	1.3	4,643	308	6.6
December.....	18,291	307	1.7	9,723	482	5.0
Subtotal	102,092	1,346	1.3	32,208	2,159	6.7
<i>1944</i>						
January.....	17,232	419	2.4	6,943	535	7.7
February.....	15,509	127	.8	8,688	187	2.2
March.....	15,670	162	1.0	10,120	233	2.3
April.....	14,429	232	1.6	11,041	597	5.4
May.....	17,943	165	.9	12,143	120	1.0
June.....	16,619	472	2.8	8,592	293	3.4
July.....	15,442	177	1.1	8,236	265	3.2
August.....	13,915	98	.7	7,785	95	1.2
September.....	15,818	151	1.0	10,220	95	.9
October.....	15,171	411	2.7	7,282	514	7.1
November.....	17,723	329	1.9	9,646	242	2.5
December.....	20,408	189	.9	10,871	87	.8
Subtotal	195,879	2,932	1.5	111,567	3,263	2.9
<i>1945</i>						
January.....	21,359	63	.3	10,994	64	.5
February.....	20,226	85	.4	13,846	63	.5
March.....	25,804	231	.9	19,922	455	2.3
April.....	26,132	342	1.3	21,355	763	3.6
May.....	25,308	164	.6	20,416	152	.7
June.....	24,188	402	1.7	17,300	619	3.6
July.....	18,719	939	5.0	10,379	702	6.8
August.....	8,629	560	6.5	5,522	527	9.5
Subtotal	170,365	2,786	1.6	119,734	3,345	2.8
Total.....	475,783	7,250	1.5	265,360	9,118	3.4

¹No figures available prior to this date.

PART 8A.—Navy and Marine—Land-based aircraft—Operations against merchant shipping by areas

	West Japan		Korea		Hokkaido-Honshu		Midway-Wake-Marcus	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
December, 1941 ¹							7	5
Subtotal							7	5
January, 1942 ¹							3	0
June							4	3
Subtotal							7	3
April, 1944 ¹							1	1
August							2	1
October							3	1
November							3	2
Subtotal							9	5
March, 1945 ¹	1		2					
April			13	9				
May	25	13	78	55				
June	34	17	54	19				
July	29	29	58	49				
August	35	12	19	12				
Subtotal	124	71	224	144				
Total	124	71	224	144			23	13

¹ No figures available for 1943 and only for those months shown for 1941, 1942, 1944 and 1945.

Navy and Marine—Land-based aircraft—Operations against merchant shipping by areas

	New Guinea-Halmahera		Gilberts-Marshall		Solomon-Bismark		Java-Sumatra-Malaya	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
August, 1942 ¹					20	5		
September					105	19		
October					48	14		
November					140	72		
December					43	13		
Subtotal					356	123		
January, 1943					72	31		
February					34	70		
March					56	29		
April					31	13		
May					8	6		
June					3	3		
July					70	26		
August					71	31		
October	3	2	1	1	55	4		
November	2	1			114	10		
December	1	2			131	36		
Subtotal	6	5	1	1	742	314		
January, 1944	14	4	68	34	201	109		
February	19	12	16	5	233	100		
March	26	26	75	11	464	99		
April			75	19	140	24		
May	7	2	54		136	19		
June	6	3	122	4	54	3		
July	23	9	21		126	10		
August	8	5	51	12	81	11		
September	21	4	68	6	79	27		
October			52	4	235	68		
November			110	28	173	26		
December	7		159	45	10	1		
Subtotal	131	65	871	168	1,932	497		
January, 1945	3		22					
February	3		26					
March	2		35	2				
April			30	3				
May			34		1	2		
June			2					
July			18	7				
August			5	2				
Subtotal	8		172	14	1	2		
Total	145	70	1,044	183	3,031	936		

¹ No figures available prior to this date.

Navy and Marine—Land-based aircraft—Operations against merchant shipping by areas

	Bonins		Celebes-Borneo		Philippines		Aleutians		Eastern Carolines	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
<i>1942</i> ¹										
July.....							1			
August.....							6	6		
September.....							2	1		
October.....							5	2		
November.....										
December.....										
Subtotal.....							14	9		
<i>1943</i> ¹										
July.....							2	1		
August.....									1	1
September.....									1	1
October.....										
November.....										
December.....										
Subtotal.....							2	1	2	2
<i>1944</i> ¹										
February.....									16	9
March.....									10	4
April.....									42	4
May.....									10	5
June.....	1	1					1	1	9	3
July.....	6		2	2	1		2		16	14
August.....			20	4	3		22	6	1	
September.....			20	4			14	1	1	
October.....	15	5	29	6	47	11			12	2
November.....	14	2	37	8	55	21	2		14	
December.....	14	1	39	9	204	66			6	
Subtotal.....	50	9	147	33	310	98	41	8	136	41
<i>1945</i>										
January.....	26	1	6		104	6				
February.....			10		104	25			7	
March.....			21	1	33	5			8	1
April.....	3		41	2	15	5			6	1
May.....	8		67	16	10	8			2	
June.....	3		20							
July.....	4		14	1					1	
August.....			12	1					1	
Subtotal.....	44	1	191	25	266	49			25	2
Total.....	94	10	338	58	576	147	57	18	163	45

¹ No figures available for 1941 and only for those months shown for 1942, 1943, and 1944.

Navy and Marine—Land-based aircraft—Operations against merchant shipping by areas

	Marianas		Western Carolines		Kuriles		Ryukus		Formosa	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
<i>1944</i> ¹										
March.....	2	1								
April.....			6							
May.....			6	2						
June.....	5	3	4	2						
July.....			2		2					
August.....			1		18	3				
September.....					13	1				
October.....	12		253	9	2		4	3		
November.....			265	11						
December.....	3		181	1					2	
Subtotal.....	22	4	718	25	35	4	4	3	2	
<i>1945</i>										
January.....			162	6			8	2	8	8
February.....			112				23	2	24	7
March.....			48		3		37	5	23	2
April.....			27	2					25	9
May.....			31	7	3		23	10	25	5
June.....			3		11	2	105	9	25	4
July.....			13				62	2	17	4
August.....			1		11	2	18		9	1
Subtotal.....			397	15	28	4	276	30	156	40
Total.....	22	4	1,115	40	63	8	280	33	158	40

¹ No figures available prior to this date.

Navy and Marine—Land-based aircraft—Operations against merchant shipping by areas

	Central China		Indo-China		South China		Central Japan		Eastern Japan	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
<i>1944</i> ¹										
December			1		1					
Subtotal			1		1					
<i>1945</i> ¹										
February			17	10	20	3				
March	16	1	8	5	55	21	6		10	
April	21	15	9	2	46	10	11		9	3
May	8	4	23	9	41	4	37	13	25	4
June	14	6	13	4	27	9	23	7	32	7
July	26	15	20	8	20	1	2	2		
August	4	2	11	1	11	1	2			
Subtotal	89	43	101	39	220	49	81	22	76	14
Total	89	43	102	39	221	49	81	22	76	14

¹ No figures available prior to this date and only for those months shown in 1945.

