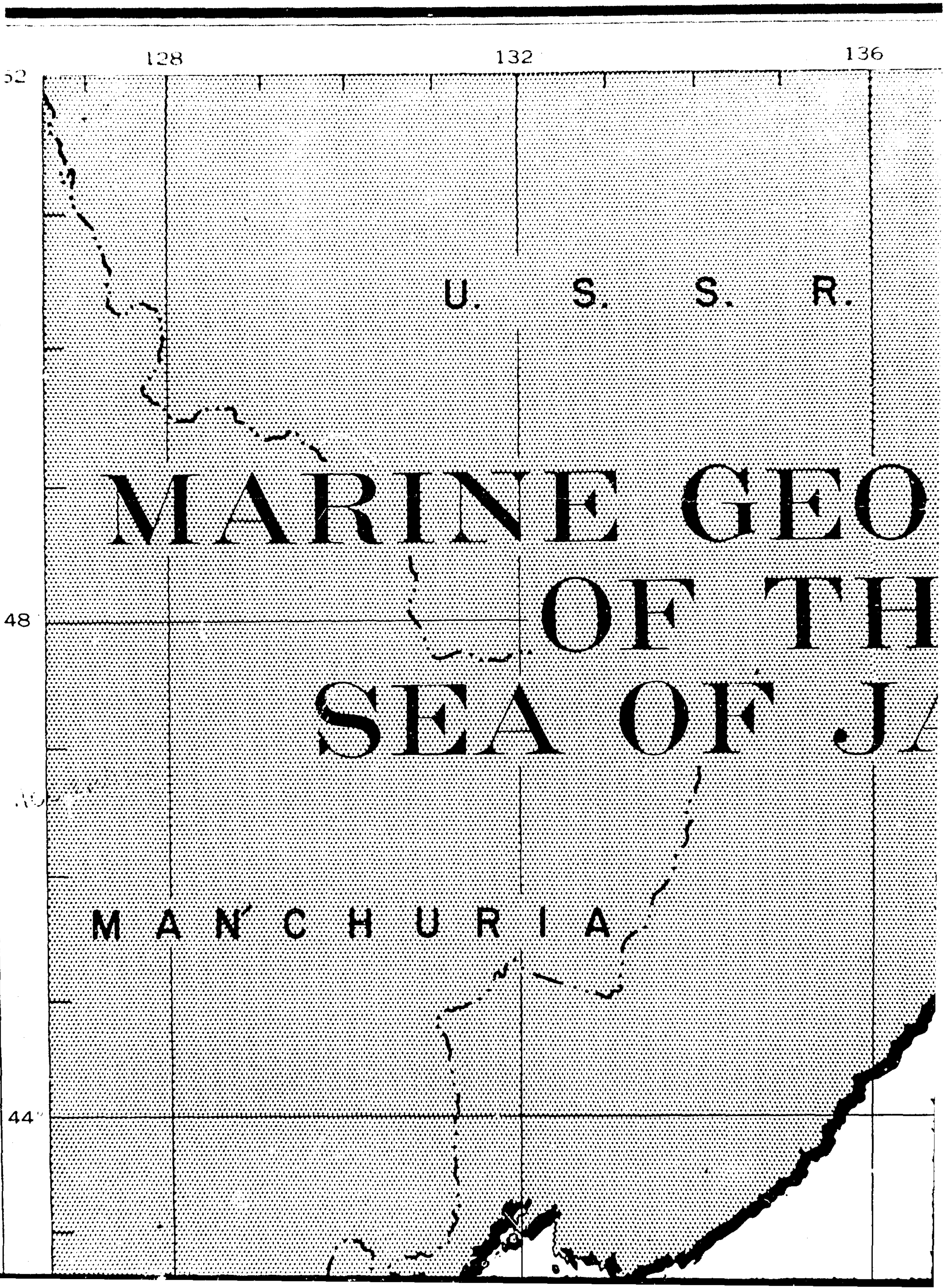
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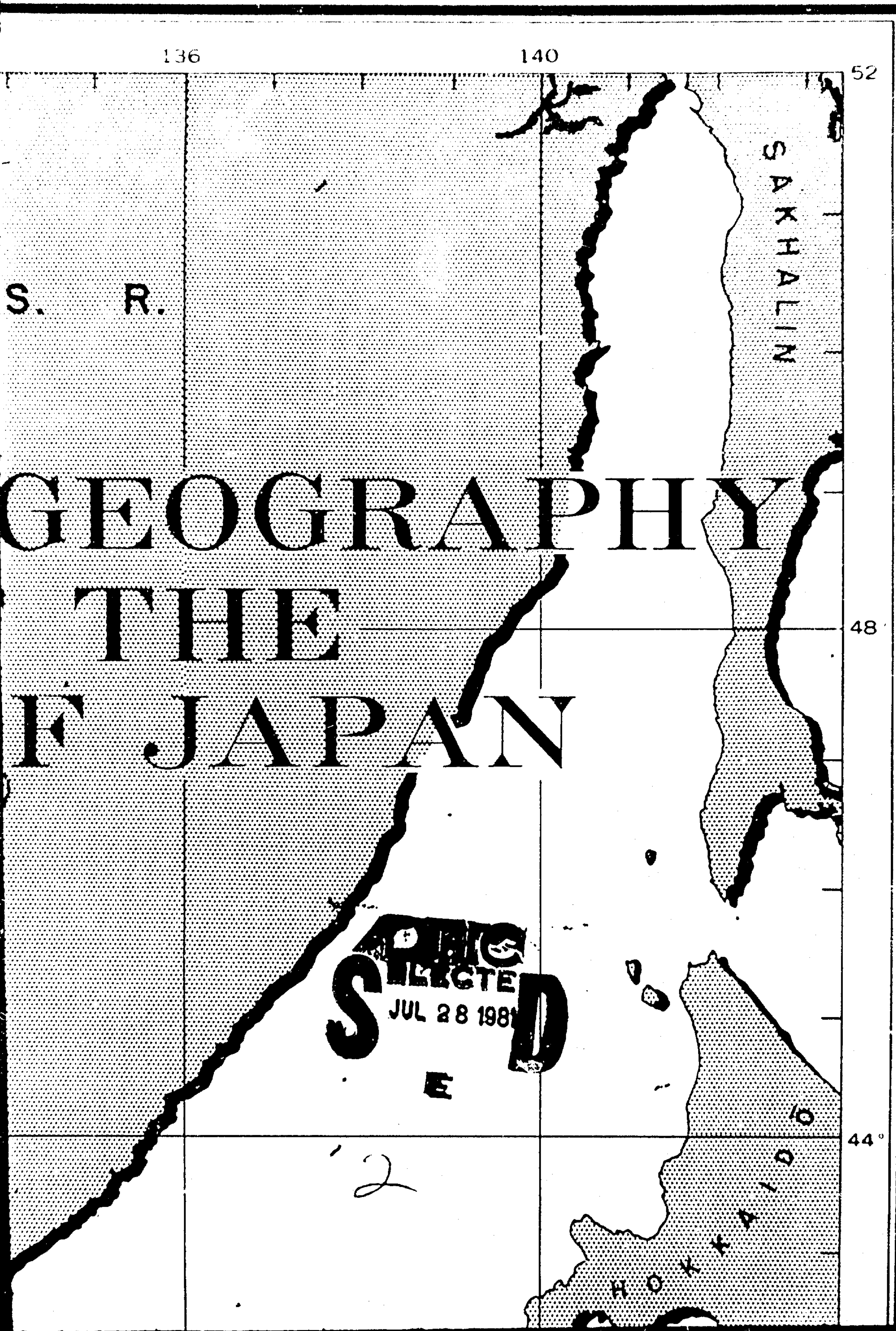

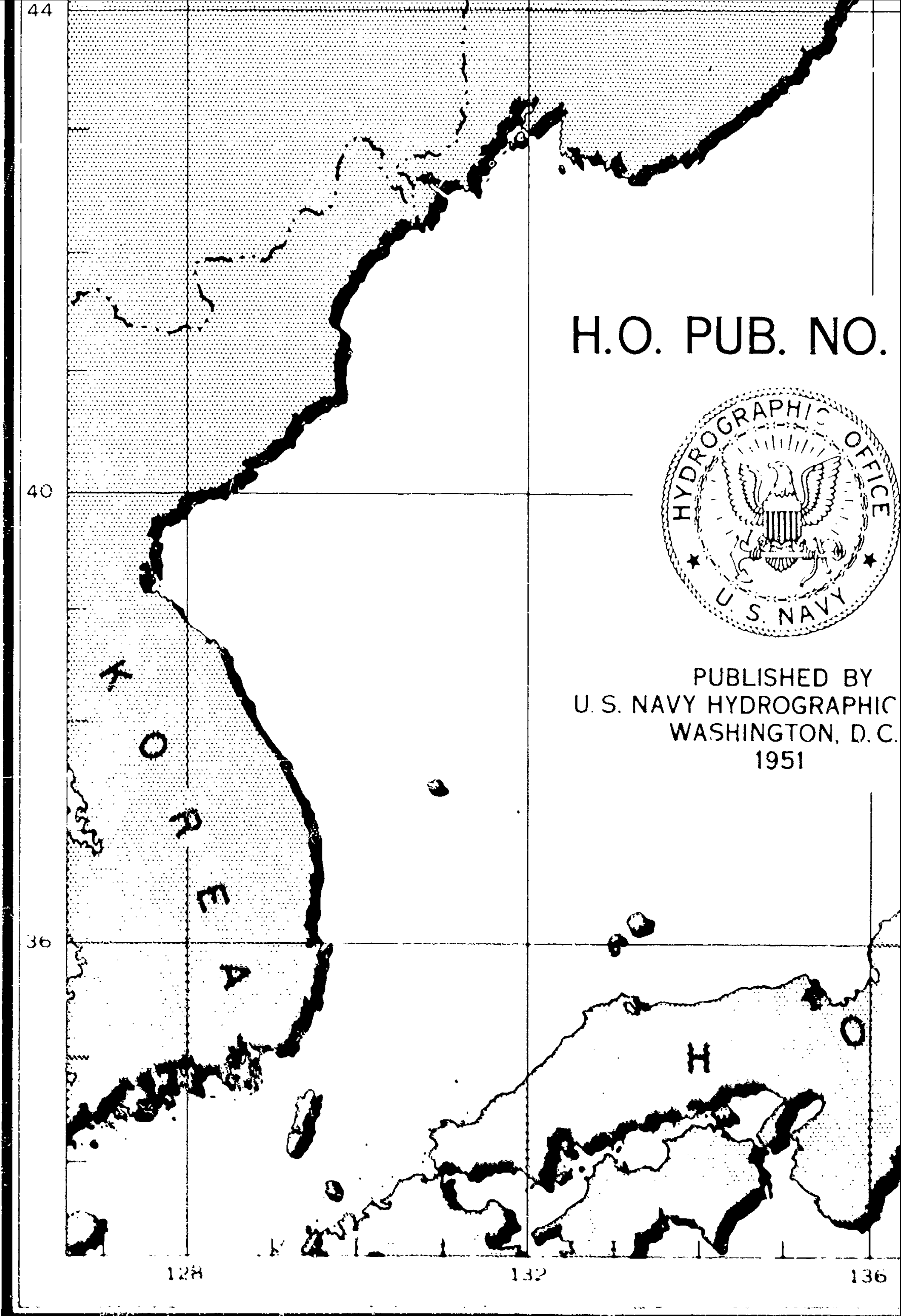


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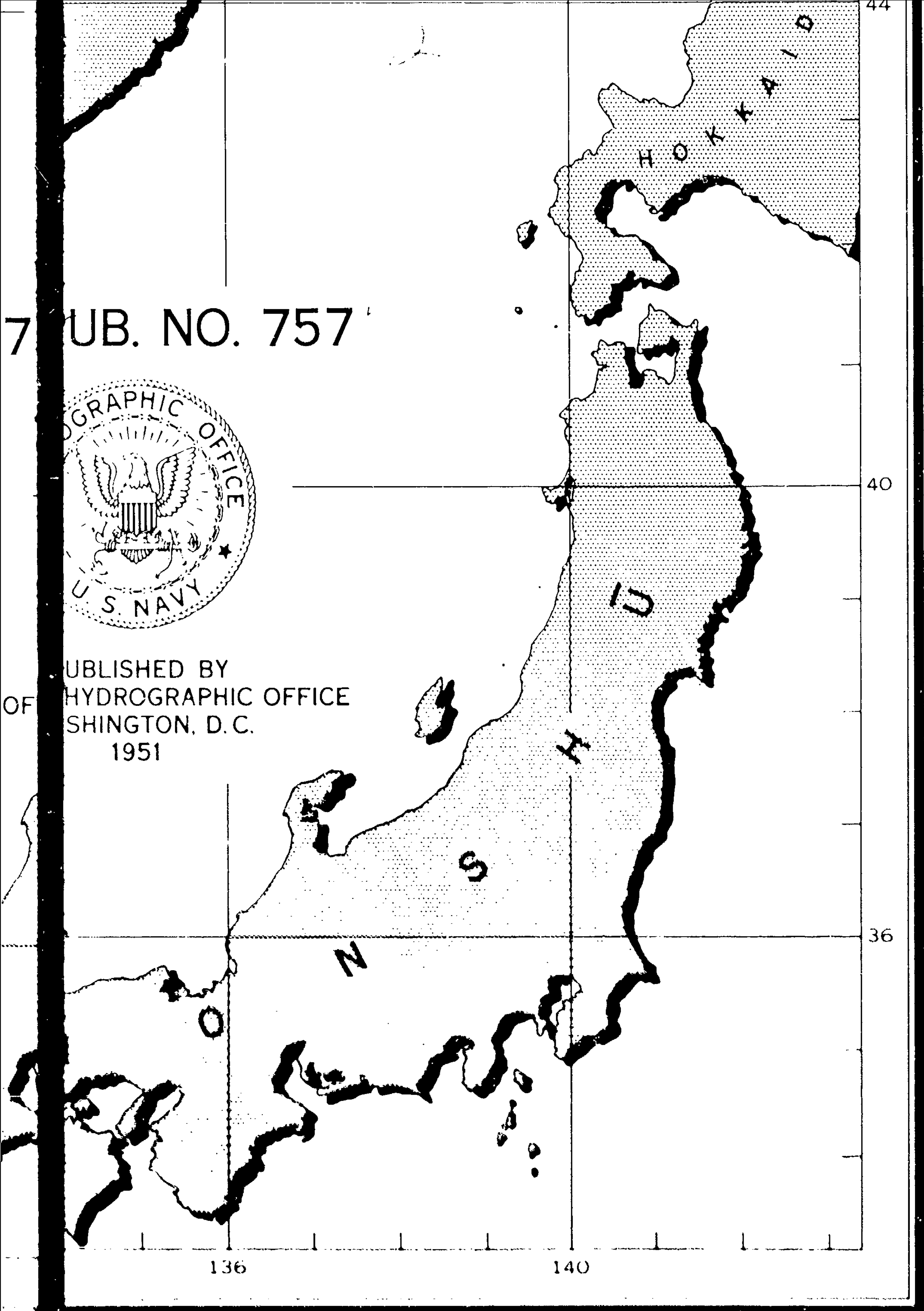


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This publication is a continuation of the series on the marine geography of areas in the Western Pacific begun with H. O. Pub. No. 752, "Marine Geography of Korean Waters." Although the area of the present study overlaps with that of H. O. Pub. No. 752, corresponding charts of both studies will not agree in these overlapping areas in many cases for the reason that different sources of data covering different areas had to be used and these could not always be reconciled. Moreover, some very late sources of information were incorporated into the charts to bring them up to date.

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| Sea of Japan | Tides | Biology |
| Bottom Sediments | Climatology | Magnetism |
| Geography | Sea State | Transparency |
| Depths | Waves | Water Color |
| | Currents | Survival |

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)


Contains monthly or seasonal charts of numerous oceanographic parameters.


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## INTRODUCTION

The Sea of Japan, an outlying part of the Pacific Ocean, lies between the islands of Japan on the east and the maritime territories of Soviet Russia and Korea on the west. It is connected with the Sea of Okhotsk by Tatar Strait on the north and Soya Kaikyo on the east; with the Pacific Ocean by Tsugaru Kaikyo on the east between Hokkaido and Honshu; and with the East China and Yellow Seas by Korea Strait on the south.

Japan proper, usually taken to include Kyushu, Shikoku, Honshu, and Hokkaido, extends 147,652 square miles. Of this group, Honshu takes up 86,772 square miles; Hokkaido, the next largest, 29,997 square miles; Kyushu 15,587 square miles; and Shikoku 7,031 square miles. North of Hokkaido lie the Kuril Islands and Karafuto, the southern part of Sakhalin.

Geologically speaking, Japan consists of a rugged chain of volcanic islands pushed up from the bottom of the ocean. The southern coast line of Japan is broken considerably, affording a great number of sheltered anchorages. However, much of the east and west coasts of Honshu and Hokkaido are very little indented, so that good harbors in these localities are few. One of Japan's great natural features is the Inland Sea, bounded by Honshu on the north and Kyushu and Shikoku on the south, providing smooth water and safe navigation for half the distance between Yokohama and Nagasaki.

The island of Sakhalin extends in a north-south direction for about 511 miles, varying in width from 15 to 100 miles. The westernmost part of the island is separated from the continent of Asia by the shallow Tatar Strait which in its narrowest part has a width of less than 5 miles. On the south the island is separated from Hokkaido by Soya Kaikyo, a strait less than 27 miles wide.

The coast of Siberia from abreast of the northern end of Sakhalin southward to the Korean border is for the most part steep and rugged, and backed by heavily forested mountain ranges from 2,000 to over 6,000 feet high. The long stretches of cliffs are broken here and there by a small beach at the mouth of a stream. Lowlands are limited to a few small coastal plains and the alluvial flood plains of the main rivers.

TABLE OF CONTENTS



2

width from 15 to 100 miles. The westernmost part of the island is separated from the continent of Asia by the shallow Tatar Strait which in its narrowest part has a width of less than 5 miles. On the south the island is separated from Hokkaido by Soya Kaikyo, a strait less than 27 miles wide.

The coast of Siberia from abreast of the northern end of Sakhalin southward to the Korean border is for the most part steep and rugged, and backed by heavily forested mountain ranges from 2,000 to over 6,000 feet high. The long stretches of cliffs are broken here and there by a small beach at the mouth of a stream. Lowlands are limited to a few small coastal plains and the alluvial flood plains of the main rivers.

Korea is mountainous in its northern and eastern parts. In general, the mountain ranges extend along a north-south axis near the east coast and parallel to it. Korea Strait, about 115 miles wide between Pusan and Shimonoseki, separates the peninsula from Japan.

Japan shares in the monsoons of eastern Asia and resembles China in the main features of its climate. Most of the rain falls in summer and the temperature ranges are considerable. The prevailing winds are northwest in winter, southeast in summer. However, modifications in the climate occur because of the insularity of Japan. Also, the area is frequently under the influence of extratropical cyclones which migrate from the continent of Asia and frequently cause widespread rainfall both in the Sea of Japan and Japan proper as they pass on their way toward the Aleutians.

Wave conditions in the Sea of Japan tend to be rough during the winter and calm in the summer unless the area is under the influence of a typhoon. In winter, except in the frozen over areas of the Gulf of Tatary and along coastal regions, rough seas up to 8 feet in height and very rough seas 8 to 13 feet in height occur very frequently. Waves above 13 feet in height have been reported. During the summer the frequency of waves less than 2 feet in height exceeds 50 percent.

The Marine Geography of the Sea of Japan has been compiled with a twofold purpose: (1) to provide a basis for strategic planning insofar as the oceanographic environment is concerned and (2) to present in a readily usable form oceanographic information that is operationally applicable in the field.