PART 8B.—All Navy and Marine Land-based operations against merchant shipping¹

	Total Sorties	Sorties M/S	Percent of total	Total tonnage	Tonnage M/S	Percent of total
<i>1941</i>						
December	28	7	26.0	10	5	50.0
Subtotal	28	7	26.0	10	5	50.0
<i>1942</i>						
January	3	3	100.0			
February	195			77		
March	127			51		
April	6			1		
May	223			142		
June	321	4	1.2	120	3	2.5
July	3	1	33.3	1		
August	488	26	5.3	198	11	5.5
September	263	107	40.6	74	20	27.2
October	514	53	10.3	217	16	7.3
November	547	140	25.4	205	72	35.1
December	305	43	14.0	83	13	15.6
Subtotal	2,995	377	12.5	1,169	135	1.2
<i>1943</i>						
January	371	72	19.4	120	31	25.8
February	364	34	9.3	248	70	28.2
March	296	56	18.9	211	29	13.7
April	256	31	12.1	159	13	8.2
May	425	8	1.9	230	6	2.6
June	468	3	.6	344	3	.8
July	2,456	72	3.0	1,675	27	1.6
August	1,043	72	3.0	543	32	5.9
September	1,241	57	4.6	682	6	.8
October	1,956	117	6.0	1,008	12	1.2
November	4,523	133	2.9	2,143	37	1.7
December	2,733	98	3.6	1,585	57	3.6
Subtotal	16,132	753	4.7	8,948	323	3.6
<i>1944</i>						
January	4,456	283	6.4	1,739	147	8.5
February	6,266	284	4.5	2,614	126	4.8
March	7,635	577	7.6	3,445	141	4.1
April	10,440	264	2.5	4,185	48	1.1
May	6,026	213	3.5	2,632	29	1.1
June	11,621	201	1.7	3,462	19	.5
July	18,152	201	1.1	6,219	35	.5
August	8,138	207	2.5	3,218	42	1.3
September	19,850	216	1.1	4,652	52	1.1
October	18,098	664	3.7	7,978	100	1.2
November	11,269	673	6.0	4,021	98	2.4
December	6,991	625	8.9	2,450	123	5.0
Subtotal	128,942	4,408	3.4	46,615	960	2.1
<i>1945</i>						
January	10,623	339	3.2	3,824	23	.6
February	13,407	352	2.6	4,999	48	1.0
March	19,223	302	1.6	7,201	46	.6
April	21,714	256	1.2	9,161	61	.7
May	15,761	441	2.8	8,024	150	1.9
June	11,695	366	3.1	5,096	84	1.6
July	12,646	295	2.3	5,612	120	10.0
August	4,943	128	2.6	2,045	32	1.5
Subtotal	110,012	2,479	2.3	45,960	564	1.2
Total	258,109	8,024	3.1	102,702	1,987	1.9

¹ Total sorties and tonnage shown, include both land and carrier-based aircraft. No breakdown available.

PART 9A.—Navy and Marine—Carrier-based aircraft—Operations against merchant shipping by areas

	Kuriles		Ryukus		Formosa		Central China	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
October 1944 ¹			811	307	662	185		
Subtotal			811	307	662	185		
January 1945			51		771	376	5	
March			683	182				
April			488	90				
May			163	11				
June			45	6				
Subtotal			1,430	289	771	376	5	
Total			2,241	596	1,433	561	5	

¹ No figures available prior to this date and only for those months shown in 1944 and 1945.

Navy and Marine—Carrier-based aircraft—Operations against merchant shipping by areas

	Aleutians ¹		Eastern Carolines		Marianas		Western Carolines	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
February 1944 ²			459	196	135	44		
March							772	196
April			261	1			10	4
May			13					
June					802	122		
July					321	1	242	62
October							433	41
Subtotal			733	197	1,258	167	1,457	303
Total			733	197	1,258	167	1,457	303

¹ No carrier activity reported.

² No figures available prior to this date.

NOTE—No figures available for 1945 and only for those months shown in 1944.

Navy and Marine—Carrier-based aircraft—Operations against merchant shipping by areas

	Java-Sumatra		Bonins		Celebes-Borneo		Philippines	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
May 1944 ¹	20							
June			108	24				
July			359	132				
August			345	110				
September			39	6			2,051	658
October							987	244
November							1,547	813
December							371	23
Subtotal	20		851	272			4,956	1,738
January 1945 ¹								
February			160	21			316	67
March			33	6				
Subtotal			193	27			316	67
Total	20		1,044	299			5,272	1,805

¹ No figures available prior to this date and only for months shown in 1945.

Navy and Marine-Carrier-based aircraft-Operations against merchant shipping by areas

	Midway-Wake-Marcus		New Guinea-Halmahera		Gilbert-Marshall		Solomon-Bismarek	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
<i>1942</i> ¹								
February	9	2			37	11		
March			56	29				
April	6	1					36	18
May							9	11
August	5	2					16	4
October							30	10
November								
Subtotal	20	5	56	29	37	11	91	43
<i>1943</i>								
August							5	2
November					90	11	56	10
December							116	68
Subtotal					90	11	177	80
<i>1944</i> ¹								
January					554	13		
February					75	8		
March					21	3		
April			313	41				
May	20	3						
September	6		64					
Subtotal	26	3	377	41	650	24		
Total	46	8	433	70	777	46	268	123

¹ Figures only available for months shown in 1942, 1943 and 1944. No figures available for 1941 and 1945.

Navy and Marine-Carrier-based aircraft-Operations against merchant shipping by areas

	West Japan		Korea		Hokkaido-Honshu	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
<i>1945</i> ¹						
February	2					
March	158	49				
April	32	10				
May	24					
July	410	166			420	185
August					179	91
Subtotal	626	225			599	276
Total	626	225			599	276

¹ No figures available prior to this date and only for months shown in 1945.

Navy and Marine-Carrier-based aircraft-Operations against merchant shipping by areas

	Indo-China		South China		Central Japan		Eastern Japan	
	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S	Sorties M/S	Tonnage M/S
<i>1945</i> ¹								
January	390	187	270	98			180	7
February					16			
March					23			
June							168	48
July					203	76	161	65
August					2			
Subtotal	390	187	270	98	244	76	509	120
Total	390	187	270	98	244	76	509	120

¹ No figures available prior to this date and only for months shown in 1945.