# RELIEF OF SEA BOTTOM (SIMPLIFIED)

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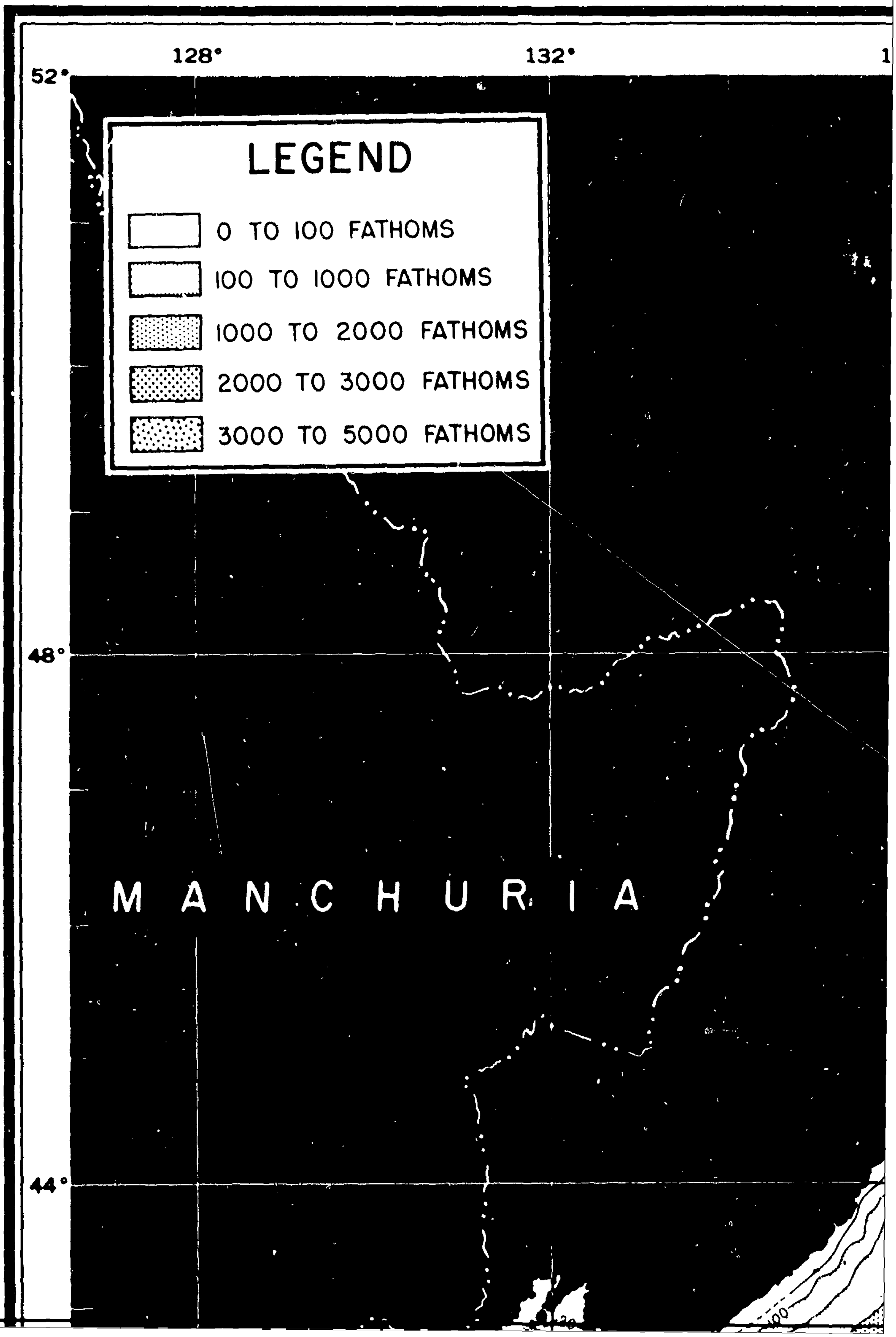
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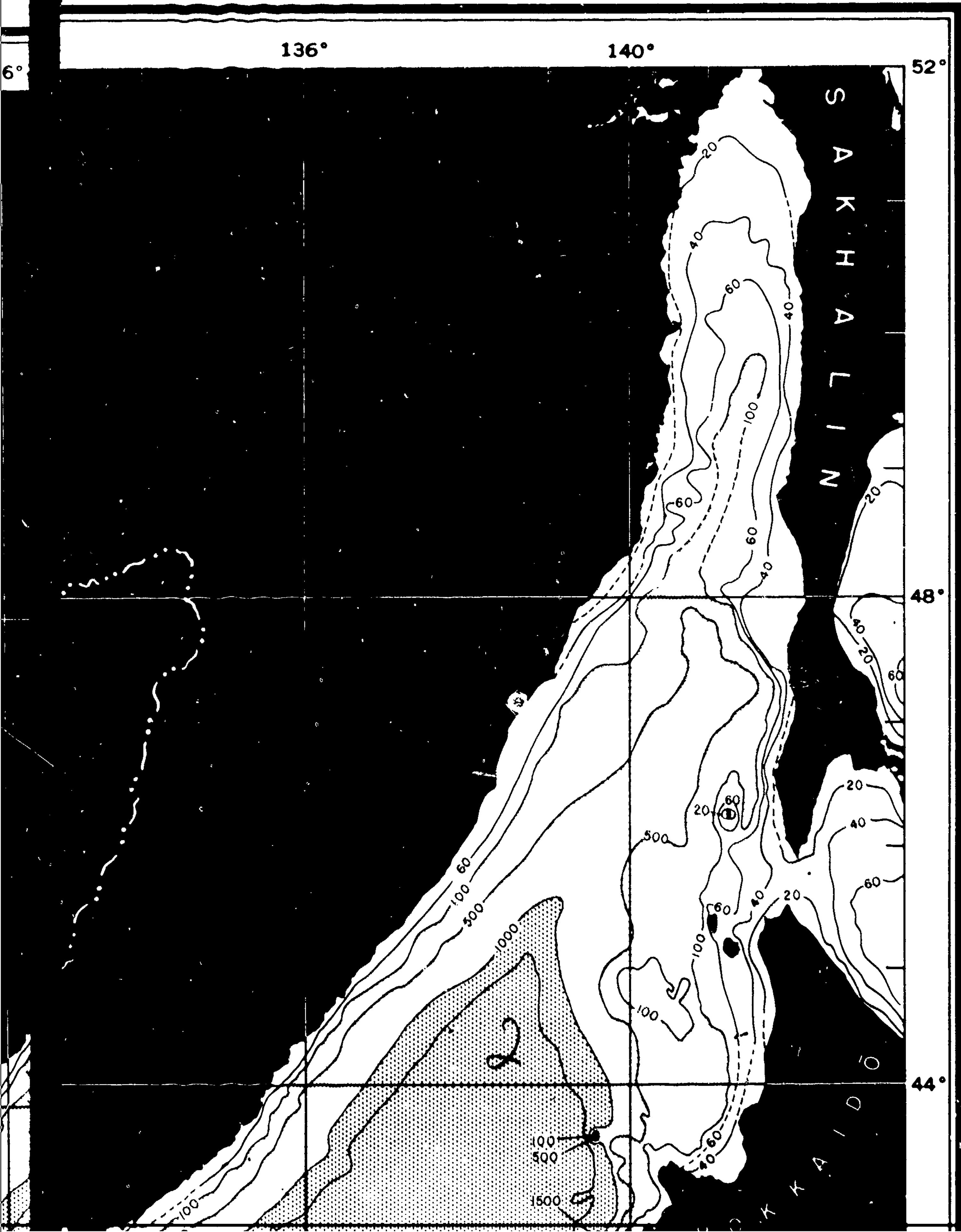
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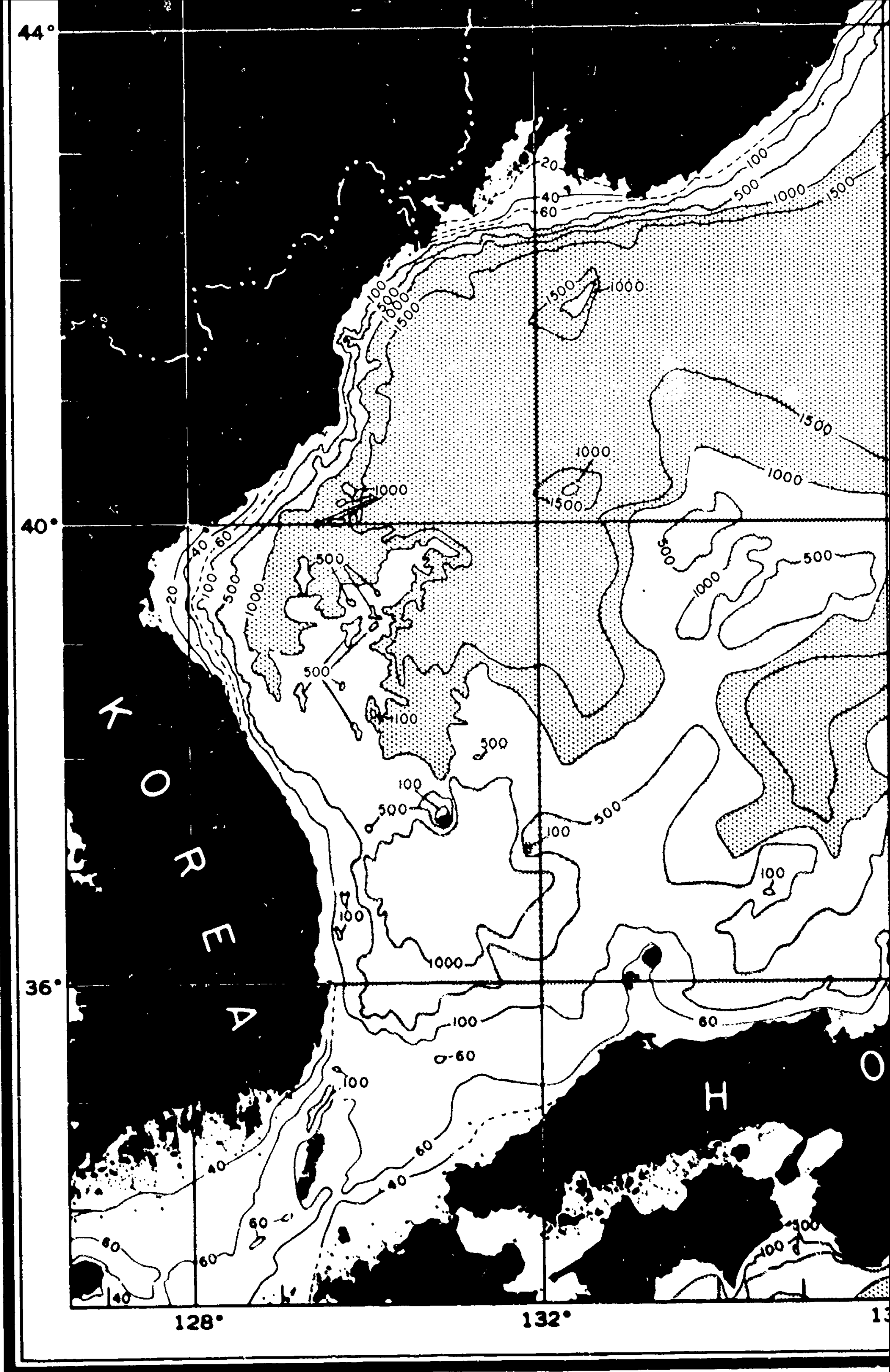
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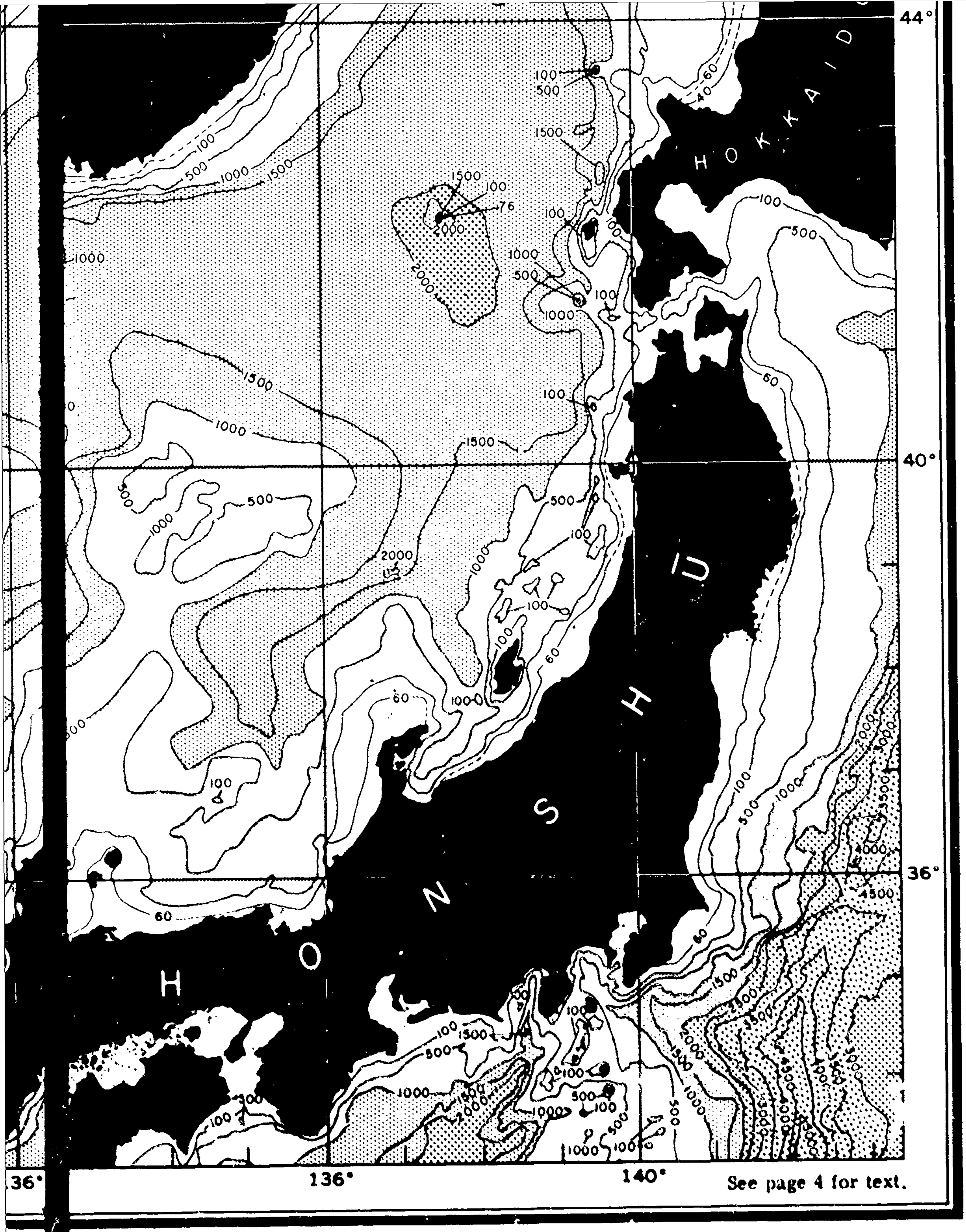


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## GEOLOGY

Although there are various theories regarding the origin of the Japanese islands, almost all agree that they are the rugged crests of submarine mountains that have risen from the ocean bottom. These mountains have been formed over a long period of time with several centers and periods of volcanic activity. Granites and other igneous rocks, together with sedimentary rocks that have been folded, faulted, and crushed, form the material of which the mountains are made.

The Japan Sea fills an oval basin roughly 400 miles across, formed by the Japanese islands on the east and the Asiatic mainland on the west. Formerly, this sea was a part of the Pacific Ocean as the oldest identifiable rocks of Honshu are marine Paleozoic (200–450 million years) sediments.

Part of the coast line of Japan on her west coast is relatively smooth where it roughly parallels a fault system. At Wakasa Wan, however, south of this area, a fault system which developed at an angle to the coast has produced a major irregularity in the coast line.

In general, the volcanoes that still can be identified in Japan are not older than the Pleistocene or Glacial epoch (1 million years), although some may have had their origin in the preceding Pliocene epoch (20 million years). Moreover, lava flows have been found interbedded with sediments of the Miocene epoch (30 million years). This volcanic activity is still continuing today, as evidenced by volcanic dust in the atmosphere, lava flows, earthquakes, and changing strand lines.

Before Tertiary times (70 million years) Sakhalin had been connected with the mainland. Now it is essentially a mountainous region which was formed between the post–Tertiary and Pliocence (20 million years) epochs.

The continental coast of the Japan Sea is a complex region of mountains and river basins. Metamorphic and sedimentary rocks form the backbone of the folded Sikhote Alin range which lines the coast from the west coast of the Gulf of Tatary to Vladivostok. The most intensive faulting and folding occurred in the Lower Cretaceous (110 million years) epoch. Volcanic activity was very common, the most recent occurring during Quaternary (less than 1 million years) times. Most of this volcanic activity took place at the same time or somewhat earlier than in the Japanese islands. Erosion of the igneous rocks provided the source material for the sandstones of the areas, whereas the limestone derives from the time the area was under the ocean. Alluvium has been brought down from the mountains by streams which have deposited it in the river basins. Loose material falling down the slopes of the mountains accounts for the unconsolidated rock also found in the basins.

On the Pacific side of the Japanese islands faulting across the trend of the coast line has formed many bays and inlets of fault origin. East of the Japanese islands may be found one of the greatest series of submarine trenches known to exist in any ocean basin. Thus, from the highest mountain peaks of Japan to the lowest depths of the trenches, there is a difference of elevation of at least seven or eight miles. This immense range of elevation within a lateral distance of about a hundred miles inevitably developed enormous strains and stresses, with the result that this has become a weak and unstable portion of the earth's crust in which readjustments of the rock masses are constantly occurring. Therefore, in this area there are numerous volcanoes and frequent earthquakes.

**References:**

Many submarine canyons are present on the continental shelf, but due to the small scale of the chart they cannot be shown. A seamount 76 fathoms below the surface exists in the vicinity of 42°N., 138°E., where the sides dip steeply to over 2,000 fathoms. If this same peak were on dry land, it would be 11,500 feet high. A submarine plateau exists in the broad portion of the Japan Sea, delineated by the 500–fathom contour. In the western portion of the Japan Sea there are a number of rises from the sea floor to within 100, 500, and 1,000 fathoms of the surface.

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## BOTTOM SEDIMENTS

The Japan Sea, being a genuine ocean basin, is floored primarily by mud. On the narrow continental shelves off Siberia and the Japanese islands, sand is the predominant sediment associated with other deposits of mud–and–sand, gravel (stony), and rock. Where the currents are strong, as in the Straits of Tsugaru, Korea, and Soya, bed rock, gravel, and coarse sand are to be found. A long strip of rock is found bordering the coast of Siberia, which might be expected since the Sikhote Alin mountain range is located here, and there are very few indentations along the coast. The two plateaus in the center of the sea are covered mainly with gravel and sand–and–mud.

Studies of bottom sediments have shown that both the nature and distribution of shallow sea deposits are affected by the depth of the sea, bottom topography, geologic history, and hydrographic conditions of the area. Erosion of the igneous rocks, especially the granitic types, has provided the source of sediments throughout geologic history. Bottom samples from the banks off the coast of Honshu are primarily Tertiary (70 million years) sedimentary rocks or igneous rocks which have penetrated the sedimentary rocks. The distribution of the sediments suggests that igneous rocks are exposed on the sea floor as they are on land, e.g., along the east coast of Siberia.

The basement of the bottom sediment layers consists of a Tertiary formation covered by a thin layer of sand and old gravel. Submergence to its present position is thought to have taken place after the deposition of the gravel layer. Gravel can be classified into old and new on the basis of time of origin. The distribution of old gravel varies with submarine topography, as that on the banks near latitude 40°N., while that of new gravel is determined by the bottom current, as along some of the straits and portions of the coast.

Coarse sands are usually found either at places of upwelling or where the current is strong, as at Tsugaru and Soya Straits. Where coarse and fine sands occur in strip–like one of the greatest series of submarine trenches known to exist in any ocean basin. Thus, from the highest mountain peaks of Japan to the lowest depths of the trenches, there is a difference of elevation of at least seven or eight miles. This immense range of elevation within a lateral distance of about a hundred miles inevitably developed enormous strains and stresses, with the result that this has become a weak and unstable portion of the earth's crust in which readjustments of the rock masses are constantly occurring. Therefore, in this area there are numerous volcanoes and frequent earthquakes.

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## BATHYMETRY

The bathymetry of this study cannot be characterized simply, because of the exceedingly complex nature both of the coast line and the sea bottom. The shoaler areas will be found in the Gulf of Tatary, in Tsushima Kaikyo, in Soya Kaikyo, and in a few embayments on the Korean and Chinese coasts. The remainder of the Sea of Japan is generally deep, with a steep gradient off the China coast and with sharp projections or possibly submerged islands scattered over the sea floor. The 1,500–fathom contour can be found less than 30 miles off the China coast, while there are areas with depths less than 500 fathoms in the middle of the sea. However, depths of over 2,000 fathoms are more usual over a large portion of the Japan Sea. The continental shelf is not very pronounced in many places since the 100–fathom curve can often be found about 10 or 15 miles offshore. Off the west coast of Honshu the bottom topography is further complicated by the presence of numerous banks and islands. The banks have steep, sloping sides and terraces between depths of 50 and 60 fathoms. Off the east coast of Honshu the bottom is also highly irregular and there is an exceptionally steep gradient where the depth drops off to more than 5,000 fathoms about 100 miles from shore, forming a deep trench.

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The basement of the bottom sediment layers consists of a Tertiary formation covered by a thin layer of sand and old gravel. Submergence to its present position is thought to have taken place after the deposition of the gravel layer. Gravel can be classified into old and new on the basis of time of origin. The distribution of old gravel varies with submarine topography, as that on the banks near latitude 40°N., while that of new gravel is determined by the bottom current, as along some of the straits and portions of the coast.

Coarse sands are usually found either at places of upwelling or where the current is strong, as at Tsugaru and Soya Straits. Where coarse and fine sands occur in strip–like patterns, as along the Korea and Sakhalin coasts, the formation is due probably to transportation by the currents of sediment (or mud) brought down by a river. Medium grained sand usually is deposited perpendicular to the direction of the current, while the distribution of fine grained sand is influenced by the topography.

While the distribution of gravel and coarse sand in the deposits of the continental shelf can be explained with reference to the geologic history, the distribution pattern of fine sand and mud depends on the depth of the sea, bottom topography, ocean currents, and the supply of sediments from the rivers.

Since most of the Sea of Japan is floored with mud, a classification of different types of mud based on colors has been established by the Japanese. Red clays are considered to be derived from the decomposition of volcanic ejecta or from colloidal clays that have been carried out in suspension from the land, since their mineral content is very close to that of the surrounding igneous rocks. Blue mud derives its character from organic matter and the alteration of the sulphate to ferric oxide. Black mud has a higher organic content and contains iron sulphide. Red mud contains ferrous oxide and indicates oxidizing conditions while blue mud indicates reducing conditions. A green mineral, glauconite, colors the green muds. Although these muds are classified by colors, other factors such as chemical composition are also considered, so that green or reddish–brown muds may sometimes be classified as blue muds. The distribution of these various muds is given in the "Bottom Sediment Chart of the Adjacent Seas of Japan," Nos. 7051–4, published by the Japanese Maritime Safety Board.

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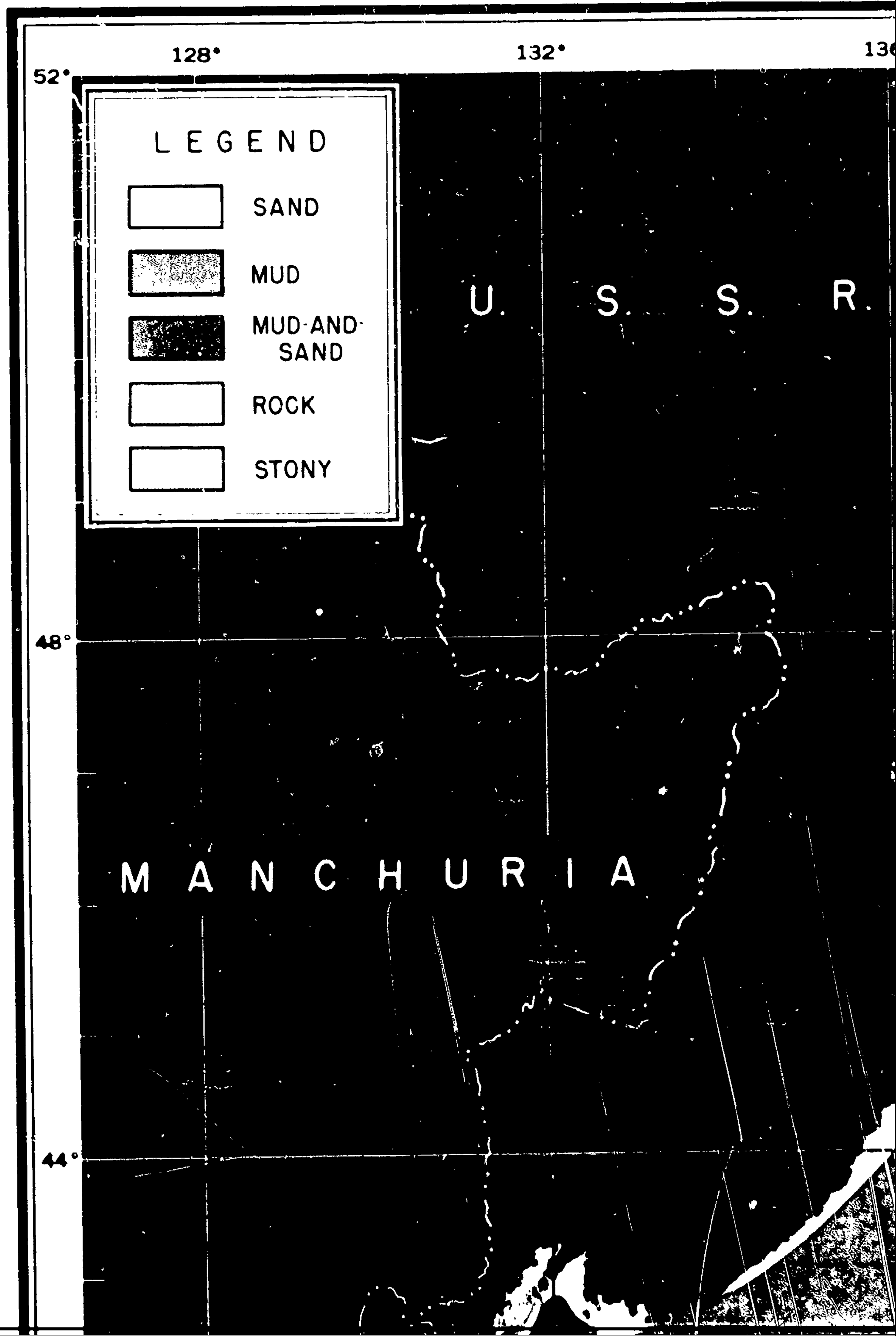
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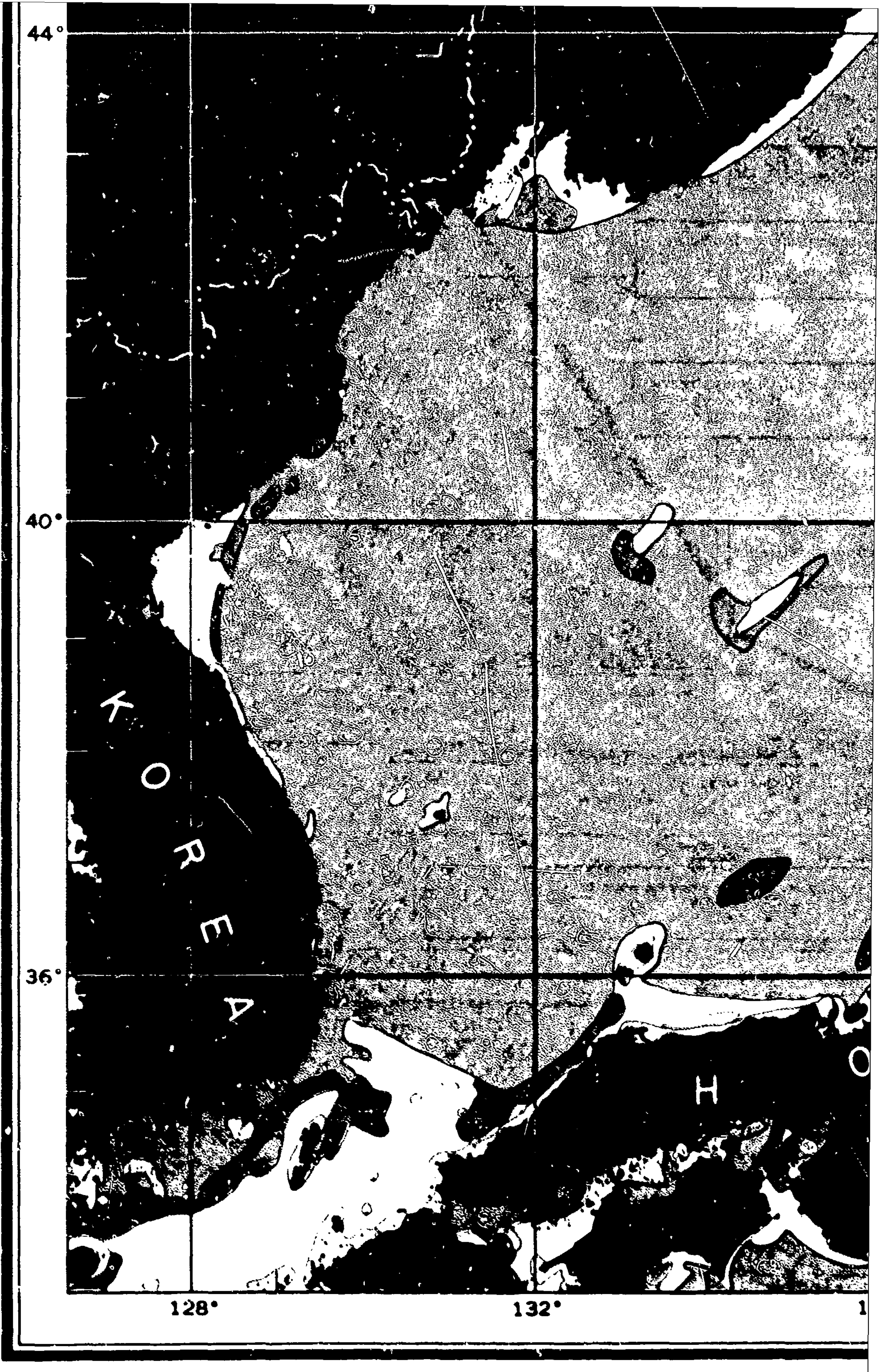