PART 9B.—All Navy and Marine land and carrier-based aircraft operations against merchant shipping

	Total sorties	Sorties M/S	Percent of total	Total tonnage	Tonnage M/S	Percent of total
1941						
December.....	28	7	25.0	10	5	50.0
Subtotal.....	28	7	25.0	10	5	50.0
1942						
January.....	3	3	100.0			
February.....	195	46	23.5	77	13	17.0
March.....	127	56	44.1	51	29	56.8
April.....	6	6	100.0	1	1	100.0
May.....	223	36	16.1	142	18	12.7
June.....	321	4	1.2	120	3	2.5
July.....	3	1	33.3	1		
August.....	488	40	8.1	198	24	12.1
September.....	263	107	40.6	74	20	27.0
October.....	514	69	13.4	217	20	9.2
November.....	547	170	31.0	205	82	40.0
December.....	305	43	14.0	83	13	15.6
Subtotal.....	2,995	581	19.3	1,169	223	19.0
1943						
January.....	371	72	19.4	120	31	25.8
February.....	364	34	9.3	248	70	28.2
March.....	296	56	18.9	211	29	13.7
April.....	256	31	12.1	159	13	8.2
May.....	425	8	1.9	230	6	2.6
June.....	468	3	.6	344	3	.8
July.....	2,456	72	2.9	1,675	27	1.6
August.....	1,043	77	7.4	543	34	6.2
September.....	1,241	57	4.6	682	6	.9
October.....	1,956	117	6.0	1,008	12	1.1
November.....	4,523	279	6.1	2,143	58	2.7
December.....	2,733	214	7.8	1,585	125	7.9
Subtotal.....	16,132	1,020	6.3	8,948	414	4.6
1944						
January.....	4,456	837	18.7	1,739	160	9.2
February.....	6,266	953	15.2	2,614	374	1.4
March.....	7,635	1,370	17.9	3,445	332	9.6
April.....	10,440	848	8.1	4,185	94	2.2
May.....	6,026	266	4.4	2,632	32	1.2
June.....	11,621	1,111	9.6	3,462	165	4.7
July.....	18,152	1,123	6.1	6,219	230	3.6
August.....	8,138	552	6.8	3,218	152	4.7
September.....	19,850	2,809	14.1	4,652	757	1.6
October.....	18,098	3,124	17.2	7,978	836	10.4
November.....	11,269	2,220	19.7	4,021	911	22.6
December.....	6,991	996	14.2	2,450	146	5.9
Subtotal.....	128,942	16,209	12.6	46,615	4,189	9.0
1945						
January.....	10,623	2,322	21.8	3,824	758	19.8
February.....	13,407	530	4.0	4,999	69	1.4
March.....	19,223	1,199	6.2	7,201	283	4.0
April.....	21,705	776	3.5	9,161	161	1.8
May.....	15,761	628	4.0	8,204	161	2.0
June.....	11,695	579	4.9	5,096	138	2.7
July.....	12,646	1,489	1.2	5,612	612	12.6
August.....	4,943	317	.6	2,045	125	6.1
Subtotal.....	110,012	7,840	7.1	45,960	2,307	5.0
Total.....	258,109	25,657	9.9	102,702	7,138	7.0

PART 10.—All Army, Navy, and Marine land-based aircraft (excluding Twentieth AF) operations against merchant shipping

	Sorties, Merchant Ship	Tonnage Merchant Ship
1941		
December.....	7	5
Subtotal.....	7	5
1942¹		
June.....	4	3
July.....	1	
August.....	26	11
September.....	107	20
October.....	53	16
November.....	202	203
December.....	167	233
Subtotal.....	563	486
1943		
January.....	137	186
February.....	88	147
March.....	81	80
April.....	110	203
May.....	32	42
June.....	59	69
July.....	271	288
August.....	161	158
September.....	179	150
October.....	272	275
November.....	304	345
December.....	405	539
Subtotal.....	2,099	2,482
1944		
January.....	702	682
February.....	411	313
March.....	739	374
April.....	496	645
May.....	378	149
June.....	673	312
July.....	378	300
August.....	305	137
September.....	367	147
October.....	1,075	614
November.....	1,002	340
December.....	814	210
Subtotal.....	7,340	4,223
1945		
January.....	402	87
February.....	437	111
March.....	533	501
April.....	598	824
May.....	605	302
June.....	768	703
July.....	1,234	822
August.....	688	559
Subtotal.....	5,265	3,909
Total.....	15,274	11,105

¹ Figures available only for months shown.

PART 11.—*Twentieth AF operations against merchant shipping (mining)*

	Total sorties	Sorties mining	Per-cent of total	Total tonnage	Tonnage mines	Per-cent of total
<i>1944¹</i>						
June.....	131			475.0		
July.....	104			207.0		
August.....	145			230.0		
September.....	199			495.0		
October.....	281			1,586.0		
November.....	515			2,180.0		
December.....	727			3,218.0		
Subtotal	2,102			8,391.0		
<i>1945</i>						
January.....	820			3,559.0		
February.....	1,108			4,261.0		
March.....	2,912	181	6.2	15,474.5	1,207.5	7.8
April.....	3,096	45	1.5	16,451.5	264.5	1.6
May.....	4,862	375	7.7	27,699.5	2,609.5	9.4
June.....	4,828	326	6.8	29,703.0	2,291.0	7.7
July.....	6,124	331	5.4	42,729.0	2,270.0	5.3
August.....	2,974	166	5.6	21,082.0	1,232.0	5.8
Subtotal	26,724	1,424	5.3	160,959.5	9,874.5	6.1
Total	28,826	1,424	4.9	169,350.5	9,874.5	5.8

¹ No figures available prior to this date.

PART 12.—*All Army, Navy, and Marine land and carrier-based aircraft (including Twentieth AF) operations against merchant shipping*

	Total sorties	Sorties M/S	Per-cent of total	Total tons	Tons M/S	Per-cent total
<i>1941</i>						
December.....	28			10		
Subtotal	28			10		
<i>1942</i>						
January.....	3	3	100.0			
February.....	195	46	23.5	77	13	16.8
March.....	127	56	44.1	51	29	57.0
April.....	6	6	100.0	1	1	100.0
May.....	223	36	16.1	142	18	12.6
June.....	321	4	1.8	120	3	2.5
July.....	3	1	33.3	1		
August.....	488	40	8.1	198	24	12.1
September.....	263	107	40.6	74	20	27.0
October.....	514	69	13.4	217	20	9.2
November.....	3,106	232	7.4	1,044	213	20.4
December.....	5,193	167	3.2	1,095	233	21.2
Subtotal	10,442	767	7.3	3,020	574	19.0
<i>1943</i>						
January.....	4,183	137	3.2	1,077	186	17.3
February.....	2,642	88	3.3	844	147	17.4
March.....	4,424	81	1.8	936	80	8.5
April.....	5,048	110	2.1	782	203	25.9
May.....	5,748	32	5.5	1,146	42	3.6
June.....	6,348	59	9.2	1,443	69	4.7
July.....	11,832	271	2.3	4,812	288	5.9
August.....	11,925	166	1.4	3,915	160	4.1
September.....	13,902	179	1.3	3,932	150	3.8
October.....	13,525	272	2.0	4,175	275	6.6
November.....	17,623	450	5.9	6,786	366	5.3
December.....	21,024	521	2.4	11,308	607	5.4
Subtotal	118,224	2,366	2.0	41,156	2,573	6.3
<i>1944</i>						
January.....	21,688	1,256	5.8	8,682	695	8.0
February.....	21,775	1,080	5.0	11,302	561	5.0
March.....	23,305	1,532	6.6	13,565	565	4.2
April.....	24,869	1,080	4.3	15,226	691	4.5
May.....	23,969	431	1.8	14,775	152	1.0
June.....	28,371	1,583	5.5	12,529	458	3.7
July.....	33,698	1,300	3.8	14,662	495	3.4
August.....	22,198	650	2.9	11,233	247	2.1
September.....	35,867	2,960	8.3	15,367	852	5.5
October.....	33,550	3,535	10.5	16,846	1,350	8.0
November.....	29,507	2,549	8.6	15,847	1,153	7.3
December.....	28,126	1,185	4.2	16,539	233	1.4
Subtotal	326,923	19,141	5.8	166,573	7,452	4.5
<i>1945</i>						
January.....	32,802	2,385	7.2	18,377.0	822.0	4.5
February.....	34,741	615	1.8	23,106.0	132.0	5.7
March.....	47,939	1,611	3.4	42,597.5	1,945.5	4.7
April.....	50,942	1,163	2.3	46,967.5	1,188.5	2.5
May.....	45,931	1,167	2.5	56,139.5	2,922.5	5.2
June.....	40,711	1,307	3.2	52,099.0	3,048.0	5.8
July.....	37,489	2,759	7.3	58,720.0	3,584.0	6.1
August.....	16,546	1,043	6.3	28,649.0	1,884.0	6.6
Subtotal	307,101	12,050	3.9	326,654.5	15,526.5	4.7
Total.....	762,718	34,324	4.5	537,413.5	26,125.5	4.8