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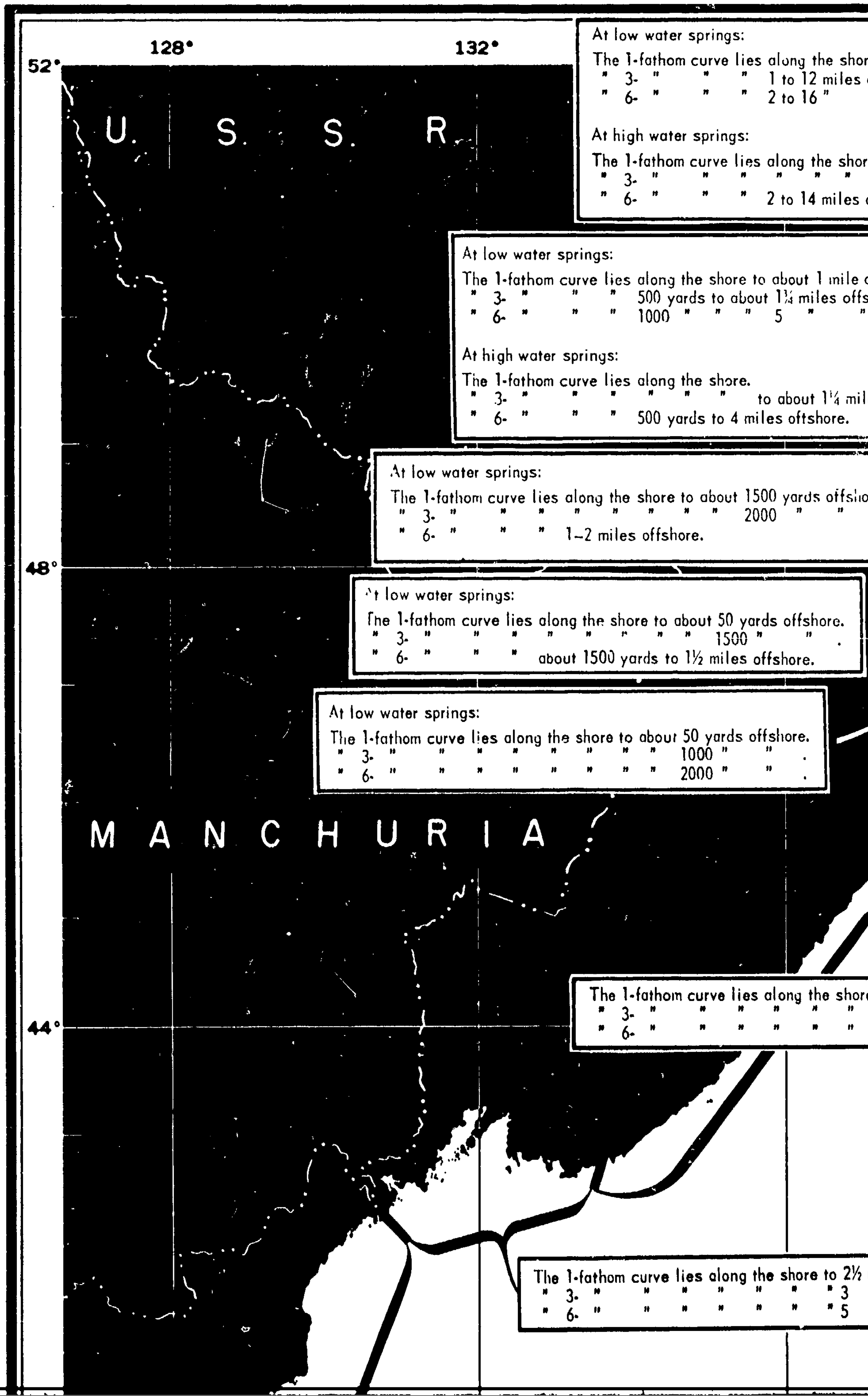

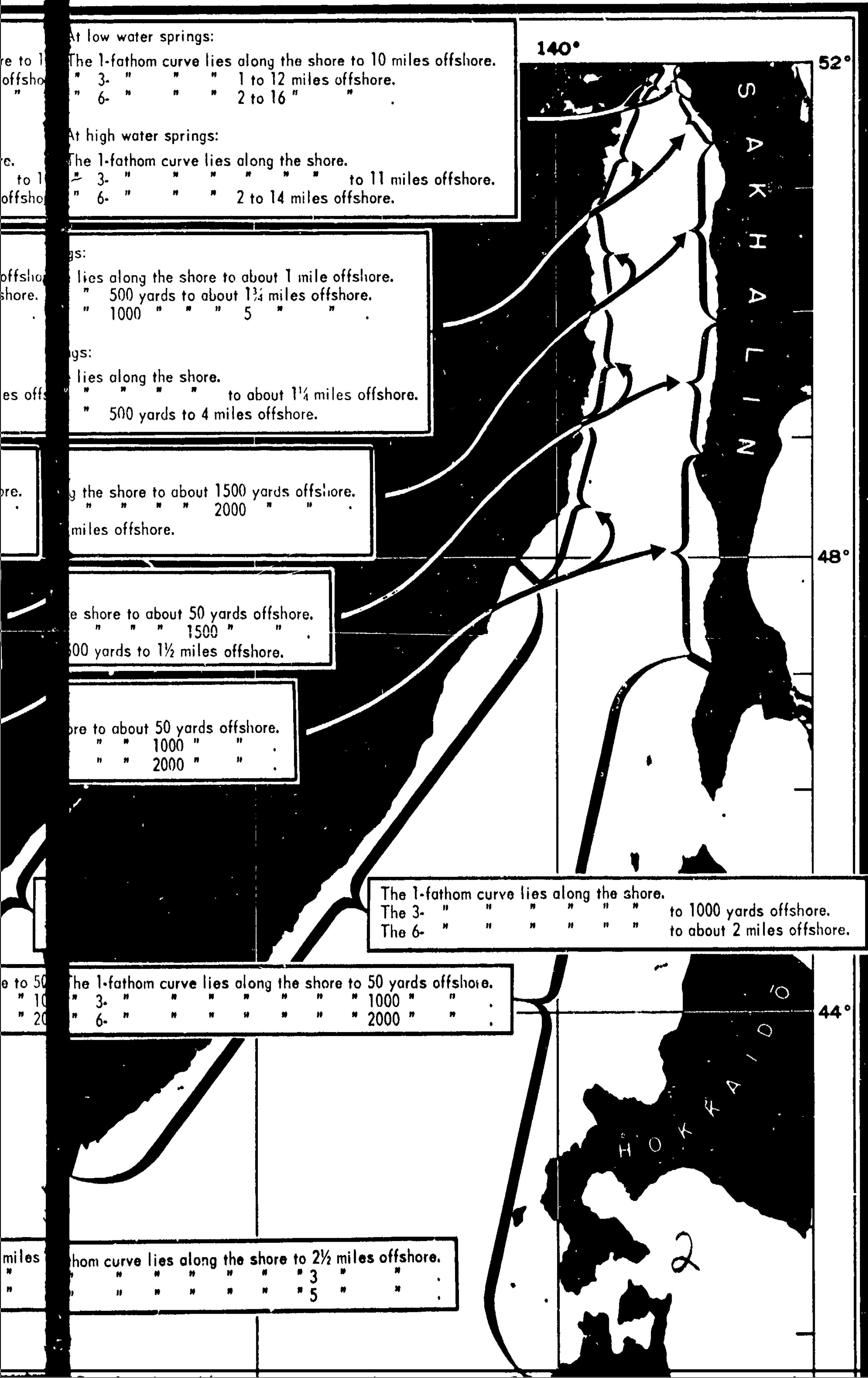
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SAKHALIN
HOKKAIDO
At low water springs:
The 1-fathom curve lies along the shore to 10 miles offshore.
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" 6- " " " 2 to 16 " " .
At high water springs:
The 1-fathom curve lies along the shore.
" 3- " " " " " " to 11 miles offshore.
" 6- " " " 2 to 14 miles offshore.
lies along the shore to about 1 mile offshore.
" 500 yards to about 1¾ miles offshore.
" 1000 " " " 5 " " .
lies along the shore.
" " " " to about 1¼ miles offshore.
" 500 yards to 4 miles offshore.
the shore to about 1500 yards offshore.
" " " " 2000 " " .
miles offshore.
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" " " 1500 " " .
00 yards to 1½ miles offshore.
re to about 50 yards offshore.
" " 1000 " " .
" " 2000 " " .
The 1-fathom curve lies along the shore.
The 3- " " " " " " to 1000 yards offshore.
The 6- " " " " " " to about 2 miles offshore.
The 1-fathom curve lies along the shore to 50 yards offshore.
" 3- " " " " " " " 1000 " " .
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hom curve lies along the shore to 2½ miles offshore.
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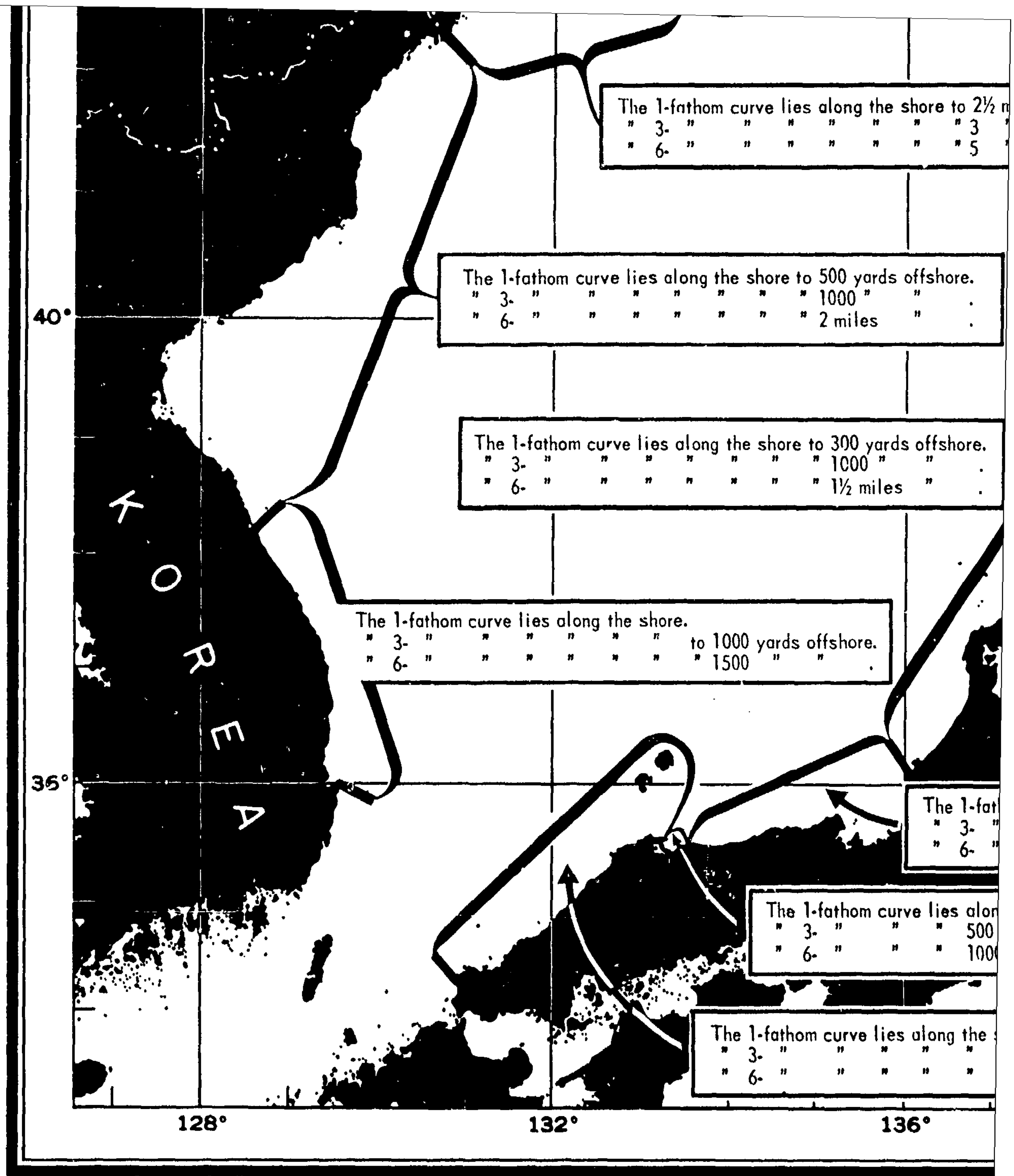


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the coast lines are rather steep, in many places the 6-fathom curve
most of area, the 1- and 3-fathom curves lie along the shore. The n
southern entrance to Tatar Strait where the 1-fathom curve lies up t
3-fathom curve up to 12 miles offshore, and the 6-fathom curve up t

From these charts estimates can be made of the distances offsh
of landing craft can be expected to hit bottom. Caution must be us
however, since the depths shown have been determined for fairly la
any specific location may vary considerably from the sector averag
tailed study.

The Gulf of Tatary is the only area in the Sea of Japan where th
1 foot. In most of the Japan Sea proper the rise is less than 0.5 fo
based on chart datum which in most instances is lowest low water.

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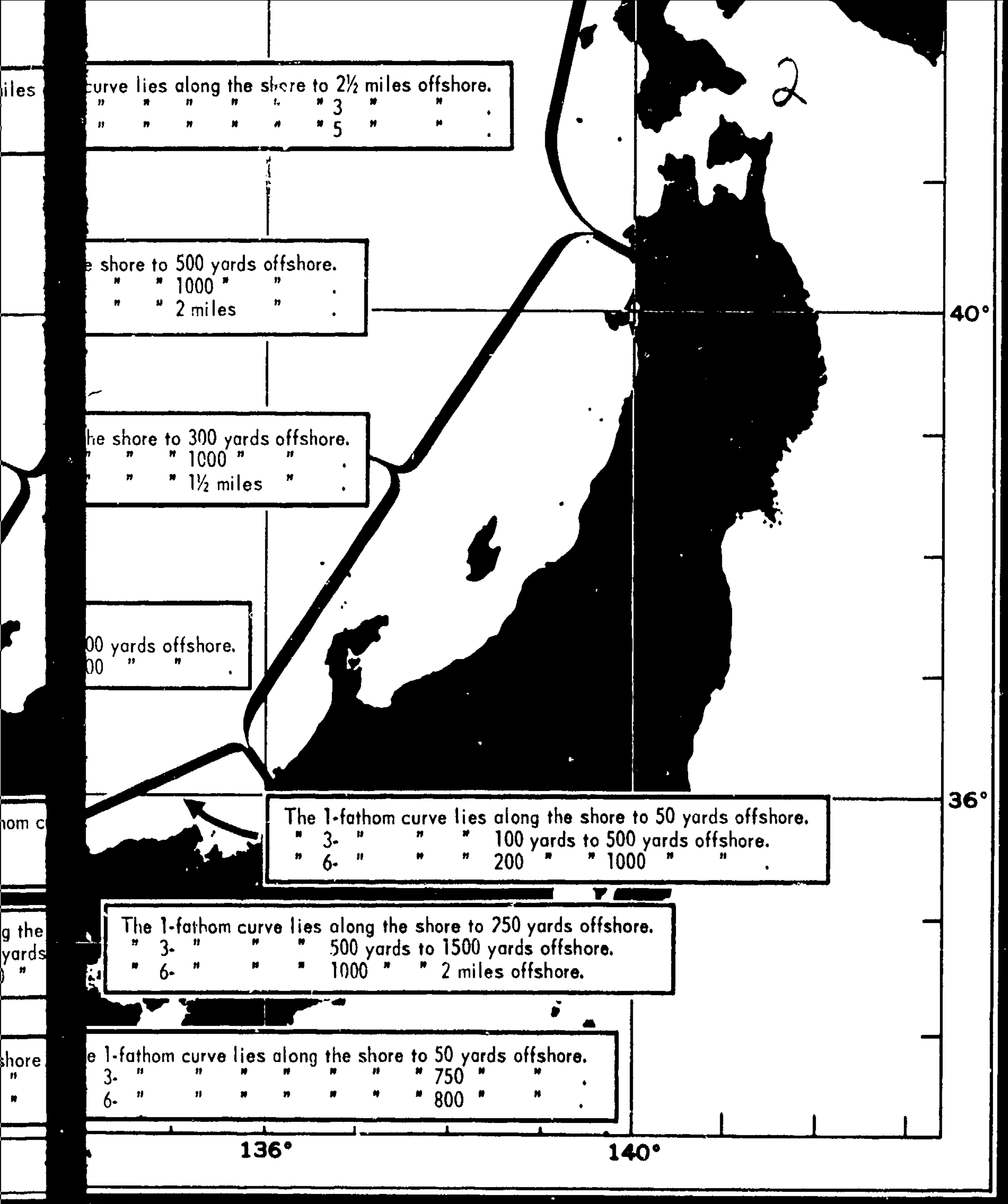
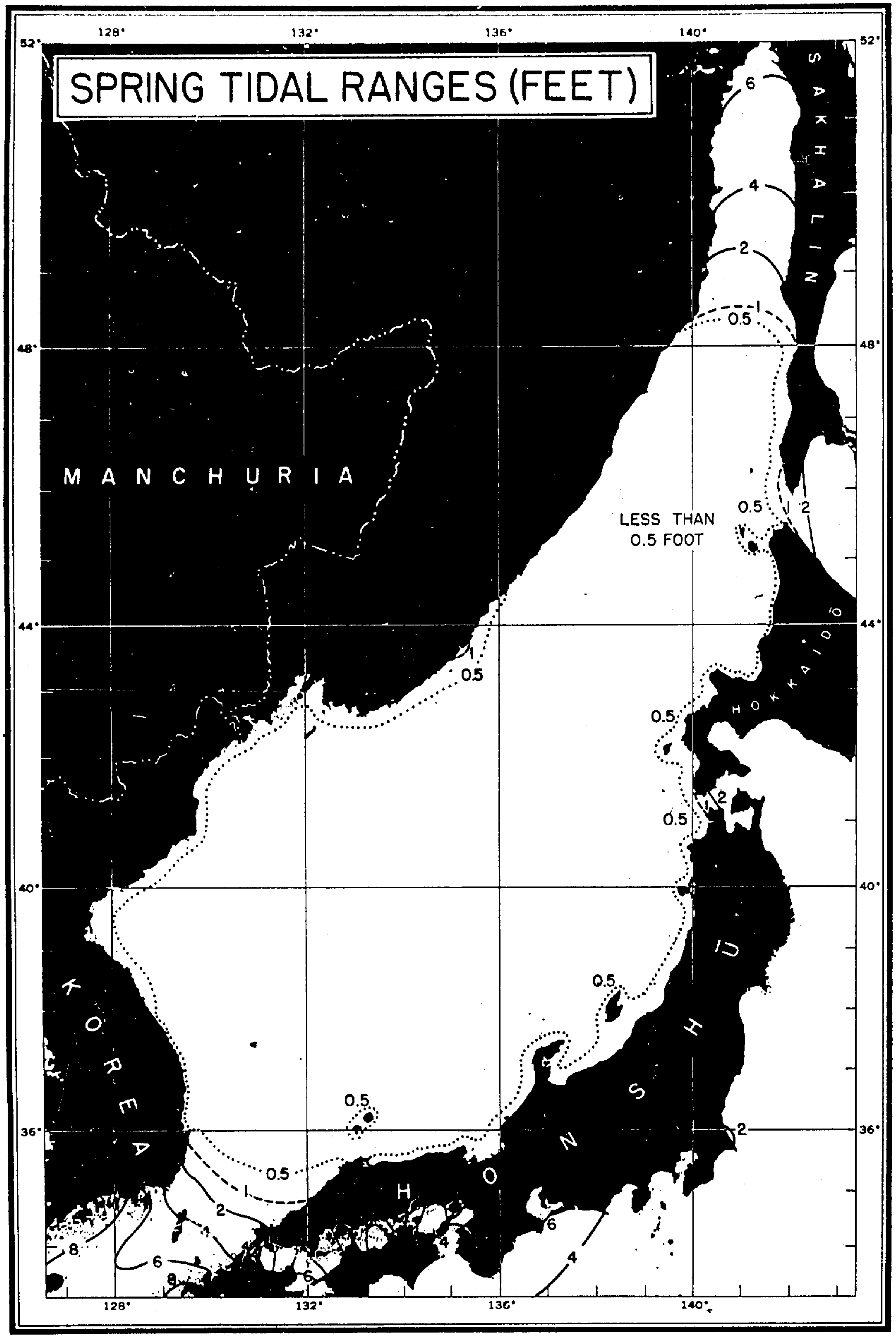



arts taken from hydrographic charts of the area. Since lies places the 6-fathom curve lies along the coast. In ajor lie along the shore. The major exceptions are at the 10 he 1-fathom curve lies up to 10 miles offshore, the 16 nd the 6-fathom curve up to 16 miles offshore.

ore a made of the distances offshore at which various types d in ottom. Caution must be used in employing these charts, ge s een determined for fairly large sectors. Conditions at s an bly from the sector averages and would require more de-

e sp the Sea of Japan where the spring rise is greater than t. he rise is less than 0.5 foot. The near-shore depths are nces is lowest low water.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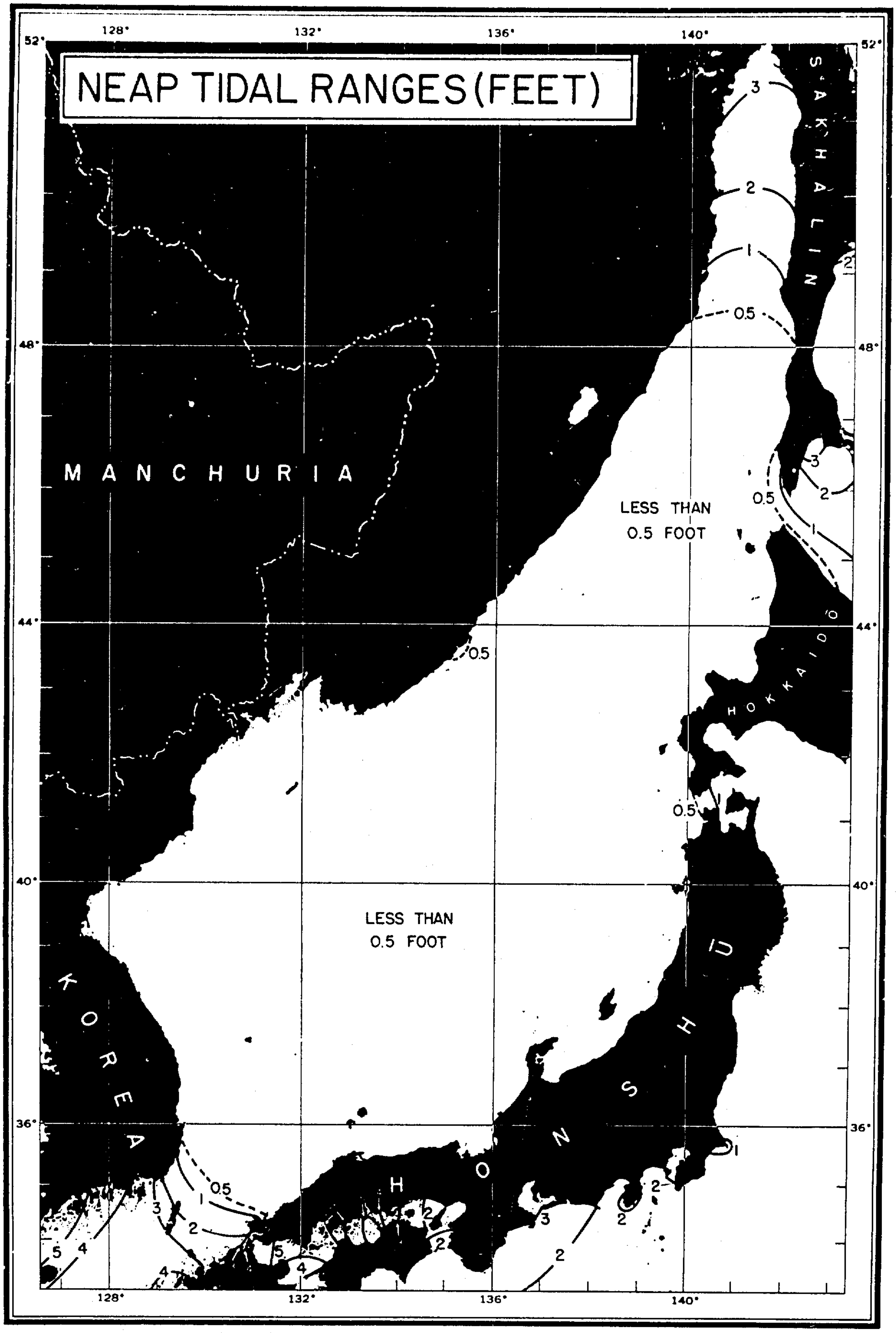
NEAP TIDAL RANGES (FEET)
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SAKHALIN
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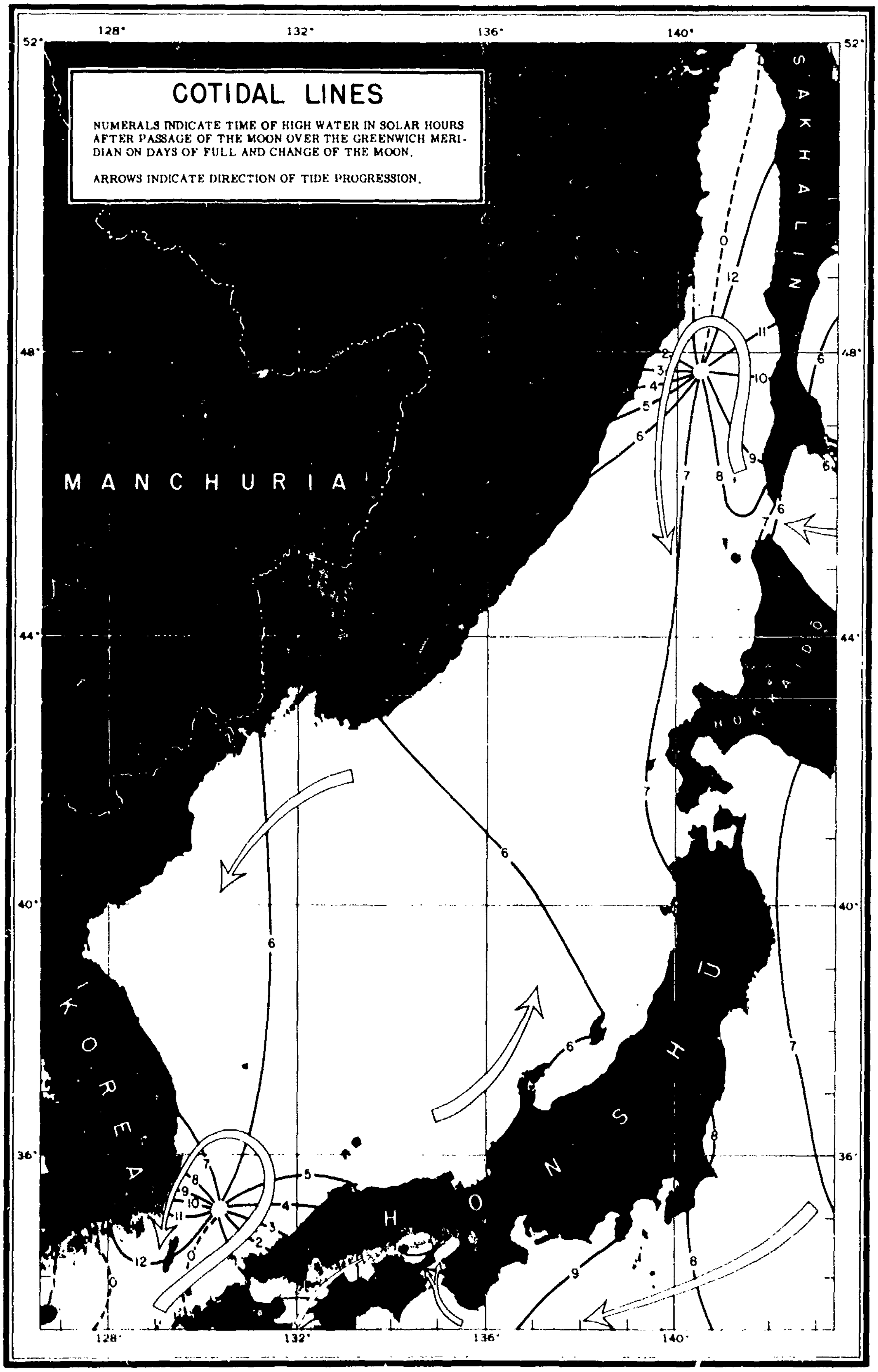
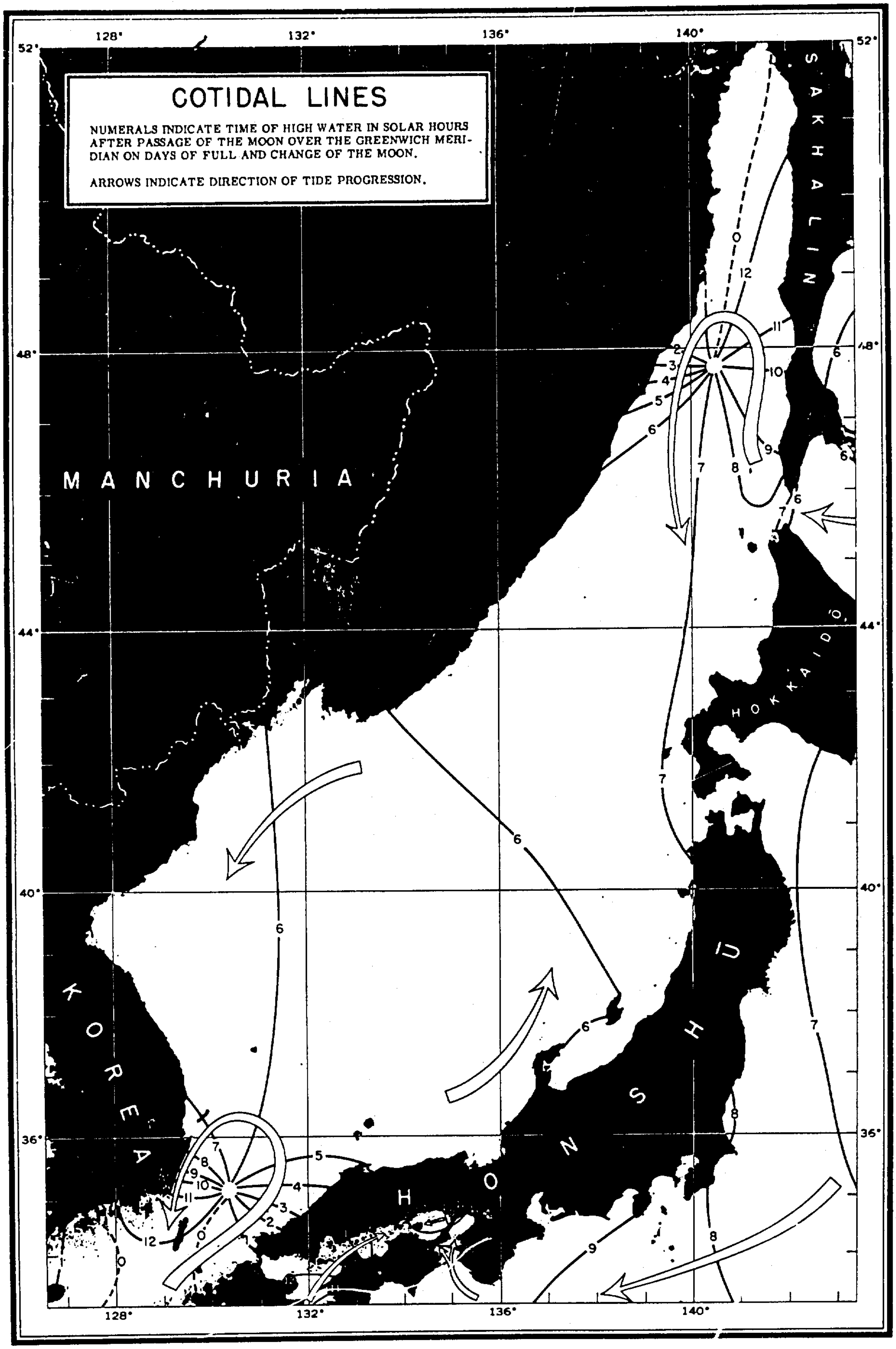

COTIDAL LINES
NUMERALS INDICATE TIME OF HIGH WATER IN SOLAR HOURS AFTER PASSAGE OF THE MOON OVER THE GREENWICH MERIDIAN ON DAYS OF FULL AND CHANGE OF THE MOON.
ARROWS INDICATE DIRECTION OF TIDE PROGRESSION.
MANCHURIA
KOREA
HONSHU
HOKKAIDO
SAKHALIN
128°
132°
136°
140°
52°
48°
44°
40°
36°


COTIDAL LINES
NUMERALS INDICATE TIME OF HIGH WATER IN SOLAR HOURS AFTER PASSAGE OF THE MOON OVER THE GREENWICH MERIDIAN ON DAYS OF FULL AND CHANGE OF THE MOON.
ARROWS INDICATE DIRECTION OF TIDE PROGRESSION.
128°
132°
136°
140°
52°
48°
44°
40°
36°
MANCHURIA
SAKHALIN
HOKKAIDO
HONSHU
KOREA

3

## SPRING AND NEAP TIDAL RANGES

Information on tidal ranges was taken from a variety of charts and publications of the U. S. Navy Hydrographic Office, the U. S. Coast and Geodetic Survey, the British Admiralty, and the Japanese Maritime Safety Agency.

The patterns of the spring and neap range lines are similar, although the spring ranges are about twice as great as the corresponding neap ranges. Spring ranges vary from 0.5 foot along all shores of the Sea of Japan proper to 7 feet in the Gulf of Tatary and to over 10 feet in the Inland Sea. Neap ranges vary from less than 0.5 foot along all shores of the Sea of Japan proper to 3 feet in the Gulf of Tatary to over 5 feet in the Inland Sea.

## COTIDAL LINES

Cotidal line information was taken from the "Bulletin of the Hydrographic Department," Imperial Japanese Navy, Volume VII, 1933. Conversion was made from lunar to solar time and corrected for the moon's transit of the Greenwich meridian.

The tide in most parts of the Sea of Japan is semidiurnal with small inequalities between heights of morning and afternoon tides. However, in the Inland Sea, along the southeast coast of Korea, the north coast of Hokkaido, and the south coast of Karafuto, inequalities in heights and times of consecutive tides are greater. In these areas the diurnal type of tide is predominant.

The diagram shows two nodal points where the range of tide is small and around which the tide progresses in the directions shown by the arrows.

References:


Great Britain, Hydrographic Department, "Admiralty Tide and Tidal Stream Tables, 1951, Pacific Ocean and Adjacent Seas," London, 1950.

Japan, Bulletin of the Hydrographic Department, Imperial Japanese Navy, Vol. VII, 1933.

————, Maritime Safety Agency, "Tide Tables," Vols. I and II, Tokyo, 1951.

U. S., Coast and Geodetic Survey, "Tide and Current Tables, Japan and China 1951," Washington, D. C., 1950.

————, Hydrographic Office, "Marine Geography of Korean Waters," (H. O. Pub. No. 752), Washington, D. C., 1951.

# COASTAL GEOG

The coast is very irregular and much indented with bays, gulfs, and coves that form many fine natural harbors and anchorages. However, numerous dangers are found in the gulfs and bays and off the beaches. The coast is rugged and steep-to in most parts and consists of medium high ranges of grass and tree covered hills. This is the most heavily populated section of the Russian Pacific area. At some points cultivated fields are visible from seaward. Surveys and chart coverage are fair. Detailed information in sailing directions and other navigational publications, although up to date, is sufficient for approach only to the more important points.

The coast
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tions is fair.

This very regular coast line has few harbors except in the extreme southern portion and is clear of dangers to distances of 5 miles from shore. In general, the coast is high, rugged, steep-to, heavily wooded, fronted with intermittent sand or gravel beaches, particularly at points where streams reach the coast, and backed by mountain ranges close inland. There are few natural landmarks recognizable from the sea. The coastal zone is unpopulated except at a few points. Surveys and chart coverage are poor. Detailed information in sailing directions and other navigational publications, although up to date, is sketchy and adequate for approach only at isolated points.

The coast is irregular, numerous bays and gulfs indenting the coast. A number of natural harbors and anchorages are found in this area. The coast presents a bold, rocky appearance from the sea and is in general steep-to, the 100-fathom curve lying 5 to 10 miles offshore. In some sectors underwater dangers exist as far as 12 miles offshore. Therefore, vessels should not cross the 100-fathom curve at night or in thick weather. Numerous sand and gravel beaches fringe the very narrow coastal plain and high mountains lie close inland. Low brush, grass, and cultivated fields cover the coastal plain and hills. Surveys are good and chart coverage is fair.

# L GEOGRAPHY

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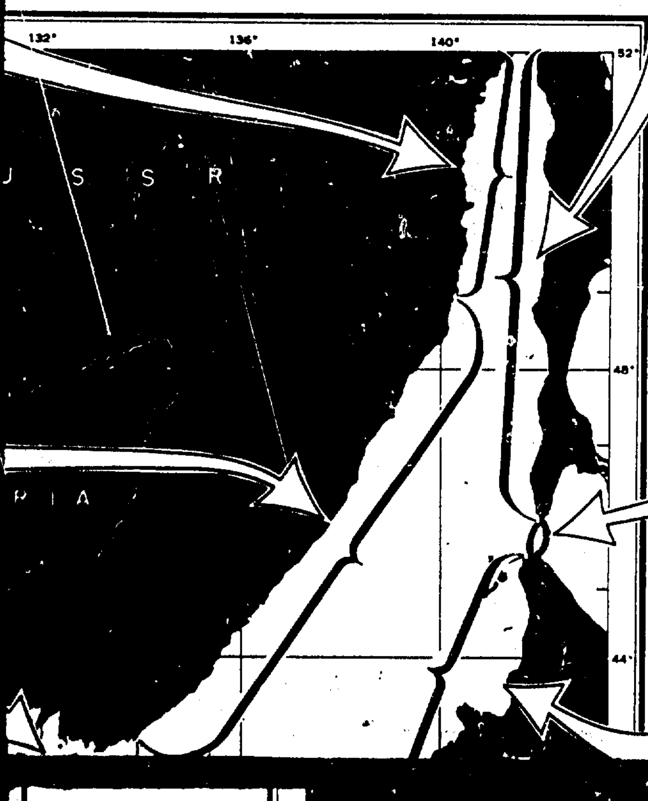
The coast is regular, consisting of heavily wooded hills fronted by intermittent, narrow, sand or gravel beaches and backed by medium high mountains close inland. There are no natural or protected harbors for large vessels and there are exceptionally few natural landmarks recognizable from the sea. The coast is clear of dangers to a distance of 1 mile offshore while the 5-fathom curve lies from 1/4 to 2 miles offshore. The coastal area is sparsely populated. The survey and chart coverage is fair. Detailed information in sailing directions and other navigational publications is fair.

Sōya Kaikyō is a short strait about 23 miles wide and 23 to 80 fathoms deep in mid-channel. It is clear of dangers except for a long rock lying north of the channel. Currents are strong and complex. The coast features four conspicuous capes that serve as excellent landmarks. Fog, snow, and ice constitute the principal hazards in passage. A wealth of detailed information for passage of the strait is published in charts, sailing directions, and other related navigational publications.




The coast is high, rugged, and fairly regular in most parts. The 5-fathom curve lies 1/4 to 1 mile offshore and the coast is clear of dangers to a distance of 3 miles offshore. Narrow sand or rocky beaches backed by cliffs 30 to 200 feet high, interspersed with cliffs that rise directly from the sea, are the rule with the exception of a few points where alluvial plains have been formed by the larger streams. The rugged, hilly coast is backed from 1 to 4 miles inland by heavily wooded mountains indenting the coast. A number of natural harbors and anchorages are found in this area. The coast presents a bold, rocky appearance from the sea and is in general steep-to, the 100-fathom curve lying 5 to 10 miles offshore. In some sectors underwater dangers exist as far as 12 miles offshore. Therefore, vessels should not cross the 100-fathom curve at night or in thick weather. Numerous sand and gravel beaches fringe the very narrow coastal plain and high mountains lie close inland. Low brush, grass, and cultivated fields cover the coastal plain and hills. Surveys are good and chart coverage is fair. Detailed information in sailing directions and navigational publications is adequate for approach to the more important points.


The coast line is irregular, being much indented with open bays and gulfs that are protected only from the west and northwest. The water is clear of dangers to a distance of 5 miles offshore. In general, the coast is high, rugged, steep-to, heavily wooded, fronted near streams and bay heads with low sand or gravel beaches, and backed close inland by high wooded mountain ranges. The coastal zone is unpopulated except in isolated places. Mountains in close vicinity of capes are considered the best landmarks but identification is difficult for the stranger. Surveys are not too dependable and chart coverage is poor. Detailed information in sailing directions and other navigational publications, although up to date, is sketchy and adequate for approach at only a few points.

The coast here is bold, rocky, steep-to, and regular. No protected harbors or anchorages are available. Vessels coasting in this area should remain in 100 fathoms of water, particularly at night or in thick weather. The very narrow coastal plain, backed by high mountains close inland, is wider south of the 37th parallel where the mountains are lower and the coast has a less rugged appearance. Since the forests have been destroyed in this sector, the mountains and hills present a barren appearance. Survey is good and chart coverage is fair. Detailed information in sailing directions and other navigational publications is adequate.

Korea Strait is about 100 miles wide, 40 to 100 fath
deep, and about 120 miles long. It is divided into an
eastern and western channel by the high, rocky, and bo
Tsushima group which lies in the middle of the strait.
Both the eastern and western channels are about 25 mi
wide in the fairways, have least depths of 40 fathoms.
are clear of dangers to a distance of 4 miles offshore.
The currents in the strait are not of excessive strengt
and visibility is excellent throughout most of the year.
Wind and weather are hazardous only during the typho
season. Surveys, charts, and navigational publications
cover the area in much detail and are sufficiently accu
for all purposes.


The coast is high, rugged, and fairly regular in most parts. The 5-fathom curve lies 1/4 to 1 mile offshore and the coast is clear of dangers to a distance of 3 miles offshore. Narrow sand or rocky beaches backed by cliffs 30 to 200 feet high, interspersed with cliffs that rise directly from the sea, are the rule with the exception of a few points where alluvial plains have been formed by the larger streams. The rugged, hilly coast is backed from 1 to 4 miles inland by heavily wooded mountains broken only by narrow, steep valleys. The western coast is not densely populated and contains few good harbors. Surveys and chart coverage are excellent. Sailing directions and other navigational publications contain sufficient detailed information for all practical purposes.

Tsugaru Kaikyō is about 55 miles long, from 10 to 30 miles wide, and more than 100 fathoms deep in mid-channel. There are no dangers near the fairways. Tides and currents are complex; maximum speed is about 6 knots. Prominent capes serve as excellent landmarks. Wind and weather are not unduly hazardous except for heavy snowstorms in midwinter. The charts, sailing directions, and other navigational publications furnish all the details necessary for passage of the strait.

ait is about 100 miles wide, 40 to 100 fathoms
it 120 miles long. It is divided into an
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rn and western channels are about 25 miles
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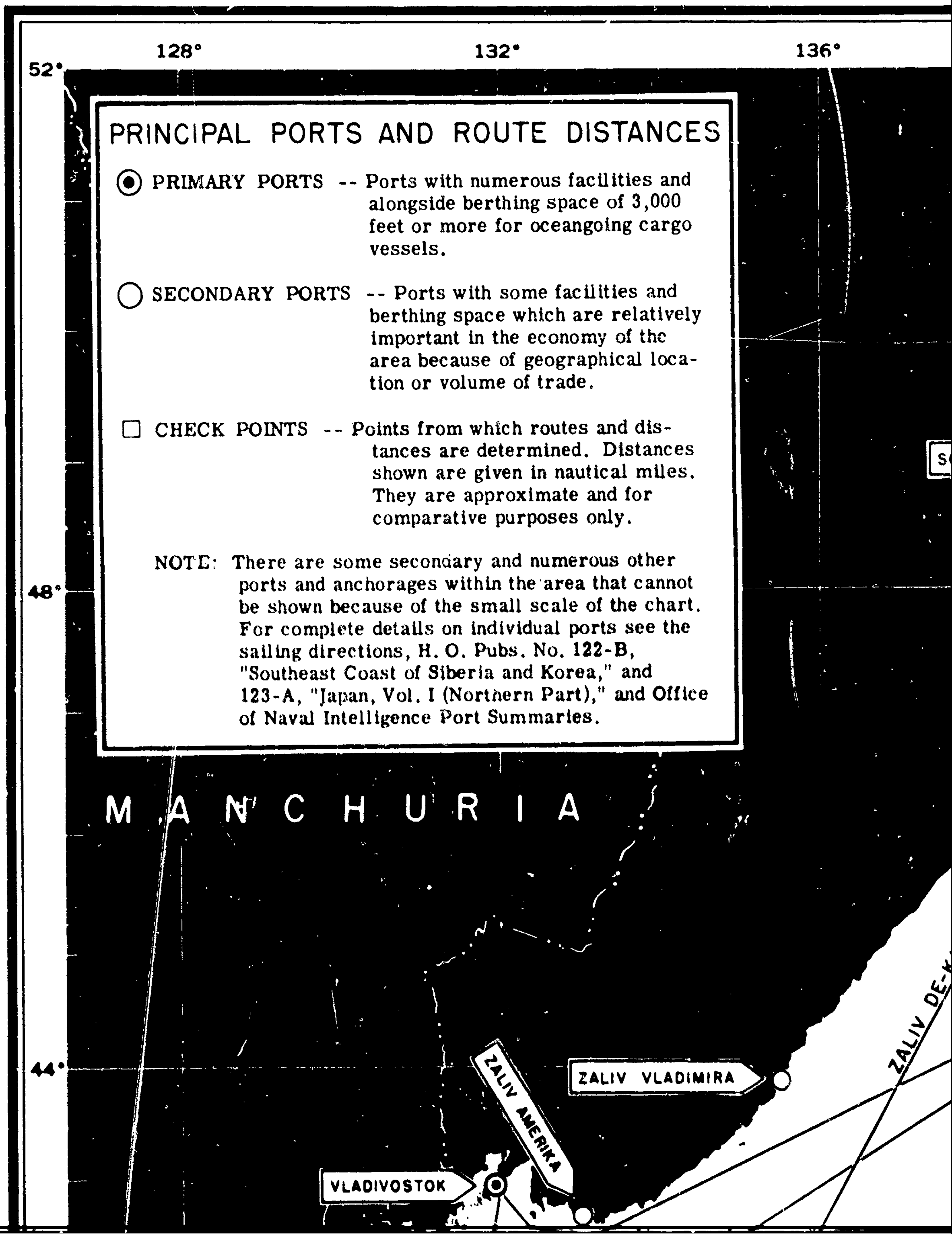
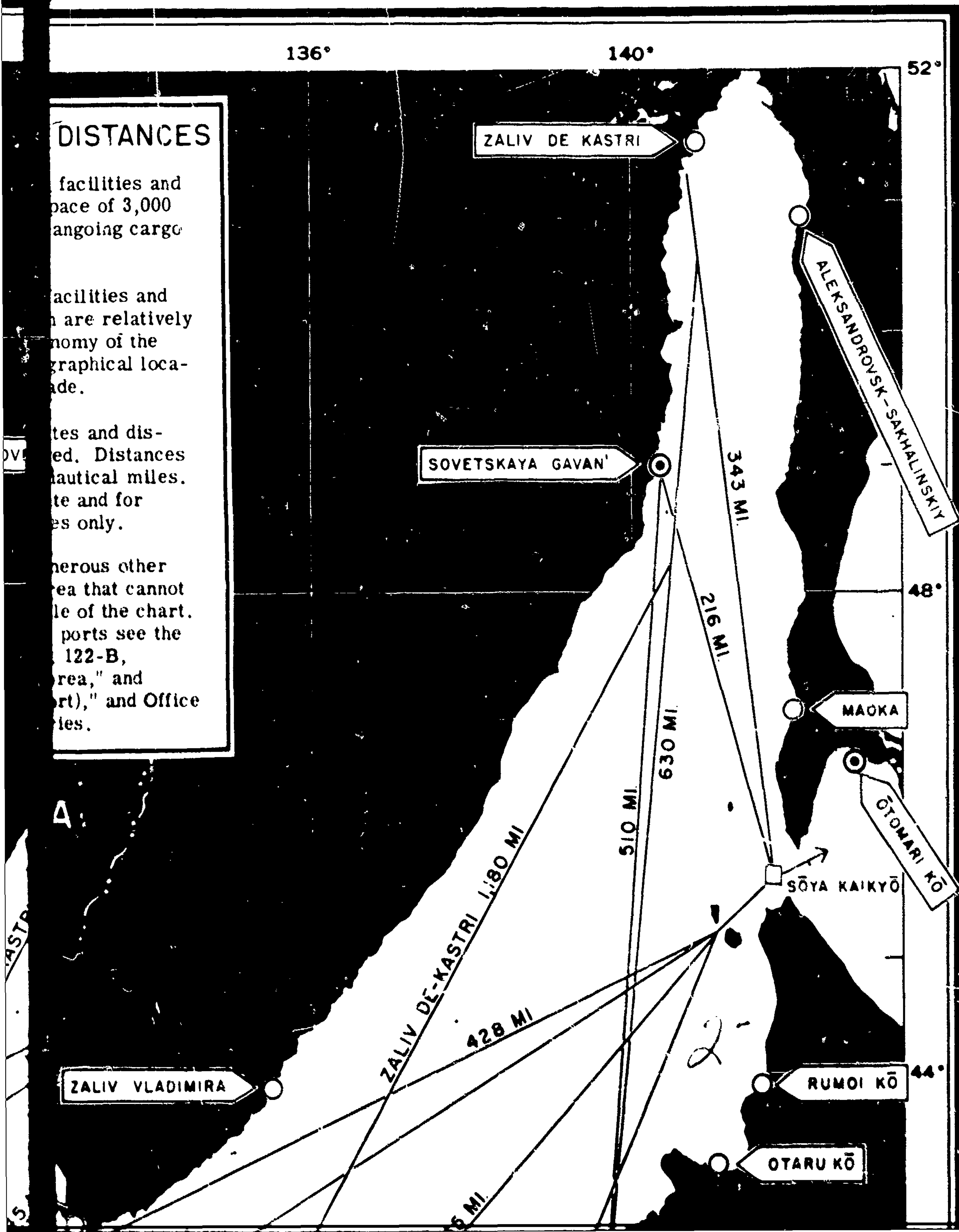
angers to a distance of 4 miles offshore.
n the strait are not of excessive strength
is excellent throughout most of the year.
her are hazardous only during the typhoon
ys, charts, and navigational publications
in much detail and are sufficiently accurate
es.