PART 13A.—Submarine operations against merchant shipping by areas

	Aleutians			North Japan			South Japan			Yellow Sea			Japan Sea			Snuth China Coast Nansei Shato		
	D	S	T	D	S	T	D	S	T	D	S	T	D	S	T	D	S	T
<i>1943¹</i>																		
January				23	4	10	89	8	34							15	5	24
February	35	3	12	32	11	37	20	4	16							22	3	18
March	16	3	9	7	5	32	35	6	25	18	10	60				17	5	21
April	31	1	4	67	17	59	13	2	8	15	3	12				30	6	33
May				63	12	48	83	9	36	3	1	14				32	7	35
June				116	11	39	68	21	80	31	9	59				43	7	34
July				117	8	31	56	10	36	10	7	22	25	8	24			
August				133	8	31	80	12	67				14	10	25	97	12	60
September				78	6	20	57	19	72	36	10	34	15	5	18	59	11	52
October				66	4	18	60	29	120	34	3	42				114	24	60
November				15	1	3	93	14	54	38	5	48				54	12	52
December				34			73	16	53	29	3	5				40	18	60
Subtotal	82	7	25	751	87	328	727	150	601	214	51	296	54	23	67	523	110	449
<i>1944</i>																		
January				20			166	30	105	28	1	6				97	14	59
February				6	1	3	34	7	17	18	6	13				103	26	81
March				24	9	31	83	13	39	3						65	9	36
April				34			109	9	31	32	1	7				158	20	65
May				15	7	26	161	9	27	9	2	12				91	14	49
June				30	5	18	139	14	43	30	7	19				71	14	44
July				75	13	40	122	8	32	37	13	35				321	54	171
August				64	7	25	123	16	48	41	10	40				253	54	176
September				55	11	30	92	17	62	65	14	49				295	57	186
October				55	12	28	161	23	86	58	10	38				476	58	198
November				69	2	8	70	10	37	165	46	158				479	48	202
December				75	3	20	63	3	16	133	10	47				260	21	96
Subtotal				522	70	229	1,323	159	543	619	120	424				2,669	389	1,363
<i>1945</i>																		
January				23			103	10	23	151	22	93				364	51	158
February				9			105	10	36	197	12	39				341	14	63
March							119	10	41	170	19	61				376	25	105
April				71	18	59	147	11	36	170	31	105				162	6	28
May				207	20	86	115	3	18	160	21	85				110	2	7
June				187	24	90	42	3	7	231	20	76	153	50	136	63	1	4
July				184	24	80	76	7	37	176	17	44	10	7	29	35	1	6
August				27	5	14	2			54	3	19	33	17	52	4		
Subtotal				708	91	329	709	54	198	1,309	145	522	196	74	217	1,455	100	371
Total	82	7	25	1,981	248	886	2,759	363	1,342	2,142	316	1,242	250	97	284	4,647	599	2,183

¹ No area breakdown available prior to this date.

Submarine operations against merchant shipping by areas

	Philippines			Western Carolines			Eastern Carolines			Marshalls			Gilberts			Wake		
	D	S	T	D	S	T	D	S	T	D	S	T	D	S	T	D	S	T
<i>1943¹</i>																		
January				22	9	35	35	5	20	19	1	4						
February				21	7	19	22			22	4	16	5	1	4	1		
March				33	7	28	68	9	27	48	3	14				2	1	4
April	5	1	4	23	6	24	78	7	22	34	2	8	5	1	4	6	2	15
May				30	8	24	43	5	22	28	2	7						
June				55	18	56	205	18	64	28	4	16						
July	20	4	16	55	8	32	87	12	54	8	2	8				12	3	12
August	15	3	12	93	14	40	67	5	28	43	8	30						
September				70	9	38	94	17	74	55	6	22	28	3	12			
October	5	1	4	115	24	69	49	13	44	45	3	12						
November	15	3	12	52	14	56	126	25	102	21	1	5						
December	5	1	4	40	12	44	39	4	16	16	2	6						
Subtotal	65	13	52	609	136	465	913	120	473	367	38	148	38	5	20	21	6	31
<i>1944</i>																		
January				95	16	70	118	9	34	4								
February				66	9	31	146	13	56									
March	10	2	8	113	18	71	24	1	6									
April	32			129	18	70	11	4	9									
May	123	24	86	159	5	28	26	3	14									
June	153	19	67	82	3	14	1											
July	239	17	92	86	4	11	22	1	6									
August	284	51	162	47	3	16	22	1	6									
September	182	16	52	16			30											
October	194	55	190				29	1	4									
November	246	48	197															
December	101	20	105															
Subtotal	1,564	252	959	793	76	311	429	33	135	4								
<i>1945</i>																		
January	9																	
February																		
March																37	1	3
April																		
May							3											
June																14		
July																		
August																		
Subtotal	9						3									51	1	3
Total	1,638	265	1,011	1,402	212	776	1,345	153	608	371	38	148	38	5	20	72	7	34

¹ No area breakdown available prior to this date.