The coast line is regular with only a few indentations and good natural harbors. The 100-fathom curve lies from 10 to 30 miles offshore and the coast is clear of dangers to a distance of 10 miles offshore except in the vicinity of Oki Rettō and Noto Hantō. The coast itself is high, consisting of low hills fronted in places by narrow sand or gravel beaches and backed by heavily wooded mountains close inland. The coastal area is in general heavily populated, numerous fishing villages and small cities being scattered throughout its length. The surveys and chart coverage are excellent. Detailed information on charts, in sailing directions, and in other navigational publications is excellent.


128°
132°
136°
52°
48°
44°
PRINCIPAL PORTS AND ROUTE DISTANCES
PRIMARY PORTS -- Ports with numerous facilities and alongside berthing space of 3,000 feet or more for oceangoing cargo vessels.
SECONDARY PORTS -- Ports with some facilities and berthing space which are relatively important in the economy of the area because of geographical location or volume of trade.
CHECK POINTS -- Points from which routes and distances are determined. Distances shown are given in nautical miles. They are approximate and for comparative purposes only.
NOTE: There are some secondary and numerous other ports and anchorages within the area that cannot be shown because of the small scale of the chart. For complete details on individual ports see the sailing directions, H. O. Pubs. No. 122-B, "Southeast Coast of Siberia and Korea," and 123-A, "Japan, Vol. I (Northern Part)," and Office of Naval Intelligence Port Summaries.
M A N C H U R I A
ZALIV VLADIMIRA
ZALIV AMERIKA
VLADIVOSTOK



136°
140°
52°
48°
44°
DISTANCES
facilities and
pace of 3,000
angoing cargo
acilities and
are relatively
nomy of the
graphical loca-
de.
tes and dis-
ed. Distances
autical miles.
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es only.
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ports see the
122-B,
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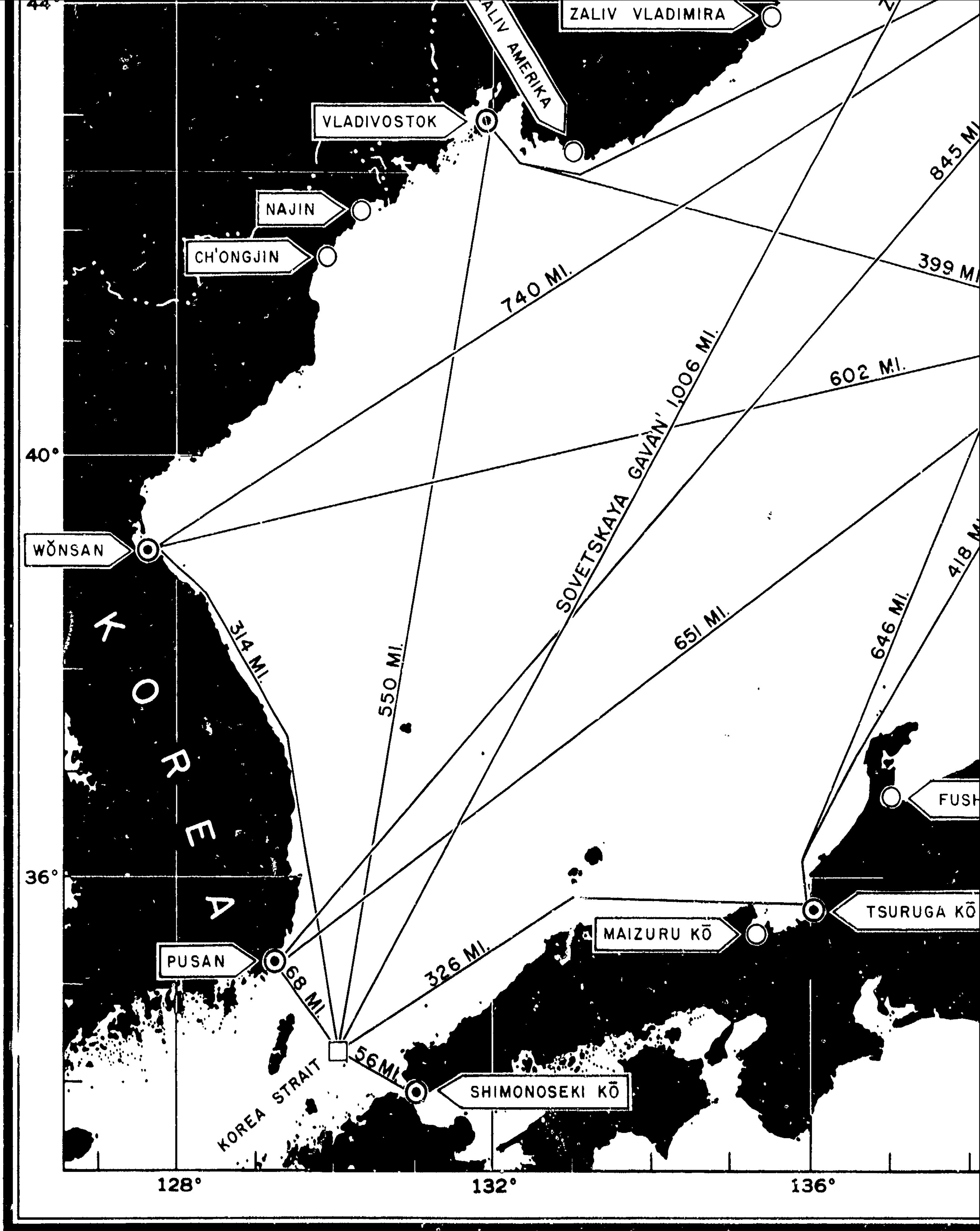
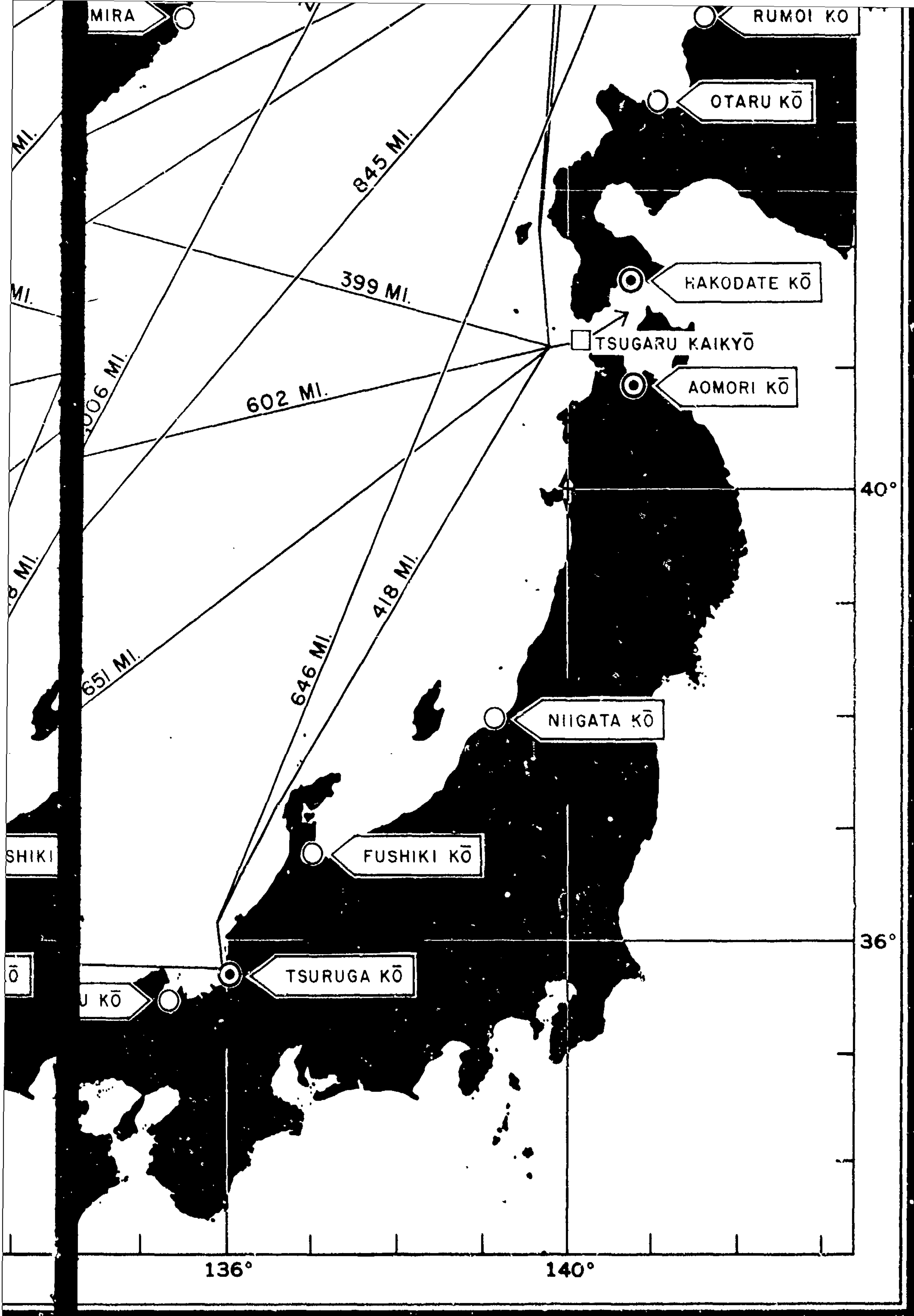
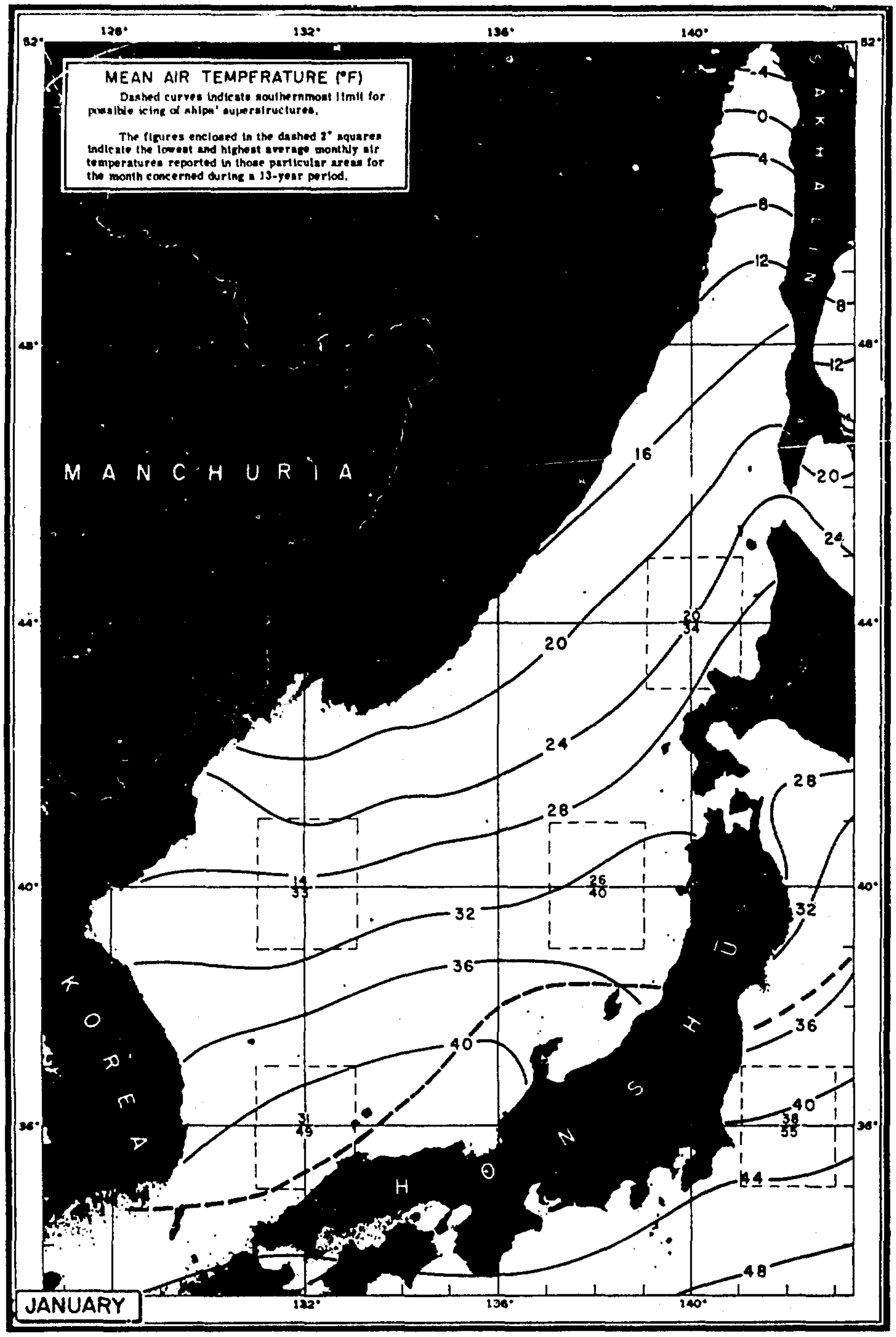
ies.
ZALIV DE KASTRI
ALEKSANDROVSK-SAKHALINSKIY
SOVETSKAYA GAVAN'
343 MI.
216 MI.
MAOKA
ŌTOMARI KŌ
630 MI.
510 MI.
SŌYA KAIKYŌ
ZALIV DE-KASTRI 1,180 MI
428 MI
ZALIV VLADIMIRA
RUMOI KŌ
OTARU KŌ



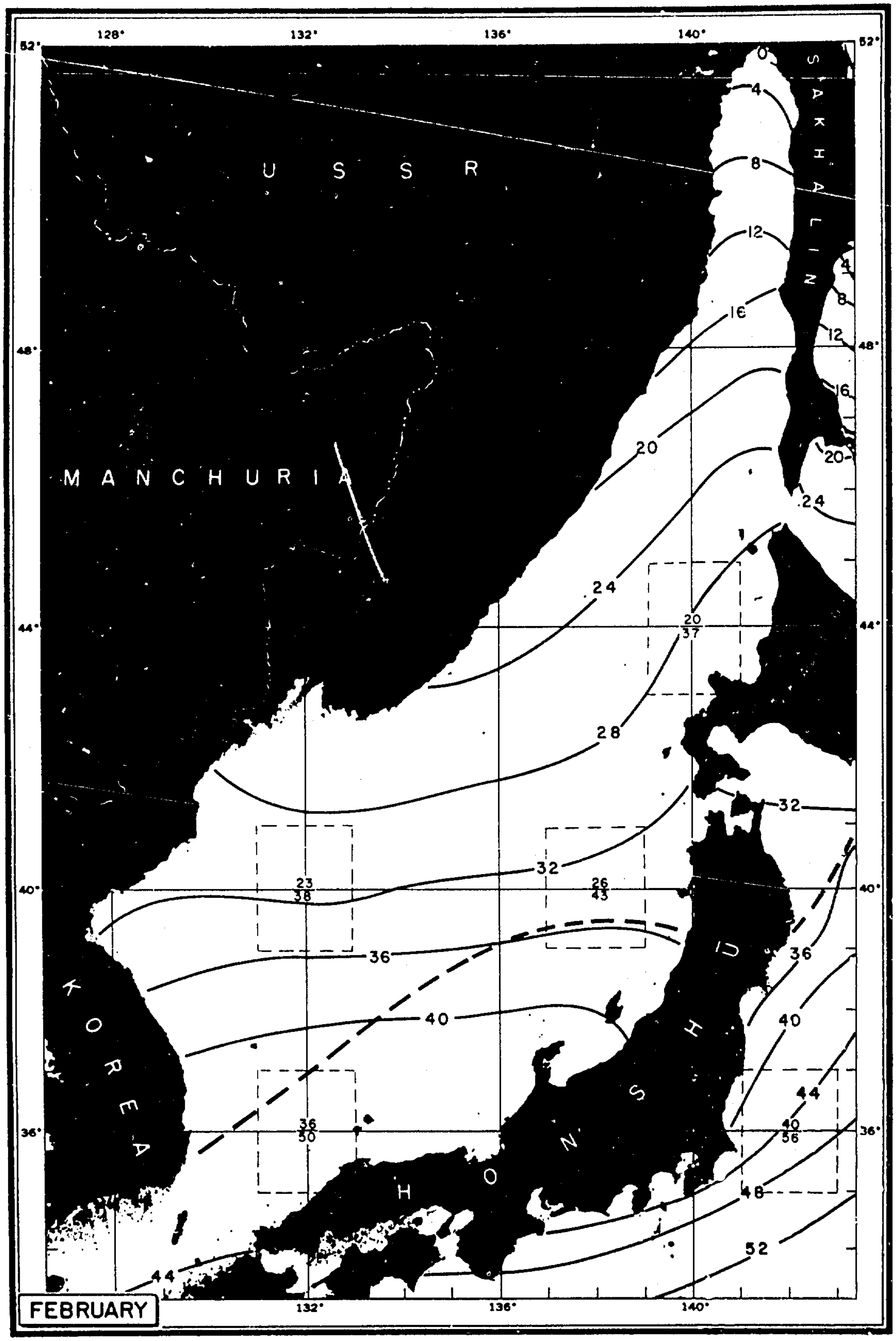
ZALIV VLADIMIRA
ZALIV AMERIKA
VLADIVOSTOK
NAJIN
CH'ONGJIN
WŎNSAN
KOREA
PUSAN
KOREA STRAIT
SHIMONOSEKI KŌ
MAIZURU KŌ
TSURUGA KŌ
845 MI.
399 MI.
740 MI.
602 MI.
SOVETSKAYA GAVAN' 1,006 MI.
418 MI.
314 MI.
550 MI.
651 MI.
646 MI.
326 MI.
68 MI.
56 MI.
44°
40°
36°
128°
132°
136°

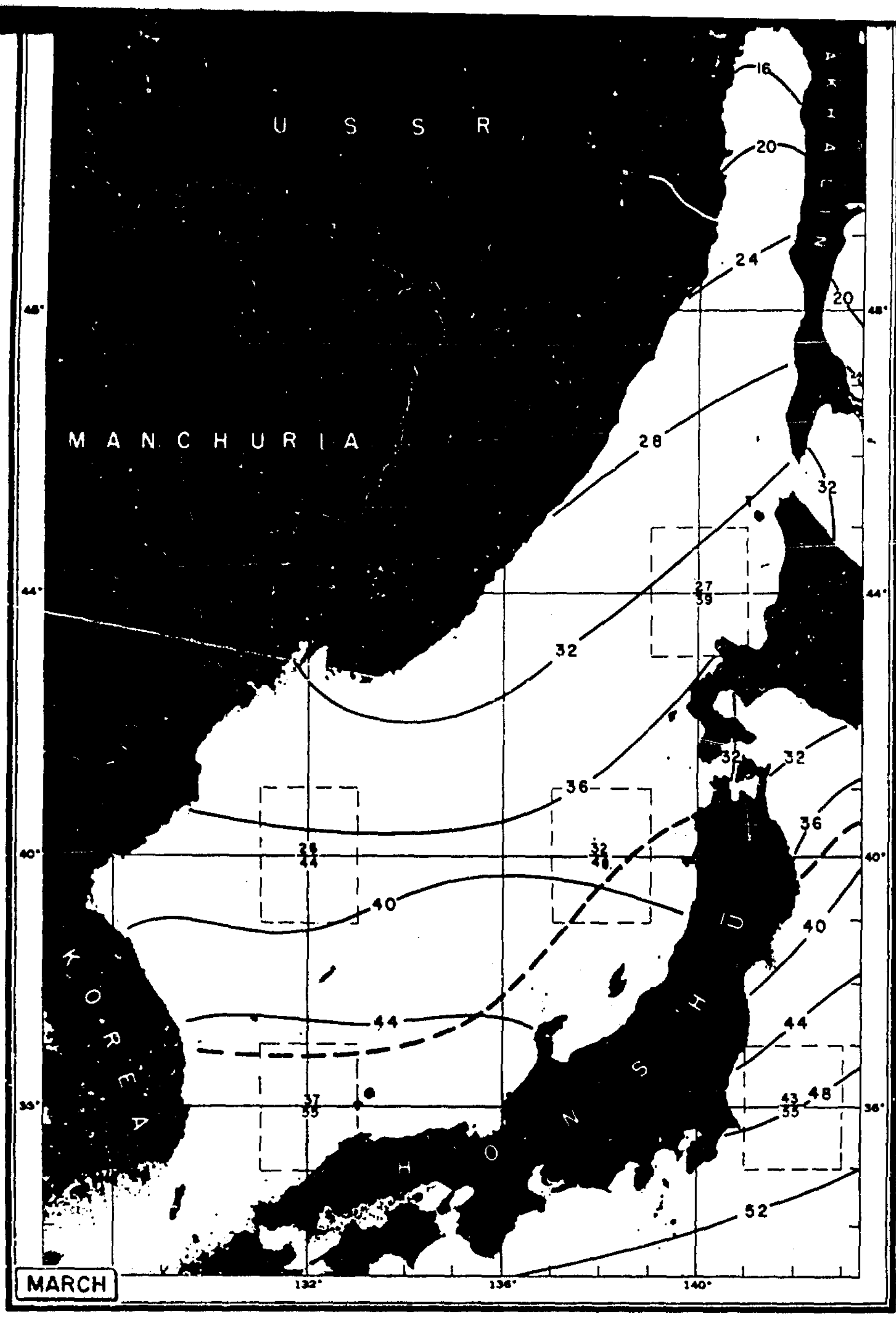

3


MIRA
RUMOI KO
OTARU KŌ
845 MI.
399 MI.
HAKODATE KŌ
TSUGARU KAIKYŌ
AOMORI KŌ
602 MI.
40°
418 MI.
646 MI.
651 MI.
NIIGATA KŌ
FUSHIKI KŌ
SHIKI
36°
TSURUGA KŌ
U KŌ
136°
140°