Submarine operations against merchant shipping by areas

	Mariannas			Bonins			South China Seas			Netherlands East Indies			Solomons— New Guinea		
	D	S	T	D	S	T	D	S	T	D	S	T	D	S	T
1943¹															
January	25	4	16							92	14	28	257	53	112
February	1	2	8							64	5	24	160	15	39
March	29	6	24							105	11	31	64	8	24
April	17	6	42							42	7	17	79	2	7
May	19	2	16	3	1	4				74	8	17	57	7	14
June	40	4	23	5	1	4	5	1	4	24	6	6	44	3	8
July	23	1	19							65	8	32	54	4	11
August	58	7	27	27	4	16				183	16	28	48	6	23
September	35	9	48	10	2	8	5	1	4	126	11	48	29	3	11
October	62	5	15	8						62	8	24	28	4	15
November	61	10	49	39	6	24				58	15	49			
December	27	3	12	15	3	12				81	10	35	8	1	4
Subtotal	397	59	299	107	17	68	10	2	8	976	119	339	828	106	268
1944															
January	86	9	34	52	12	44	5	1	4	153	22	104			
February	52	11	46	20	4	16				144	28	113	4	1	7
March	89	5	24	8	2	8	35	6	21	235	31	126			
April	101	13	39	74	4	17	54	6	27	41	6	27			
May	150	22	68	127	10	33	50	18	53	152	23	97			
June	56	12	38	115	12	38	35	3	7	112	19	74			
July				87	15	58	98	19	87	188	24	103			
August				84	6	19	54	12	37	84	13	52			
September				35	5	24	60	4	24	20	3	9			
October	1			43	8	30	160	38	142	129	25	83			
November				35	4	16	170	28	123	83	7	34			
December				23	4	20	381	34	127	92	20	75			
Subtotal	535	72	249	703	86	323	1,102	169	652	1,433	221	897	4	1	7
1945															
January				23	6	22	308	20	77	85	15	48			
February				3			312	31	134	126	26	101			
March							459	23	80	93	19	80			
April							253	9	45	205	37	157			
May							243	10	59	176	33	131			
June							184	11	48	193	38	161			
July							265	37	168	155	31	124			
August							143	19	76	75	15	60			
Subtotal				26	6	22	2,167	160	687	1,108	214	862			
Total	932	131	548	836	109	413	3,279	331	1,347	3,517	554	2,098	832	107	275

¹ No area breakdown available prior to this date.

PART 13B.—Submarine operations against merchant shipping

	Days of offensive patrol in operating areas	Merchant ships attacked	Torpedos expended
<i>1941</i>			
December.....	281	31	66
Subtotal.....	281	31	66
<i>1942</i>			
January.....	322	33	78
February.....	363	36	88
March.....	363	27	81
April.....	396	33	82
May.....	396	63	160
June.....	446	29	71
July.....	437	37	93
August.....	462	59	168
September.....	454	41	115
October.....	504	84	242
November.....	512	42	105
December.....	512	55	159
Subtotal (13 mos.).....	5,167	539	1,442
<i>1943</i>			
January.....	577	103	283
February.....	405	55	193
March.....	442	74	299
April.....	448	64	263
May.....	437	62	237
June.....	659	102	389
July.....	532	75	297
August.....	858	105	387
September.....	697	112	461
October.....	648	118	423
November.....	572	106	454
December.....	407	73	251
Subtotal.....	6,682	1,049	3,937
<i>1944</i>			
January.....	824	114	460
February.....	593	106	383
March.....	689	96	370
April.....	775	81	292
May.....	1,063	137	493
June.....	824	108	362
July.....	1,275	168	635
August.....	1,056	173	581
September.....	850	127	436
October.....	1,306	230	799
November.....	1,317	193	775
December.....	1,128	115	506
Subtotal.....	11,700	1,648	6,092
<i>1945</i>			
January.....	1,066	124	421
February.....	1,093	93	373
March.....	1,217	96	367
April.....	1,045	113	433
May.....	1,014	89	386
June.....	1,067	147	522
July.....	901	124	488
August.....	338	59	221
Subtotal.....	7,741	845	3,211
Total.....	31,571	4,112	14,748

PART 14.—Combined operations—all forces—against merchant shipping

	Combined attack, submarine and aircraft ¹	Total tonnage, bombs, mines and torpedoes ²
<i>1941</i>		
December.....	31	22
Subtotal.....	31	22
<i>1942</i>		
January.....	36	26
February.....	82	42
March.....	83	56
April.....	39	29
May.....	99	71
June.....	33	27
July.....	38	31
August.....	99	80
September.....	148	48
October.....	153	101
November.....	274	248
December.....	222	286
Subtotal.....	1,306	1,055
<i>1943</i>		
January.....	240	280
February.....	143	211
March.....	155	180
April.....	174	291
May.....	94	121
June.....	161	198
July.....	346	387
August.....	271	289
September.....	291	304
October.....	390	416
November.....	556	517
December.....	594	691
Subtotal.....	3,415	3,885
<i>1944</i>		
January.....	1,370	848
February.....	1,186	689
March.....	1,628	688
April.....	1,161	789
May.....	568	316
June.....	1,691	579
July.....	1,468	707
August.....	823	441
September.....	3,087	997
October.....	3,765	1,616
November.....	2,742	1,411
December.....	1,300	402
Subtotal.....	20,789	9,483
<i>1945</i>		
January.....	2,509	962.0
February.....	708	256.0
March.....	1,707	2,067.5
April.....	1,276	1,332.5
May.....	1,256	3,051.5
June.....	1,454	3,222.0
July.....	2,883	3,747.0
August.....	1,102	1,958.0
Subtotal.....	12,895	16,596.5
Total.....	38,436	31,041.5

¹ Tonnage: Torpedos were arbitrarily figured at one-third tons each, bombs and mines at actual weight.

² Combined attack: submarine attacks on ships were added to all aircraft sorties against merchant shipping.

APPENDIX F.—TRANSPORT BY SHIPPING UNDER CIVILIAN CONTROL DURING THE WAR

PART 1.—Comparison by fiscal years of steamship transport in ships controlled by the shipping control association, including import, colonial, inter-island and coastal trade

[In 1,000 MT. Years begin 1 April]

Type	1939	1940	1941	1942	1943	1944	1945 (April-July)
Coal	22,922.2	26,669.8	24,144.8	19,717.8	14,031.6	8,374.9	1,617.4
Iron ore	4,471.8	4,916.8	4,847.3	4,709.4	3,332.6	1,084.9	130.5
Steel and iron	3,537.8	4,214.2	3,749.5	3,533.7	3,139.5	2,017.9	207.4
Salt	1,036.0	1,460.9	1,759.9	1,727.0	1,405.8	828.6	378.8
Nonferrous metals	1,446.7	2,464.0	3,191.8	2,692.6	2,436.6	1,810.6	215.9
Types of cokes			92.0	248.6	254.9	294.4	79.9
Cement	774.5	906.2	789.4	321.8	204.8	69.8	5.2
Types of soda			52.8	70.7	28.5	11.6	1.0
Types of oils	3,554.6	3,929.6	161.7	89.9	105.0	51.5	2.6
Paper and pulp	383.4	764.4	635.6	673.2	395.1	149.5	21.7
Cotton and wool	744.5	517.8	265.4	614.0	31.1	29.0	12.0
Raw rubber		72.0	29.9	54.5	36.1	13.0	
Lumber	2,803.3	2,994.3	2,025.7	1,267.9	349.8	271.4	19.2
Grains	2,793.0	2,873.3	3,373.9	2,278.9	1,871.3	1,188.2	927.5
Sugar	1,799.9	992.9	477.5	256.8	335.2	122.1	
Fertilizer	785.4	929.4	1,136.9	1,039.5	581.3	399.4	123.4
Phosphates	701.6	668.9	453.9	256.8	240.9	77.4	9.5
Fodder	338.4	145.7	280.3	221.7	152.0	63.8	1.8
Fats and oils			234.3	149.9	135.1	53.3	14.2
Other products			451.3	454.0	239.4	172.1	23.0
Fishing in northern waters			561.0	415.7	187.6	69.1	
Total	48,137.6	54,653.4	48,704.9	40,531.1	29,494.2	17,152.5	3,791.0
Miscellaneous goods	15,291.4	13,375.7					50.0
Grand total	63,429.0	68,029.1					3,841.0

¹ Source: Shipping Control Association, Tokyo.

PART 2.—Table of seaborne traffic by the civilian merchant marine (steel ships) during year ending 1 April 1943¹

	1942										1943			
	April	May	June	July	August	Septem-ber	Octo-ber	Novem-ber	Decem-ber	January	February	March	Total	
Coal	1,480,452	1,358,763	1,411,113	1,733,186	1,767,597	1,803,322	1,990,294	1,798,958	1,644,165	1,524,888	1,515,999	1,567,192	19,595,929	
Iron ore	252,546	326,153	415,694	444,307	374,899	369,490	458,806	403,077	443,325	373,840	323,401	478,238	4,663,776	
Scrap steel	353,775	264,378	295,705	317,051	271,370	256,856	331,581	287,261	297,584	260,840	255,490	341,135	3,533,026	
Nonferrous	185,707	204,305	195,105	227,825	241,536	265,206	271,317	225,732	231,644	185,809	210,729	245,295	2,690,210	
Cokes	28,115	22,255	15,629	19,532	24,518	22,921	16,419	22,078	26,178	17,250	13,565	19,953	248,413	
Salt	96,085	119,176	165,148	167,191	169,716	152,444	165,236	177,782	151,898	112,656	125,908	117,727	1,720,967	
Cement	32,323	24,261	33,279	36,561	42,491	36,428	29,284	25,243	20,209	15,445	7,698	16,716	319,848	
Soda	9,071	3,495	6,907	8,598	6,713	4,854	6,622	4,858	7,725	3,227	2,462	6,417	70,949	
Oils	15,924	5,280	5,119	8,611	4,297	7,296	8,257	5,423	8,692	11,342	3,445	5,691	89,377	
Grains	286,394	302,875	200,892	98,729	192,309	190,172	213,228	107,072	118,985	95,796	116,916	165,828	2,089,196	
Paper and pulp	45,765	40,608	55,582	74,840	56,787	66,273	54,507	67,511	51,125	47,817	50,188	56,648	667,651	
Raw rubber	2,110	10,347	2,743	144	2,765	2,863	5,678	1,280	5,177	4,714	1,819	4,445	44,085	
Cotton and wool	12,312	12,045	8,267	2,690	14,662	983	2,306	2,639	4,976	8,457	12,905	12,316	94,558	
Lumber	69,529	72,634	85,144	148,302	180,427	174,498	143,359	144,235	81,942	61,323	29,811	68,407	1,259,611	
Sugar	39,357	42,499	30,476	22,518	32,037	21,451	57,961	84,125	44,840	45,334	43,088	56,855	520,541	
Phosphates	22,600	9,980	22,134	13,709	22,537	11,460	45,695	17,515	21,230	19,046	25,214	25,830	256,950	
Fertilizers	105,817	146,779	121,726	70,018	59,797	58,467	78,718	65,028	51,515	121,218	78,886	73,075	1,031,044	
Fodder	7,991	9,638	15,111	15,843	26,406	18,881	62,713	10,964	15,712	19,128	8,940	7,105	218,432	
Oils and fats	1,998	2,368	1,946	3,812	1,210	999	1,476	584	3,220	1,690	233	365	19,901	
Oil products	9,811	13,060	15,444	14,057	4,667	5,248	18,106	2,176	10,247	9,739	8,367	9,484	120,406	
Others	1,131	811	8,419	3,650	3,829	8,269	20,502	19,640	18,967	23,320	20,297	21,758	150,593	
Total	3,058,813	2,991,710	3,111,583	3,431,174	3,500,570	3,478,381	3,982,065	3,473,181	3,259,356	2,962,879	2,855,271	3,300,480	39,405,463	
Miscellaneous	37,758	48,405	30,820	39,318	35,126	38,359	33,806	20,191	478,798	318,879	362,804	363,954	1,808,218	

¹ Source: Shipping Control Association.

APPENDIX F.—TRANSPORT BY SHIPPING UNDER CIVILIAN CONTROL DURING THE WAR (Cont.)

PART 3.—Table of seaborne traffic by the civilian merchant marine (steel ships) during year ending 1 April 1944¹