MEAN AIR TEMPFRATURE (°F)
Dashed curves indicate southernmost limit for possible icing of ships' superstructures.
The figures enclosed in the dashed 2° squares indicate the lowest and highest average monthly air temperatures reported in those particular areas for the month concerned during a 13-year period.
MANCHURIA
KOREA
SAKHALIN
HONSHU
128°
132°
136°
140°
52°
48°
44°
40°
36°
-4
0
4
8
12
16
20
24
28
32
36
40
44
48
20/34
14/33
26/40
31/49
38/55
JANUARY

RESTRICTED

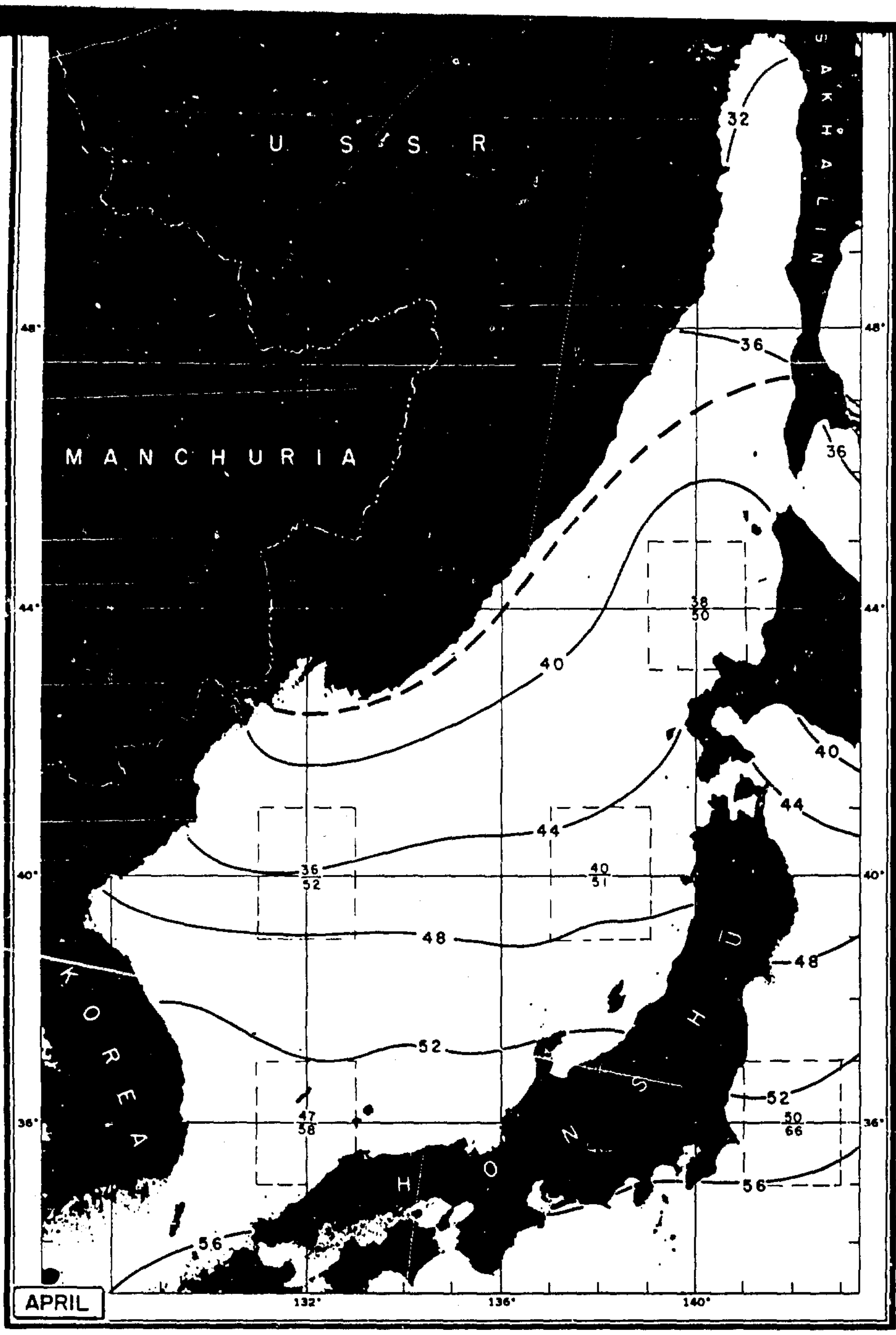

U S S R
MANCHURIA
SAKHALIN
KOREA
HONSHU
FEBRUARY
128°
132°
136°
140°
52°
48°
44°
40°
36°
0
4
8
12
16
20
24
28
32
36
40
44
48
52
20
37
23
38
26
43
36
50
40
56




## AIR TEMPERATURE

The remarkable feature of the charts for this period is the increase in temperature along the same latitude as one goes from west to east across the Sea of Japan. In January the temperature gradient ranges from 44°F. on the southern tip of Honshu to 26°F. on the northern tip of Hokkaido, as compared to 40°F. off the tip of Korea and 16°F. at 45°N. on the Russian coast. Two main factors contribute to the southwest-northeast direction of the isotherms in the Sea of Japan. First, the warm, north-setting Tsushima Current 60 miles off the west coast of Japan influences the cold air coming off the mainland. Second, a further modification of the air temperature takes place by passage of the air over the water of the Sea of Japan, which is normally warmer than land masses during this season. A similar temperature discontinuity is observable across the Sea of Japan throughout the year with the possible exception of September. As a result, ice conditions along the coast of Siberia are the severest throughout the entire Sea of Japan.

The air temperature gradient off the east coast of Japan is similar to that off the west coast. However, as the air travels eastward from Japan it is warmed by the Kuroshio, so that the temperature increases rapidly. This situation is present throughout

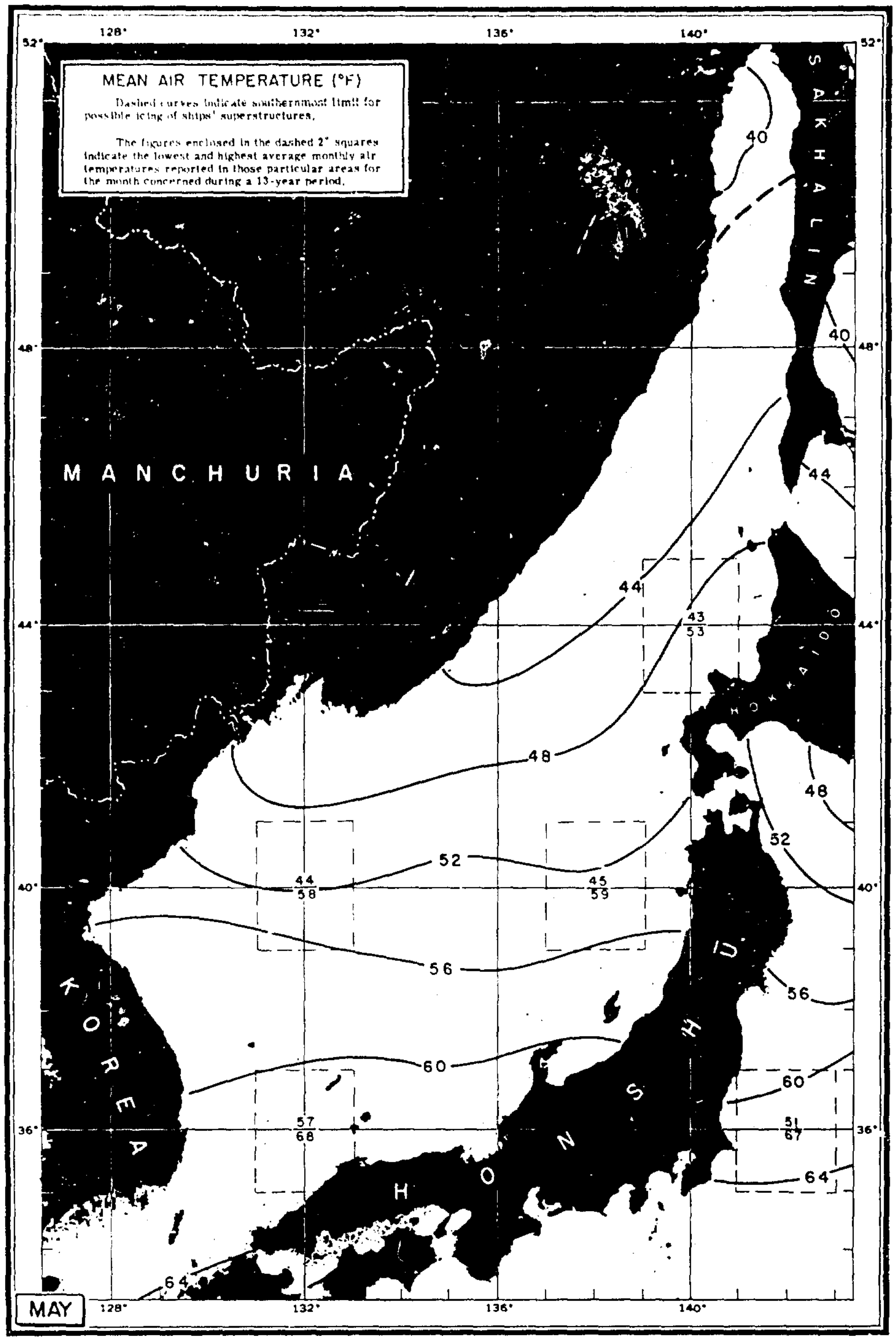


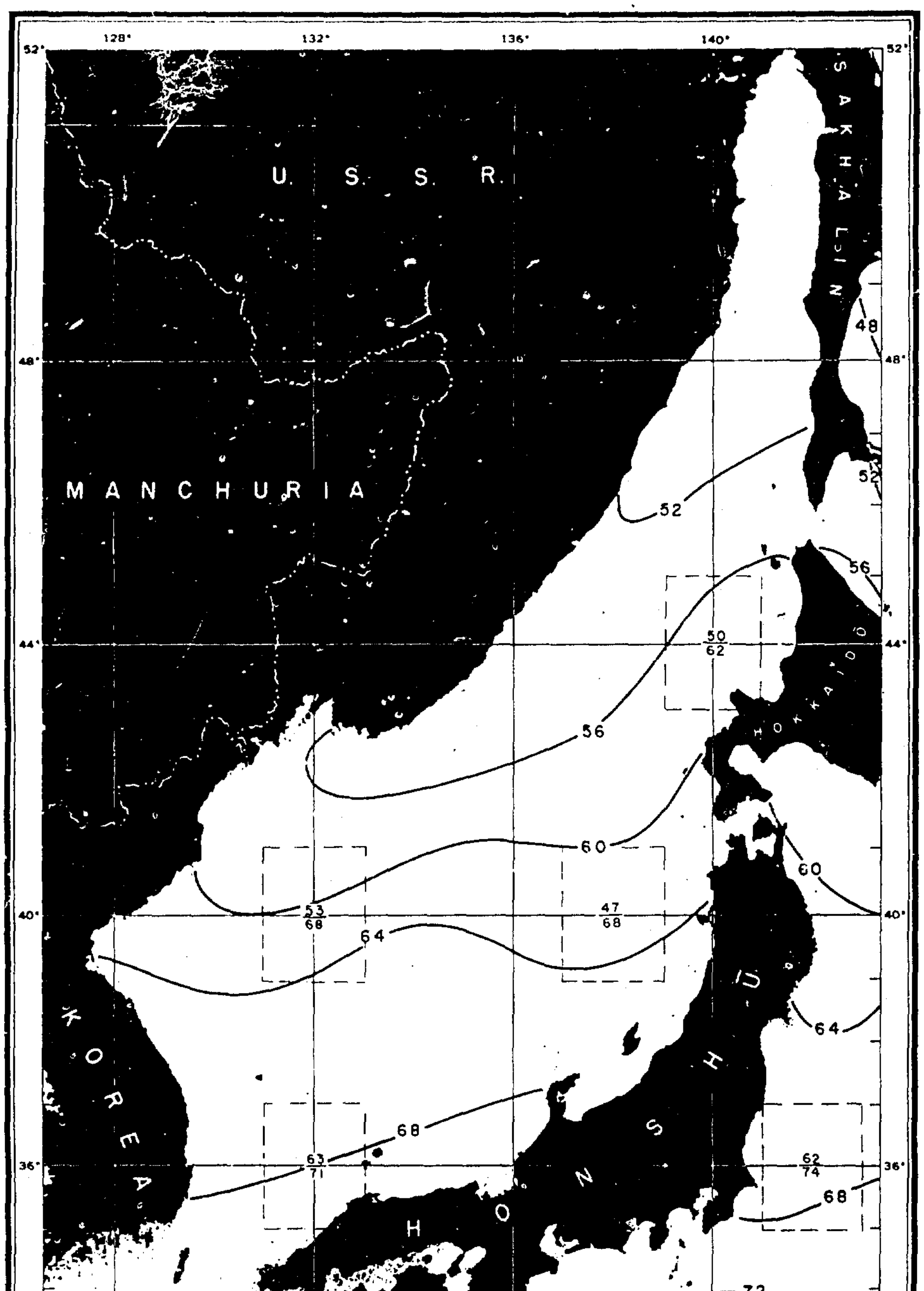

almost the entire year but is most prominent during the winter when air and sea temperatures show the greatest differences.

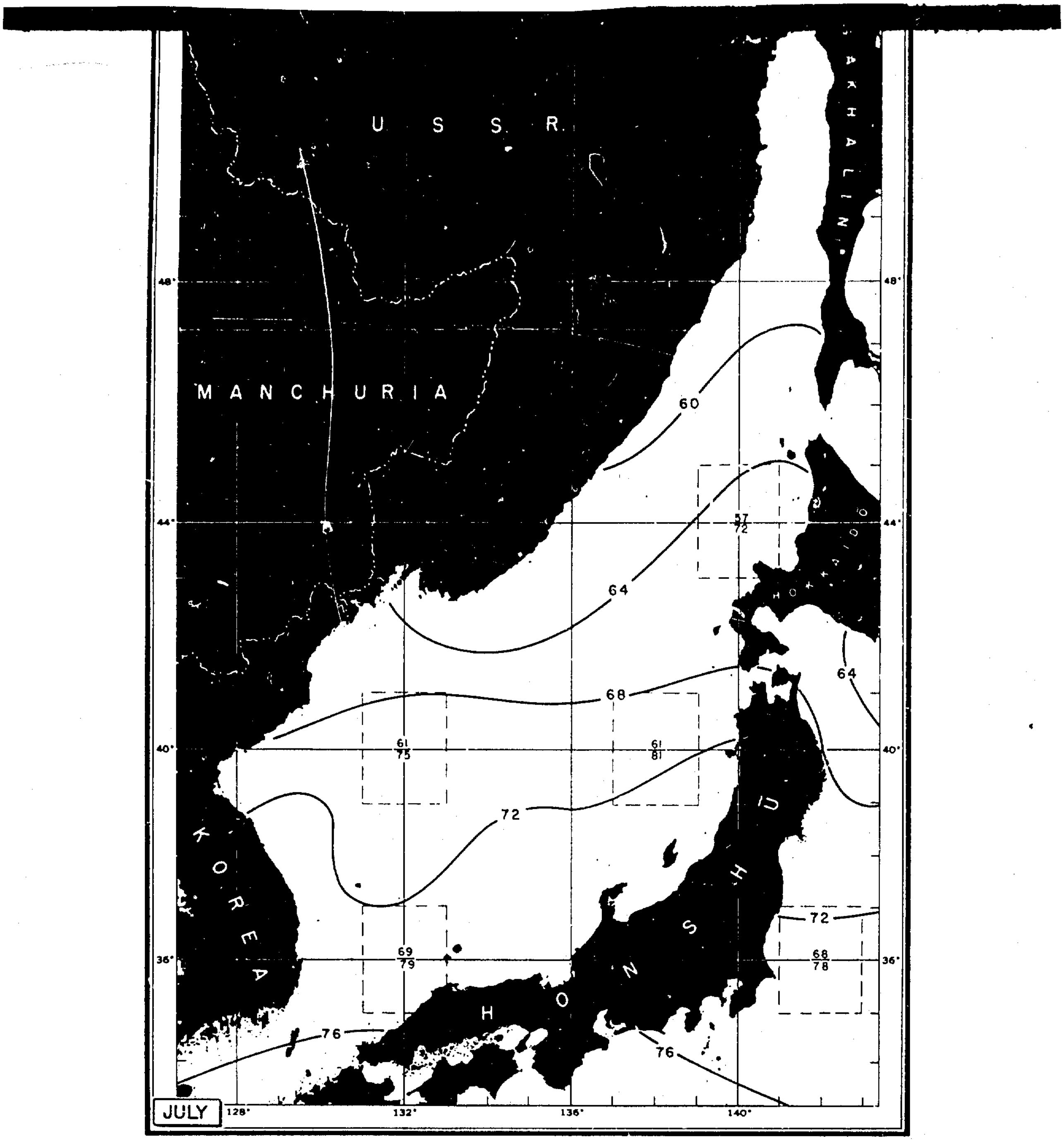
Air temperatures in February average approximately the same as in January, although the temperature begins to rise toward the end of the month. This rise accelerates through March and April. The greatest temperature rise, however, occurs between March and April in the northern portion of the Sea of Japan where the increase between March and April amounts to almost 12°F., compared with about 8°F. in the south. Nevertheless, the temperature may fall below freezing even in April.

During the winter, the diurnal range of air temperature is 10° to 12°F. throughout the Sea of Japan. There are occasional warm spells which are generally associated with interruptions of the monsoon, attributable to the passage of a depression. North of 48°N., the area is icebound most of the year and data are extremely scarce.

Due to the lack of statistical data, the maximum and minimum temperatures presented on these charts show the means based on extremely warm and extremely cold years. The values do not indicate extremes in temperature. Minimum temperatures in the northern part of the Sea of Japan can be expected to reach –10°F. or lower.


MEAN AIR TEMPERATURE (°F)
Dashed curves indicate southernmost limit for possible icing of ships' superstructures.
The figures enclosed in the dashed 2° squares indicate the lowest and highest average monthly air temperatures reported in those particular areas for the month concerned during a 13-year period.
128°
132°
136°
140°
52°
48°
44°
40°
36°
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
40
44
48
52
56
60
64
43/53
44/58
45/59
57/68
51/67
MAY

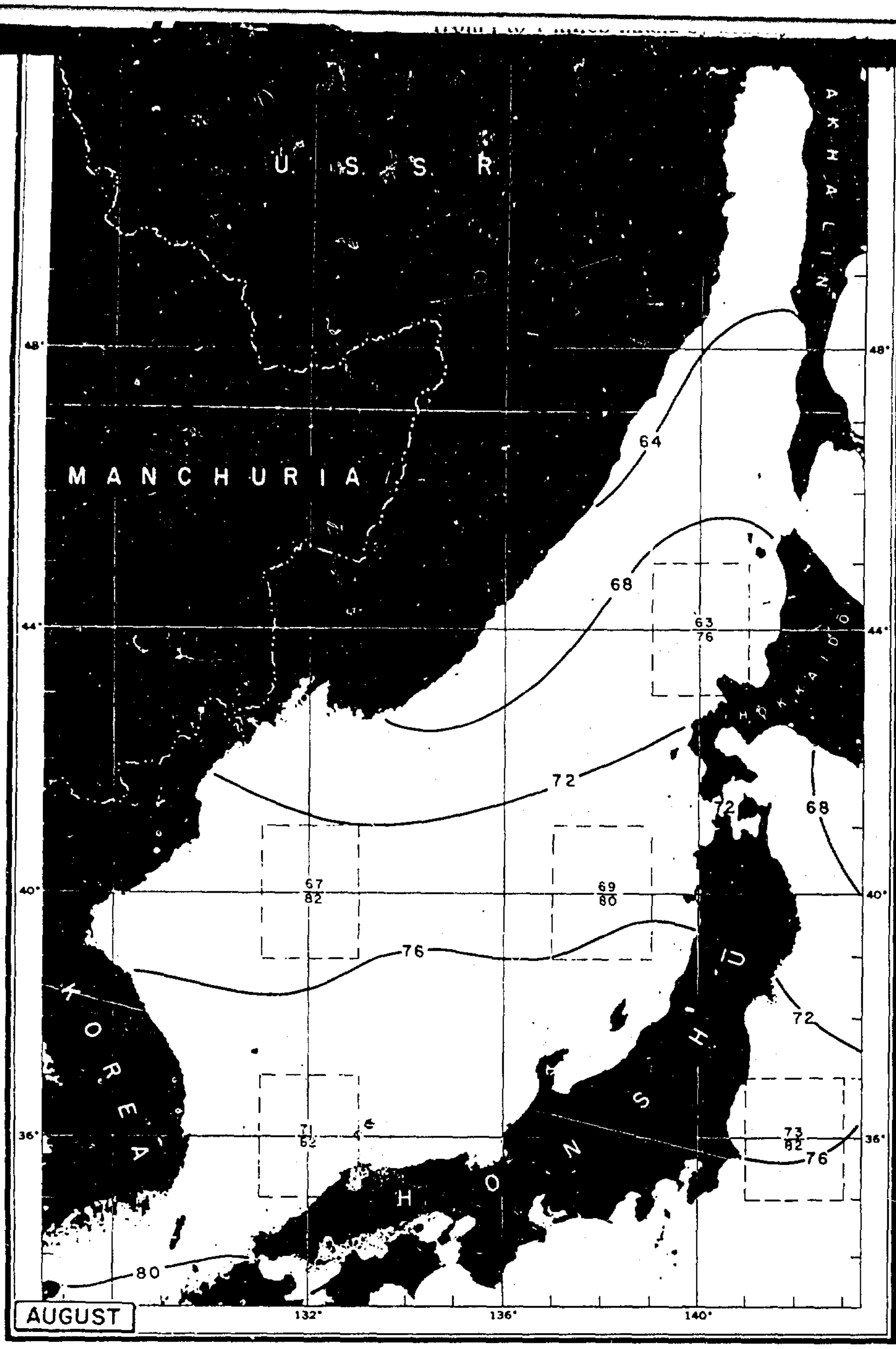

U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
JUNE
52
56
60
64
68
72
48
50/62
53/68
47/68
63/71
62/74
128°
132°
136°
140°
52°
48°
44°
40°
36°




Throughout the period May-August, the temperature increases steadily until it reaches the peak of the year in August. In May, the temperature ranges from 52°F. in the northern portion of Honshu to 64°F. in the southern portion, as compared to a range of from 72° to 80°F. in August. This reduction in temperature difference from 12°F. per 300 miles in May to 8°F. per 300 miles in August shows the general flattening of the temperature gradient over the whole region. In August, the temperature gradient over the entire Sea of Japan is only 16°F., although the temperature has been known to go above 100°F., particularly along the coast of Japan. From June to August, the air off both coasts of Japan has about the same mean temperature. The effect of the Tsushima Current off the west coast is negligible as the air is warmer than the water over which it passes.

The Sea of Japan north of 42°F. still shows the southwest-northeast slant of the isotherms between Siberia and the coasts of Hokkaido and Sakhalin. In August the 64°F. isotherm intersects the west coast of Sakhalin at about 48°30'N., while it does not touch the continent until as far south as 45°30'N., a difference in latitude of approximately 3 degrees or 180 nautical miles.