	1943									1944			
	April	May	June	July	August	Septem-ber	Octo-ber	Novem-ber	Decem-ber	January	February	March	Total
Coal	1,430,727	1,515,389	1,334,719	1,391,924	1,246,076	1,066,314	1,135,199	1,067,597	976,472	942,341	872,322	1,050,996	14,030,976
Iron ore	409,618	338,206	301,383	297,095	321,595	262,160	245,935	229,439	214,272	206,877	240,590	225,786	3,292,956
Scrap steel	319,221	357,196	316,708	283,198	245,155	261,590	251,439	267,173	254,099	217,789	202,449	198,151	3,174,168
Nonferrous	205,095	285,856	233,092	217,543	299,971	192,989	217,815	183,134	174,254	148,490	129,296	171,144	2,458,679
Cokes	25,401	31,129	23,481	23,909	19,766	15,904	17,864	27,427	17,306	21,085	18,442	13,366	255,080
Salt	127,184	147,507	168,014	137,670	122,553	113,806	110,787	130,035	101,648	94,381	70,593	87,022	1,411,200
Cement	17,410	16,057	18,874	26,019	23,435	28,459	27,599	18,538	14,422	3,623	5,332	7,125	206,893
Sodas	6,833	3,502	3,802	4,639	2,725	1,572	767	1,659	419	489	715	2,215	29,337
Oils	8,182	9,712	7,308	6,716	11,029	7,605	3,539	6,951	8,601	3,308	15,276	13,791	102,018
Grains	140,809	202,433	174,193	194,840	184,425	198,230	164,384	94,802	58,600	90,152	182,976	233,746	1,919,590
Paper and pulp	37,050	52,690	47,303	48,382	34,571	28,388	28,318	29,015	29,682	27,510	17,179	15,223	395,311
Raw rubber	8,400	2,598	4,042	2,491	434	2,060	2,859	3,871	5,702	2,178	2,767	3,674	41,076
Cotton and wool	8,144	8,016	2,806	344	1,775	994			2,197	3,828	2,312	687	31,103
Lumber	41,036	61,934	22,517	39,587	26,474	32,668	15,119	38,956	23,895	23,284	14,004	10,311	349,785
Sugar	35,650	58,731	32,257	34,687	43,125	46,558	5,863	18,848	18,996	10,438	236	29,450	334,839
Phosphates	23,088	36,231	28,261	24,774	6,907	11,487	22,913	20,083	20,919	11,673	20,398	17,184	243,918
Fertilizer	72,038	73,399	71,732	47,594	51,897	27,940	35,531	16,241	38,281	43,906	44,618	57,964	581,141
Fodder	11,677	10,326	18,784	4,920	5,802	6,262	7,412	5,492	7,345	3,967	2,187	2,504	86,778
Oils and fats	1,590	1,158	1,132	453	274	384	338	403	208	142	2,181	538	6,451
Oil products	17,454	26,653	11,246	7,257	7,828	9,072	7,630	4,951	6,659	7,540	12,060	8,794	127,144
Others	21,387	15,940	25,644	20,826	21,217	11,864	17,731	12,395	9,468	29,825	13,020	35,241	234,558
Total	2,967,994	3,253,663	2,846,298	2,814,868	2,677,034	2,326,406	2,319,042	2,176,660	1,983,445	1,892,826	1,868,953	2,184,912	29,312,101
Fish from northern waters		43,714	72,344	19,049	30,875	18,896	2,800						187,678
Miscellaneous	350,973	384,410	366,910	296,944	287,661	292,127	243,659	179,721	246,590	200,333	236,380	202,211	3,287,919
Cattle and horses	3,841	3,737	1,815	1,100	2,914	5,393	5,100	3,044	2,345	2,954	1,730	1,729	36,702

¹ Source: Shipping Control Association.

PART 4.—Table of seaborne traffic by the civilian merchant marine (steel ships) during year ending 1 April 1945¹

	1944									1945			
	April	May	June	July	August	Septem-ber	Octo-ber	Novem-ber	Decem-ber	January	February	March	Total
Coal	916.545	845.527	714.222	757.805	517.905	552.937	574.812	789.529	668.287	667.221	576.664	613.294	8,194.745
Iron ore	299.355	112.426	96.223	74.845	99.486	30.871	54.988	97.752	57.241	54.562	46.120	49.196	1,073.065
Scrap steel	206.122	260.250	219.704	191.879	156.634	150.705	181.207	135.553	147.592	107.072	86.544	118.013	1,961.275
Nonferrous	192.913	170.490	198.005	225.347	153.705	174.097	137.735	137.843	115.321	107.227	106.110	119.816	1,838.609
Cokes	28.400	38.707	36.956	24.608	27.289	26.612	27.070	10.246	20.502	16.181	15.751	22.011	294.333
Salt	76.169	93.794	102.035	117.558	71.240	67.226	49.533	60.285	72.473	45.828	41.268	65.623	863.032
Cement	7.719	6.242	7.708	7.590	2.790	8.480	4.235	6.754	3.650	6.073	3.800	4.245	69.286
Sodas	.986	1.388	.411	.387	.147	.053	.778	.631	.970	.366	.661	.240	7.018
Oils	5.447	7.549	.5773	3.443	2.394	1.786	13.674	2.511	1.130	1.212	6.253	6.123	57.295
Grains	171.029	195.149	182.491	134.102	71.740	71.118	79.666	78.915	69.191	12.212	71.592	62.998	1,200.203
Paper and pulp	18.994	13.986	12.783	21.159	11.505	9.860	15.238	4.827	8.690	8.272	11.088	13.111	149.513
Raw rubber	1.803	1.304	1.146	.307	7.125	.606	2.164	3.495	1.645				19.595
Cotton and wool	3.114		8.050		1.305	2.667	5.485	3.695	1.555	1.285	2.038		29.194
Lumber	16.848	21.962	22.777	28.327	31.381	17.618	31.502	20.942	12.211	31.845	23.380	22.754	281.547
Sugar	22.730	31.990	6.540	17.955	5.608	15.729	11.600	3.209	11.030	1.636	8.735	.160	136.922
Phosphates	6.395	1.715	2.751	6.811	3.432	8.092	13.272	12.760	6.571	9.147	4.556	1.730	77.232
Fertilizer	59.089	75.216	62.257	38.569	20.801	25.857	9.249	21.346	23.895	20.451	31.081	18.030	405.841
Fodder	13.219	10.224	16.929	1.537	6.782	2.285	4.944	3.471	1.294	3.024			63.709
Oils and fats	.219	.641	.163		2.490		.392	.193		.227			4.325
Oil products	9.676	12.657	6.865	3.591	3.107	.813	1.055	.917	.707	1.213	5.253	3.691	49.545
Others	15.150	33.596	9.818	14.932	12.980	3.215	22.242	18.628	1.343	3.307	1.452	5.542	142.205
Sumitomo's own ships	11.281	10.290	6.660	4.655	9.362	10.770	8.592	11.402	10.302	9.329	9.500	12.138	114.281
Total	2,083.203	1,945.103	1,720.267	1,675.407	1,219.208	1,181.397	1,249.433	1,424.904	1,235.600	1,107.690	1,051.846	1,138.715	17,264.408
Miscellaneous	219.094	204.262	267.467	179.905	125.1975	93.819	135.799	106.531	93.357	95.681	84.901	69.212	1,675.225
Cattle	.303	2.123	.665	1.137	.411	4.341	5.453	4.078	.343	.233		.250	27.119
Horses	.969	.330	1.676	.639	1.142			1.224	1.265	.382		.155	
Sheep			.130		.015								.145
Dogs								.149	.177				.326

¹ Source: Shipping Control Association.

APPENDIX F.—TRANSPORT BY SHIPPING
UNDER CIVILIAN CONTROL DURING
THE WAR (Cont.)