Diurnal temperature variation is greater in this season than during the winter, with a difference of 15°F. or more between the maximum and minimum daily temperatures, due in part to the



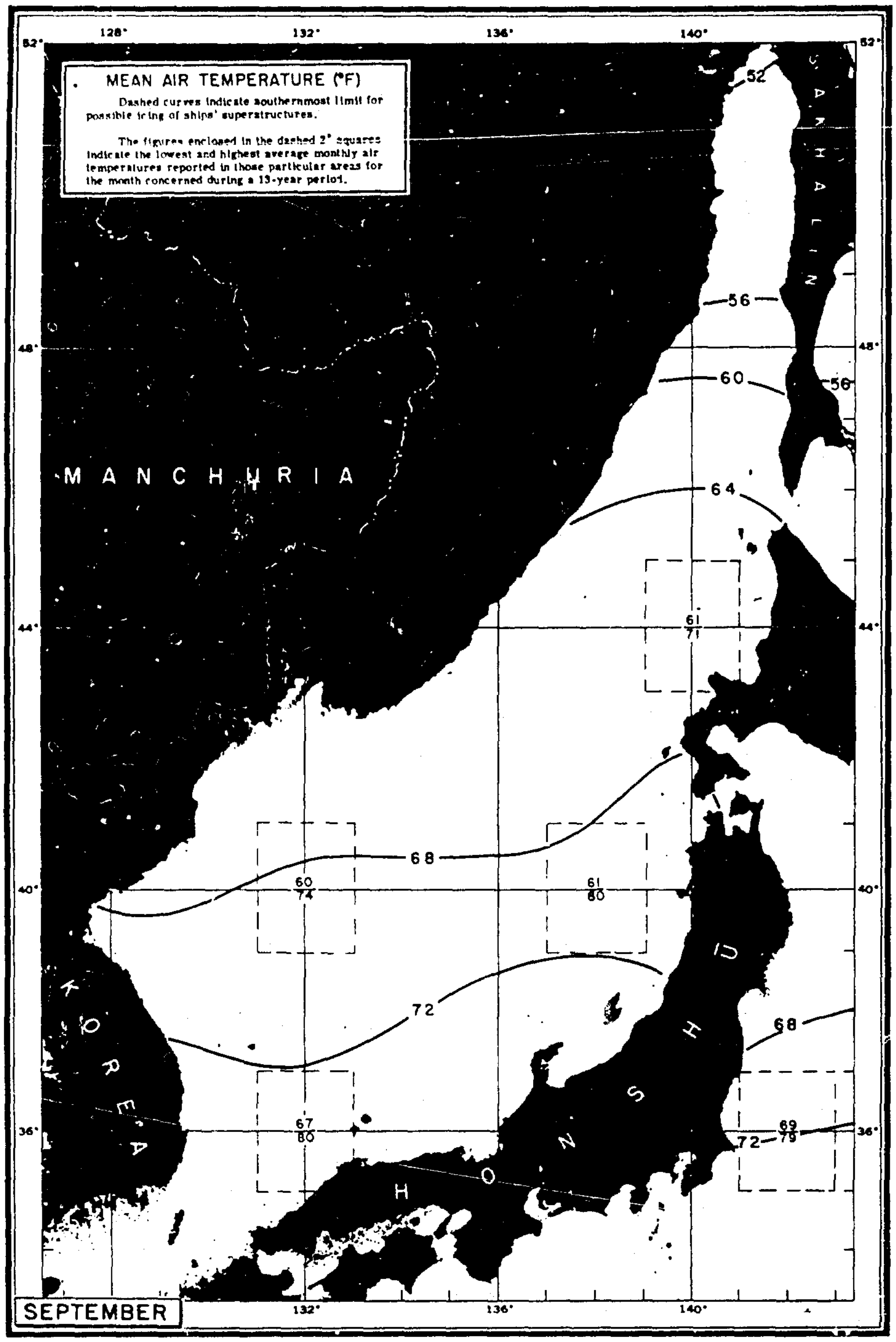

decrease in the average amount of clouds in the summer. In May and June, there are occasional cold waves, due to air flowing out from the reservoir of cold air over the Sea of Okhotsk cooled by the melting of tremendous masses of ice.

East of Honshu, the temperature variation is from 52° to 64°F. in May and 68° to 76°F. in August. The effect of the Kuroshio is less evident during these months as the air is relatively warmer than the water.

From September to December there is a rapid decrease in average temperatures, amounting to 8° to 10°F. per month in the southern section of the Sea of Japan and 13°F. per month north of 42°N. This very abrupt change almost eliminates the transition period as the winter monsoon sets in.

In September the temperature difference between latitudes 36° and 48°N. is 16°F. By December the temperature gradient is 24°F. over the same distance. At the same time the temperature at 36°N. has decreased from 72° to 48°F. As the cold continental high pressure area develops and expands over Asia, northerly winds become more frequent. Although cold winds lower temperatures along the coast of the continent, they become several degrees warmer by the time they reach the Japanese islands due to the modifying effect of the Sea of Japan. By December, the Tsushima Current is further modifying the temperature of the air west of Honshu.

# AIR TEMPERATURE AND SHIP ICING—Continued



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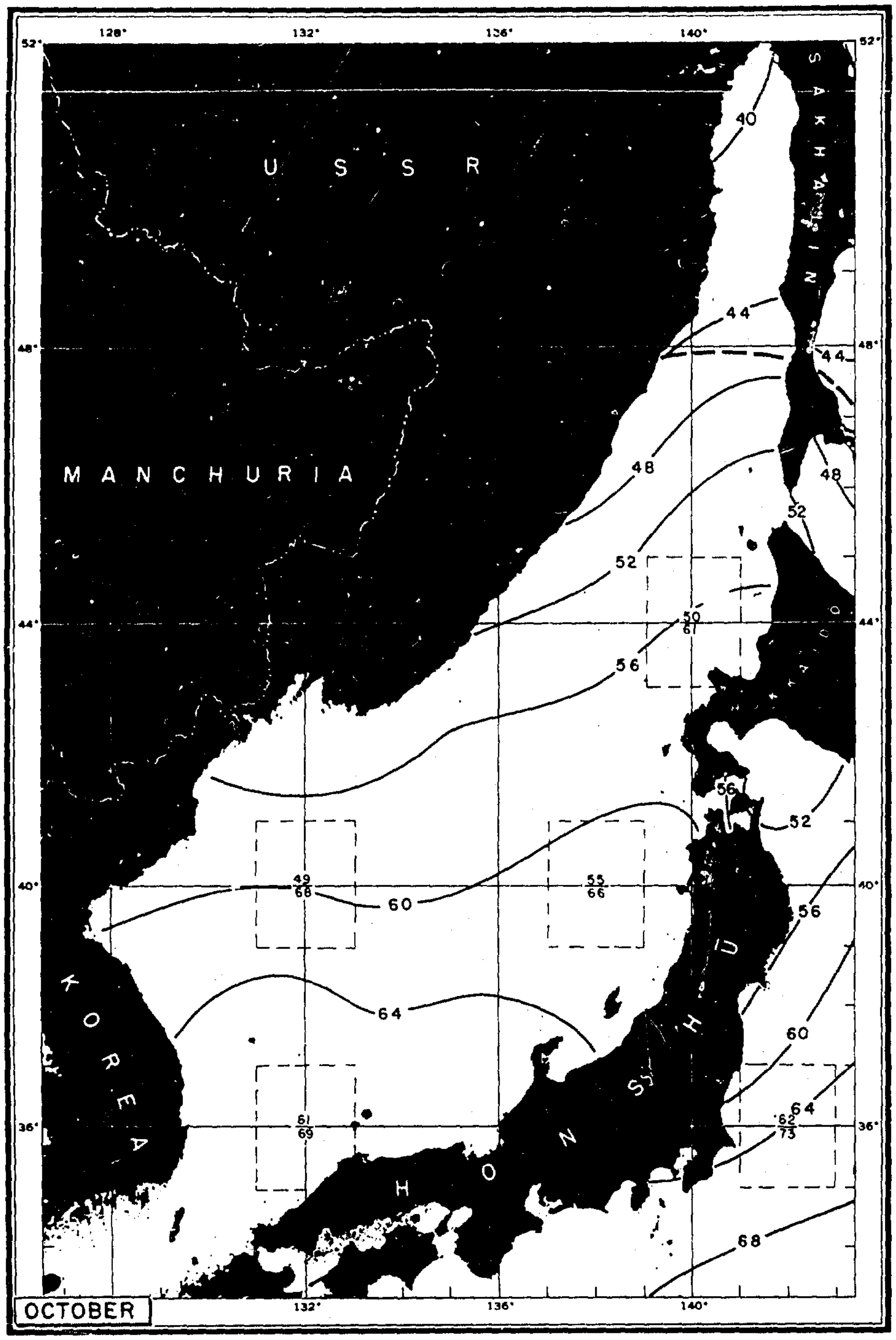
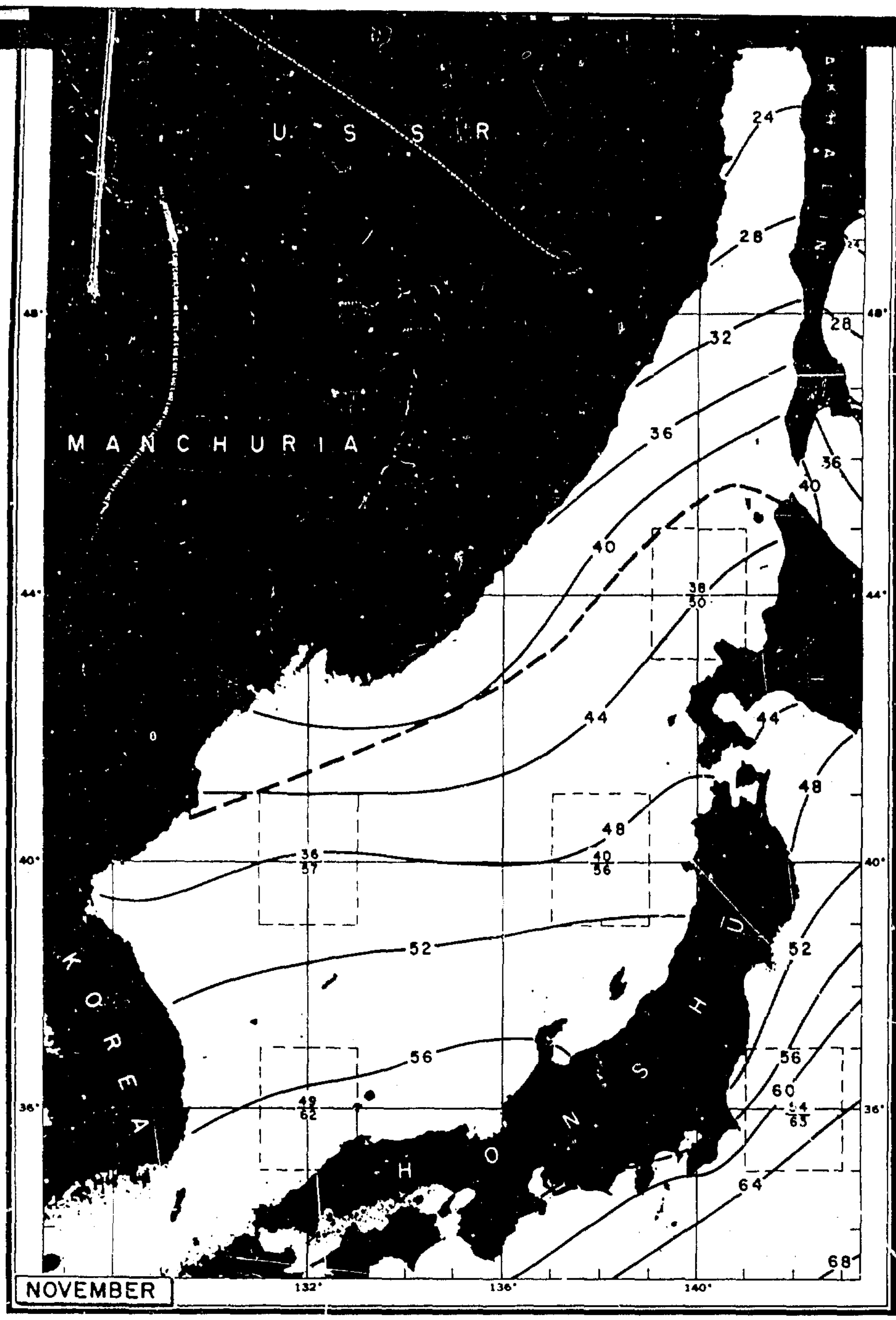


U S S R
MANCHURIA
KOREA
SAKHALIN
HONSHU
40
44
48
52
56
60
64
68
49
68
55
66
50
61
61
69
62
73
OCTOBER



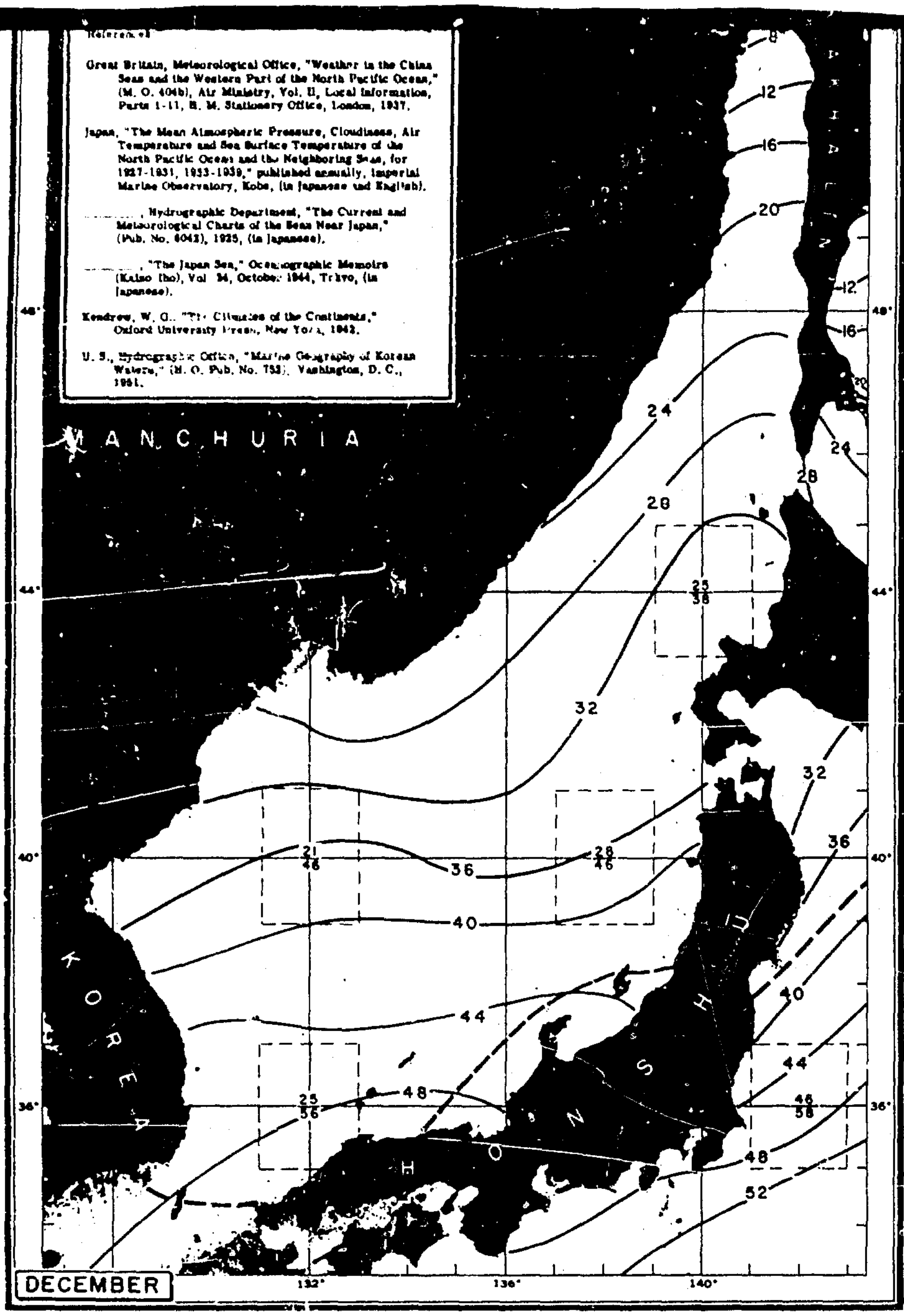

In September the temperature gradient east of Honshu ranges from 68° to 72°F. as compared to a range of 32° to 50°F. in December. In this area the Kuroshio increases in importance as winter approaches and the water becomes colder. The air temperature continues to increase steadily as one goes eastward from Honshu.

North of 40°N. the slope of the isotherm retains its southwest-northeast orientation from the Siberian coast across the sea to Hokkaido and Sakhalin. It is only in September that this slope is not apparent.

The diurnal temperature ranges from September through December are lower than those during the summer because of the increase of the average amount of clouds over the area.

## ICING OF SHIPS' SUPERSTRUCTURES

Icing of ships' superstructures not only makes a ship unstable by raising the center of gravity but hampers the topside operation of the crew. There are several factors that in-




fluence the icing of superstructures: (1) wind force, which has a direct relationship with state of sea, (2) sea surface temperatures near the freezing point, and (3) air temperatures when below the freezing point of sea water.

It is generally considered that winds in excess of Beaufort force 4 (greater than 16 knots) will generate waves of sufficient magnitude to spray superstructures. Winds greater than Beaufort force 4 may occur anywhere in this area at any time of year. Ordinary sea water with a salinity of 35 parts per thousand does not begin to freeze until it has been cooled to 28.6°F. However, some of the worst icing conditions have been reported where the water temperature was 30°F., the air temperature 20°F., and the wind force 4.

The limits for possible icing have been located on these charts on the basis of possible occurrence of freezing air temperatures. In the Sea of Japan, the air and sea isotherms have a tendency to run in a southwest to northeast direction. For a ship located close to the southern limit of icing conditions desiring to avoid ice formation on superstructures, an east or southeast heading is indicated.

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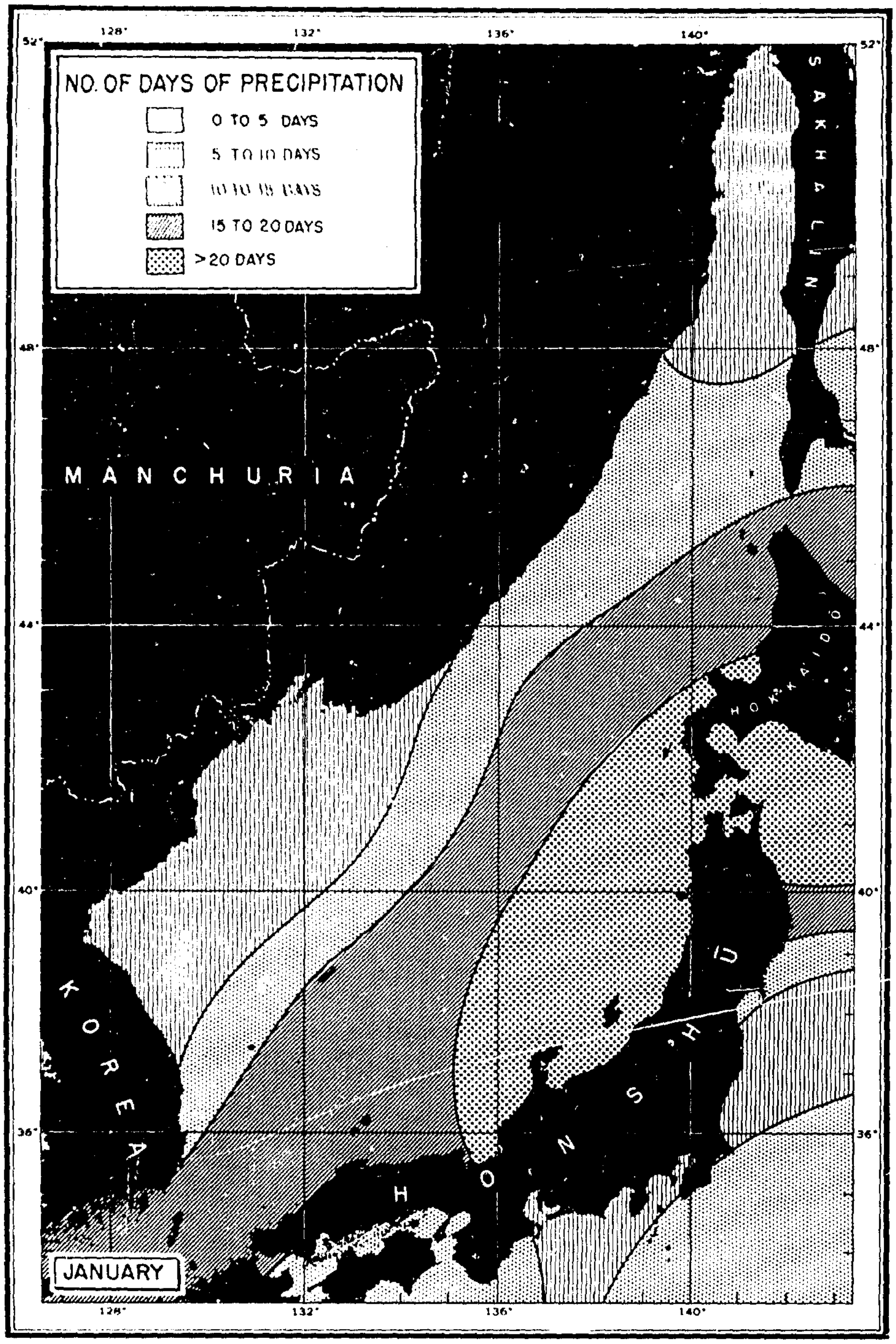
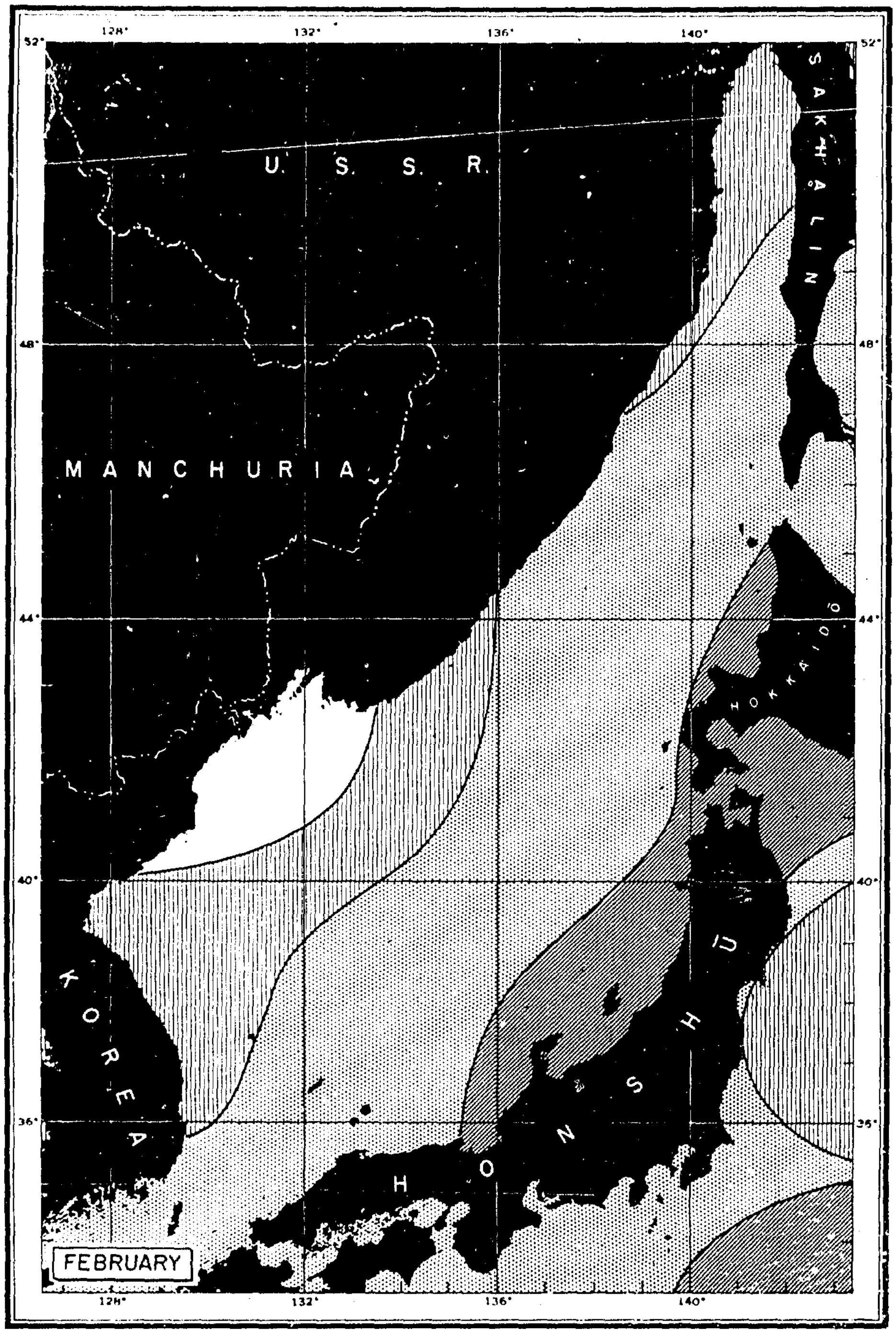
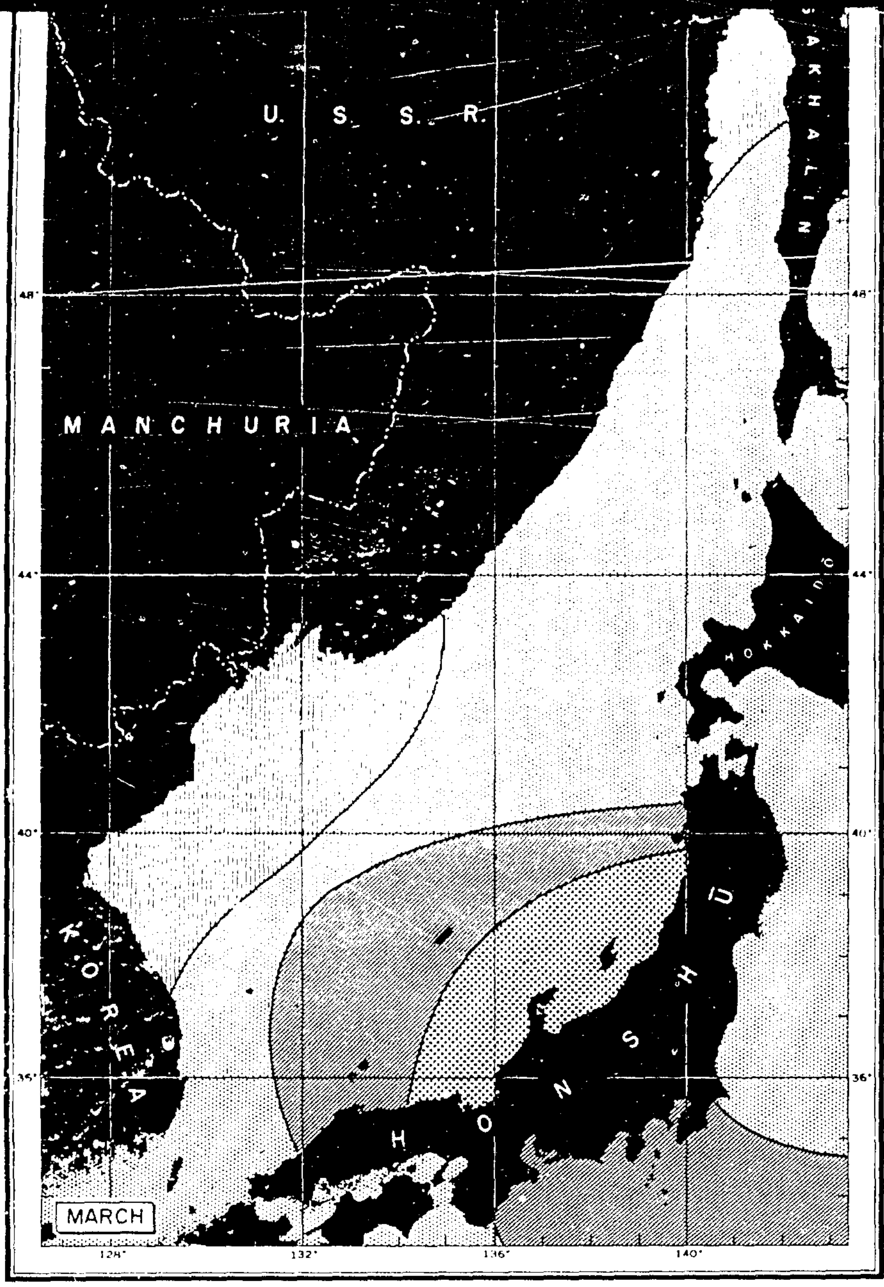
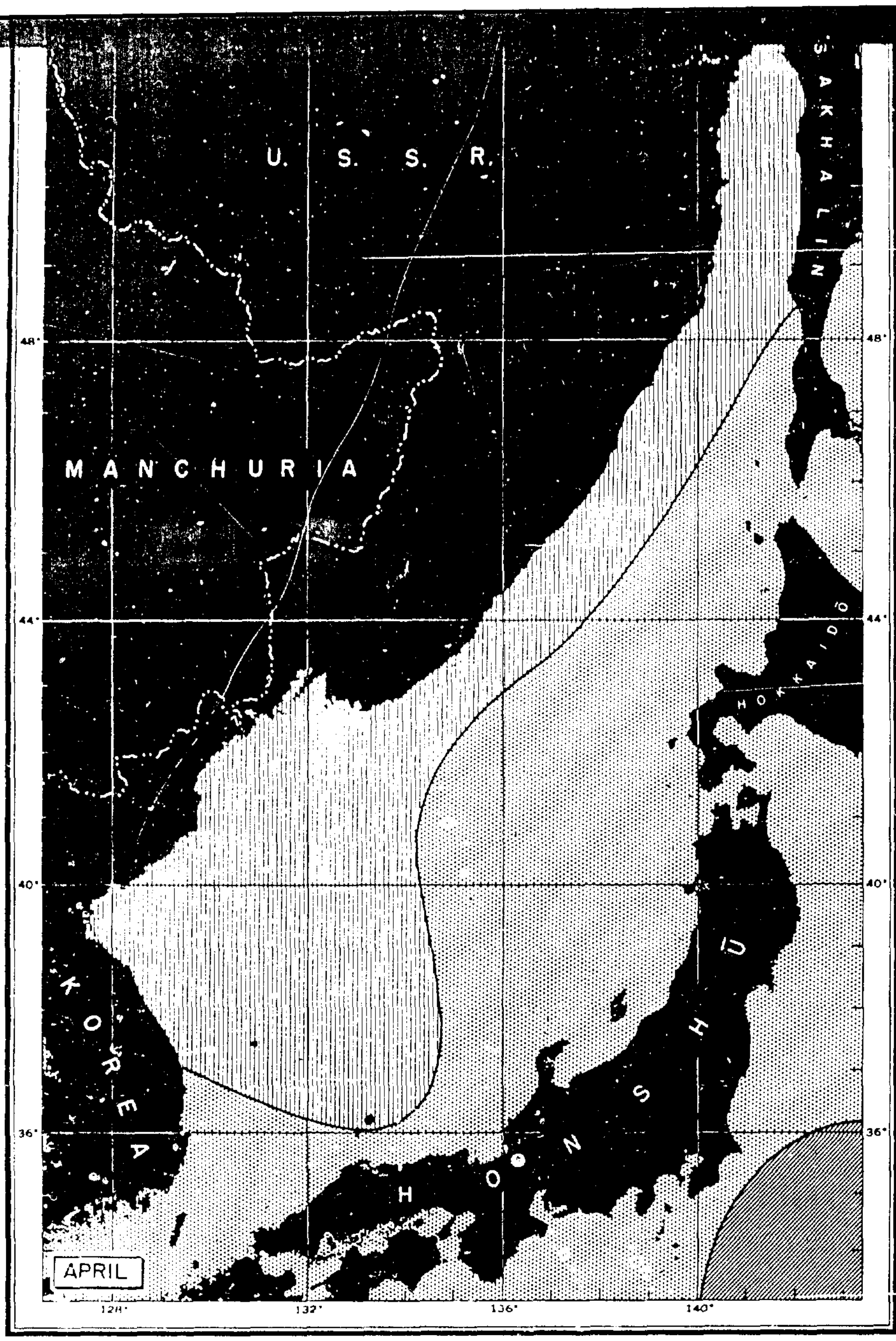