PART 5.—*Table of seaborne traffic by the civilian merchant marine (steel ships) from April to August 1945*

	April	May	June	July	August	Total
Coal	578.834	471.238	210.552	289.920	219.021	1,769.565
Iron ore	71.357	41.099	15.887	1.040	.572	129.955
Scrap steel	88.620	74.144	24.807	16.377	7.598	211.546
Non-ferrous	74.392	79.882	28.944	34.943	1.951	220.112
Cokes	27.793	22.143	19.770	11.271	5.224	86.201
Salt	70.431	82.843	105.919	111.540	33.447	404.180
Cement	3.120	1.760	.250	1.500	..	6.630
Sodas .....	.555	.420	..	..	..	.975
Oils	1.053	1.272	.188	.646	..	3.159
Grains	181.097	189.866	260.229	237.361	18.215	886.768
Paper and pulp.....	11.005	1.133	3.762	2.440	3.652	21.992
Raw rubber .....	..	..	..	..	..	..
Cotton and wool	2.791	1.540	1.000	1.564	4.71	7.366
Lumber	14.276	3.730	1.237	.025	.156	19.424
Sugar .....	..	..	..	..	..	..
Fertilizer	27.020	70.260	17.516	14.221	8.453	137.470
Podder	1.820	..	..	..	..	1.820
Oil and fats .....	..	1.100	..	..	..	1.100
Oil products.....	8.913	2.215	1.970	..	..	13.098
Others .....	..	..	..	12.512	8.244	20.756
Total	1,163.077	1,044.645	692.031	735.360	307.004	3,942.117
Miscellaneous	75.331	44.691	45.000	44.496	11.793	221.311

UNITED STATES STRATEGIC BOMBING SURVEY

LIST OF REPORTS

The following is a bibliography of reports resulting from the Survey's studies of the European and Pacific wars. Those reports marked with an asterisk (*) may be purchased from the Superintendent of Documents at the Government Printing Office, Washington, D. C.

European War

OFFICE OF THE CHAIRMAN

- *1 The United States Strategic Bombing Survey: Summary Report (*European War*)
- *2 The United States Strategic Bombing Survey: Over-all Report (*European War*)
- *3 The Effects of Strategic Bombing on the German War Economy

AIRCRAFT DIVISION

(By Division and Branch)

- *4 Aircraft Division Industry Report
- 5 Inspection Visits to Various Targets (Special Report)

Airframes Branch

- 6 Junkers Aircraft and Aero Engine Works, Dessau, Germany
- 7 Erla Maschinenwerke G m b H, Heiterblick, Germany
- 8 A T G Maschinenbau, G m b H, Leipzig (Moc-kau), Germany
- 9 Gothaer Waggonfabrik, A G, Gotha, Germany
- 10 Focke Wulf Aircraft Plant, Bremen, Germany
- 11 Messerschmitt A G, Augsburg, Germany

{	Over-all Report
	Part A
	Part B
- 12 Dornier Works, Friedrichshafen & Munich, Germany
- 13 Gerhard Fieseler Werke G m b H, Kassel, Germany
- 14 Wiener Neustaedter Flugzeugwerke, Wiener Neustadt, Austria

Aero Engines Branch

- 15 Bussing NAG Flugmotorenwerke G m b H, Brunswick, Germany
- 16 Mittel-Deutsche Motorenwerke G m b H, Taucha, Germany
- 17 Bavarian Motor Works Inc, Eisennach & Durrerhof, Germany
- 18 Bayerische Motorenwerke A G (BMW) Munich, Germany
- 19 Henschel Flugmotorenwerke, Kassel, Germany

Light Metal Branch

- 20 Light Metals Industry

{	Part I, Aluminum of Germany
	Part II, Magnesium
- 21 Vereinigte Deutsche Metallwerke, Hildesheim, Germany
- 22 Metallgussgesellschaft G m b H, Leipzig, Germany
- 23 Aluminiumwerk G m b H, Plant No. 2 Bitterfeld, Germany
- 24 Gebrueder Giulini G m b H, Ludwigshafen, Germany
- 25 Luftschiffbau, Zeppelin G m b H, Friedrichshafen on Bodensee, Germany
- 26 Wieland Werke A G, Ulm, Germany
- 27 Rudolph Rautenbach Leichtmetallgiessereien, Solingen, Germany
- 28 Lippewerke Vereinigte Aluminiumwerke A G, Lunen, Germany
- 29 Vereinigte Deutsche Metallwerke, Hedderheim, Germany
- 30 Duerener Metallwerke A G, Duren Wittenau-Berlin & Waren, Germany

AREA STUDIES DIVISION

- *31 Area Studies Division Report
- 32 A Detailed Study of the Effects of Area Bombing on Hamburg
- 33 A Detailed Study of the Effects of Area Bombing on Wuppertal
- 34 A Detailed Study of the Effects of Area Bombing on Dusseldorf
- 35 A Detailed Study of the Effects of Area Bombing on Solingen
- 36 A Detailed Study of the Effects of Area Bombing on Remscheid
- 37 A Detailed Study of the Effects of Area Bombing on Darmstadt
- 38 A Detailed Study of the Effects of Area Bombing on Lubeck
- 39 A Brief Study of the Effects of Area Bombing on Berlin, Augsburg, Bochum, Leipzig, Hagen, Dortmund, Oberhausen, Schweinfurt, Bremen

CIVILIAN DEFENSE DIVISION

- *40 Civilian Defense Division—Final Report
- 41 Cologne Field Report
- 42 Bonn Field Report
- 43 Hanover Field Report
- 44 Hamburg Field Report—Vol I. Text; Vol II, Exhibits
- 45 Bad Oldesloe Field Report
- 46 Augsburg Field Report
- 47 Reception Areas in Bavaria, Germany

EQUIPMENT DIVISION

Electrical Branch

- *48 German Electrical Equipment Industry Report
- 49 Brown Boveri et Cie, Mannheim Kafertal, Germany

Optical and Precision Instrument Branch

- *50 Optical and Precision Instrument Industry Report

Abrasives Branch

- *51 The German Abrasive Industry
- 52 Mayer and Schmidt, Offenbach on Main, Germany

Anti-Friction Branch

- *53 The German Anti-Friction Bearings Industry

Machine Tools Branch

- *54 Machine Tools & Machinery as Capital Equipment
- *55 Machine Tool Industry in Germany
- 56 Herman Kolb Co., Cologne, Germany
- 57 Collet and Engelhard, Offenbach, Germany
- 58 Naxos Union, Frankfort on Main, Germany

MILITARY ANALYSIS DIVISION

- 59 The Defeat of the German Air Force
- 60 V-Weapons (Crossbow) Campaign
- 61 Air Force Rate of Operation
- 62 Weather Factors in Combat Bombardment Operations in the European Theatre
- 63 Bombing Accuracy, USAAF Heavy and Medium Bombers in the ETO
- 64 Description of RAF Bombing
- 64a The Impact of the Allied Air Effort on German Logistics

MORALE DIVISION

- *64b The Effects of Strategic Bombing on German Morale (Vol I & II)

Medical Branch

- *65 The Effect of Bombing on Health and Medical Care in Germany

MUNITIONS DIVISION

Heavy Industry Branch

- *66 The Coking Industry Report on Germany
- 67 Coking Plant Report No. I, Sections A, B, C, & D
- 68 Gutehoffnungshuette, Oberhausen, Germany
- 69 Friedrich-Alfred Huette, Rheinhausen, Germany
- 70 Neunkirchen Eisenwerke A G, Neunkirchen, Germany
- 71 Reichswerke Hermann Goering A G, Hallendorf, Germany

- 72 August Thyssen Huette A G, Hamborn, Germany
- 73 Friedrich Krupp A G, Borbeck Plant, Essen, Germany
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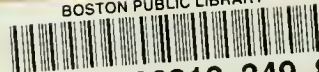
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