NO. OF DAYS OF PRECIPITATION
0 TO 5 DAYS
5 TO 10 DAYS
15 TO 20 DAYS
>20 DAYS
128°
132°
136°
140°
52°
48°
44°
40°
36°
MANCHURIA
SAKHALIN
HOKKAIDO
HONSHU
KOREA
JANUARY


U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
FEBRUARY
128°
132°
136°
140°
52°
48°
44°
40°
36°



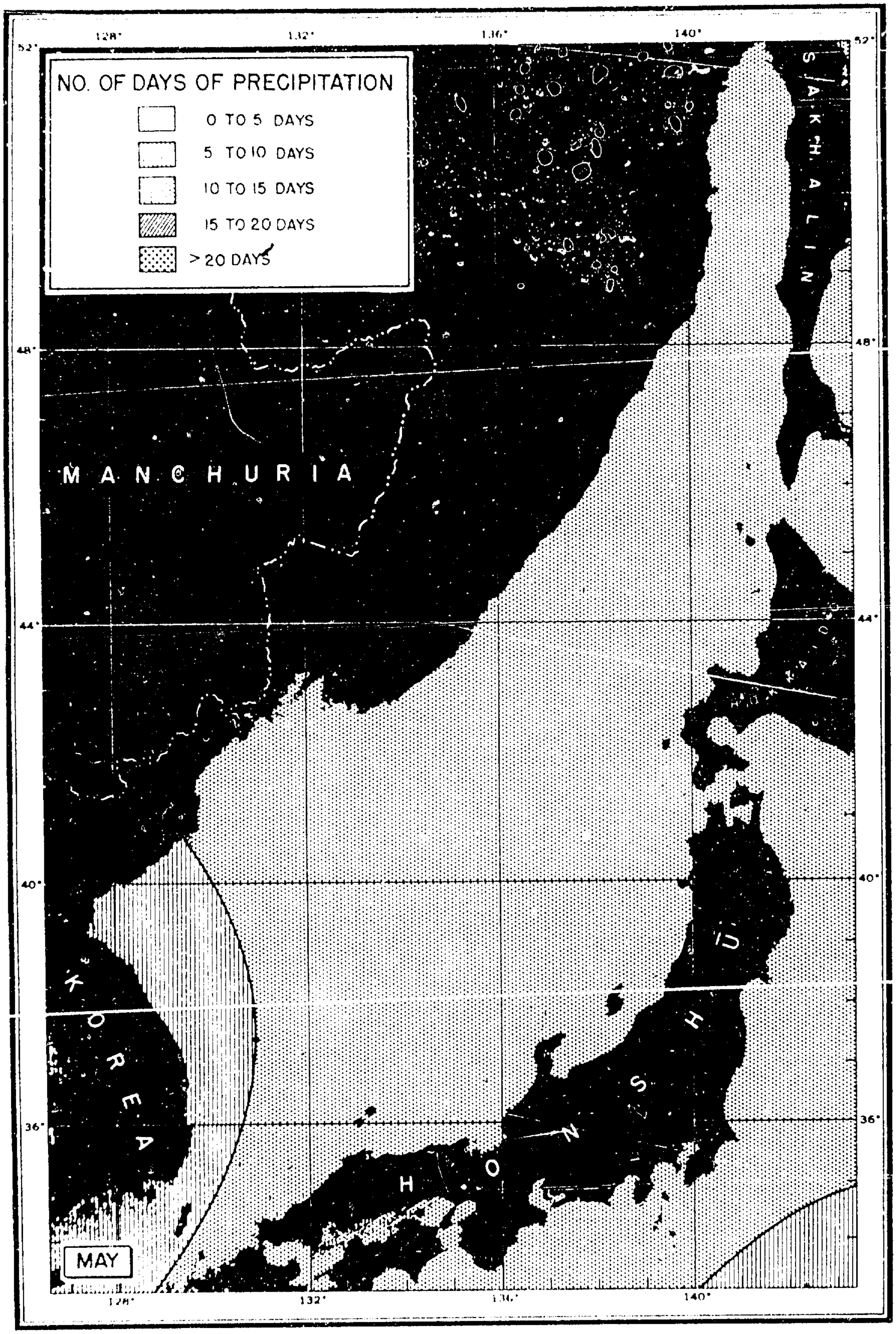

During the winter the Sea of Japan is under the influence of the cold continental high cell, resulting in a strong offshore flow of air from the northwest and north. This air is d and cold as it leaves the continent, but it becomes humid and somewhat warmer after pass over the Sea of Japan. Approaching the mountains off the west coast of Honshu, the air rises and causes heavy, frequent rain or snow, while the east coast remains relatively dry Rainfall in the vicinity of Japan is further increased by the numerous extratropical cyclon which form along the perimeter of the continental high pressure area and deepen as they m over the islands of Japan in a northeasterly direction toward the Aleutians. These factors combined result in a frequency of precipitation varying from 10 to 20 days per month throu out the winter in the vicinity of the Japanese islands of Honshu and Hokkaido. Disturban moving in a west-east direction across Siberia cause precipitation of only 5 to 10 days pe month along the Russian coastal area.

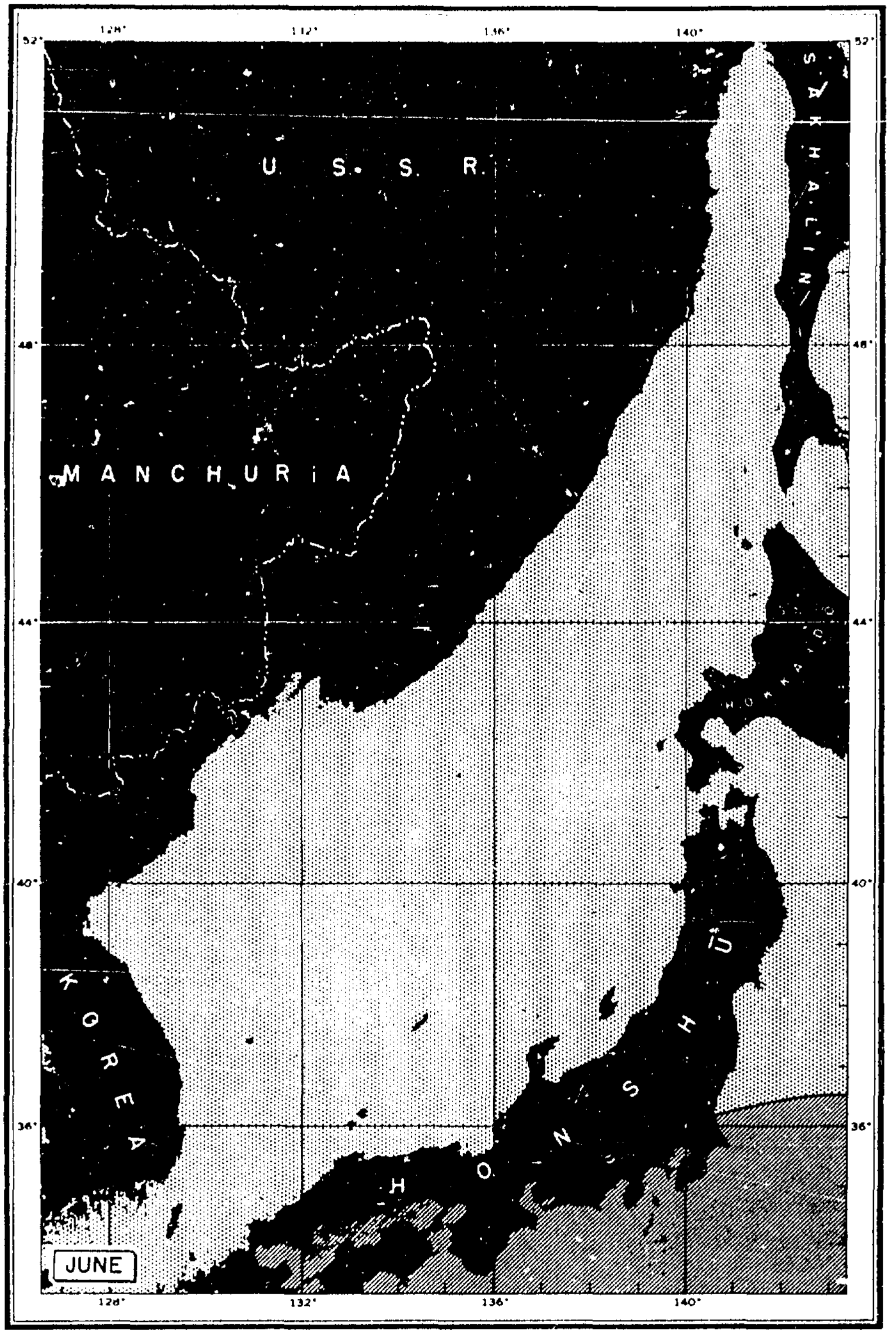


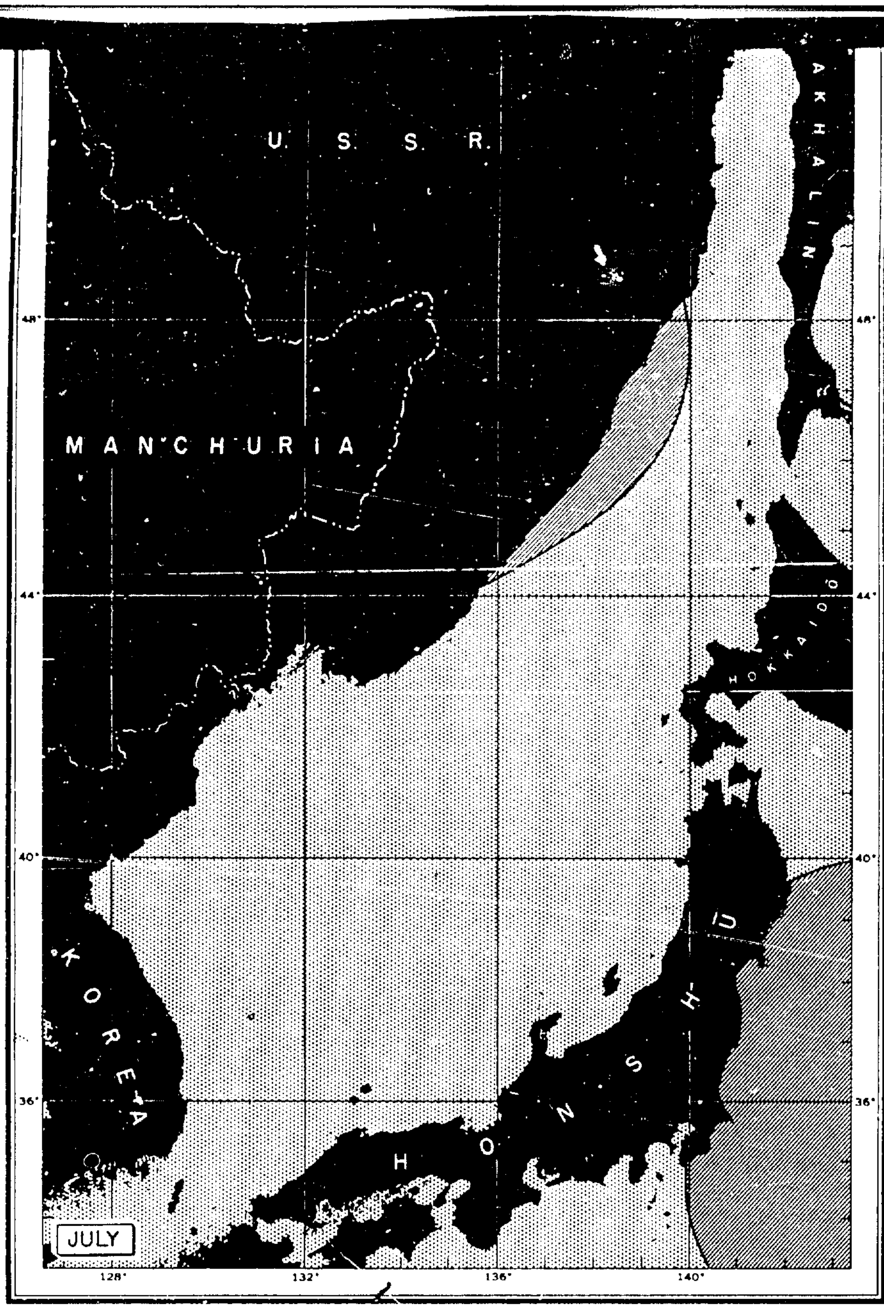

2

of Japan is under the influence of the cold continental high
shore flow of air from the northwest and north. This air is dry
tinent, but it becomes humid and somewhat warmer after passing
oaching the mountains off the west coast of Honshu, the air
uent rain or snow, while the east coast remains relatively dry.
pan is further increased by the numerous extratropical cyclones
er of the continental high pressure area and deepen as they move
a northeasterly direction toward the Aleutians. These factors
cy of precipitation varying from 10 to 20 days per month through-
of the Japanese islands of Honshu and Hokkaido. Disturbances
on across Siberia cause precipitation of only 5 to 10 days per
stal area.

# PRECIPITATION—Continued

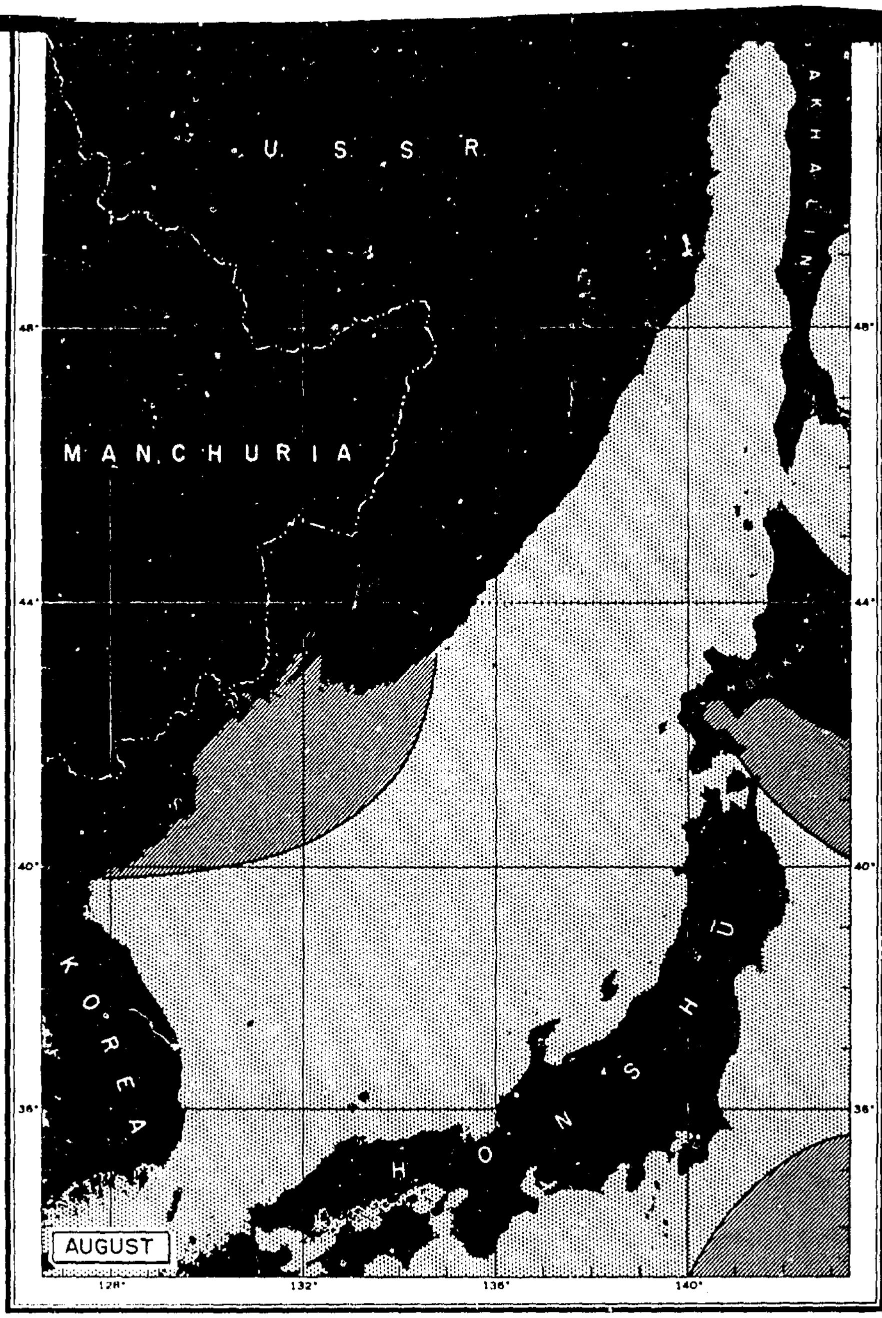



U. S. S. R.
MANCHURIA
KOREA
HONSHU
SAKHALIN
JUNE
128°
132°
136°
140°
52°
48°
44°
40°
36°




The southwest monsoon season sets in at the end of June. This monsoon
in locations where a sea breeze reinforces the prevailing wind. Such an area
Japan, where during June, July, and August the frequency of rain is 15 to 20 d
Meanwhile, most of the Sea of Japan has a uniform frequency of 10 to 15 days
which in fact is the situation for the entire period from April to October. Alon
the coast of the continent during the summer, rainfall is more frequent (15 to 2
month) than in the sea proper due to the onshore circulation and occasional lo
areas moving eastward. Extratropical cyclones originating in central China c
precipitation along the east coast of Honshu. It is these latter disturbances w
heaviest rain.

As the continental high cell recedes with approaching spring, the area of h
northwest of Japan also recedes, until in May and June almost the entire Sea
same frequency of rainfall (10 to 15 days per month). May and June constitute
period between winter and summer during which time no distinct circulation is




2

on sets in at the end of June. This monsoon is weak except
einforces the prevailing wind. Such an area is southeast of
nd August the frequency of rain is 15 to 20 days per month.
pan has a uniform frequency of 10 to 15 days per month,
the entire period from April to October. Along portions of
the summer, rainfall is more frequent (15 to 20 days per
to the onshore circulation and occasional low pressure
pical cyclones originating in central China contribute to the
t of Honshu. It is these latter disturbances which cause the

ecedes with approaching spring, the area of high precipitation
until in May and June almost the entire Sea of Japan has the
15 days per month). May and June constitute the transitional
r during which time no distinct circulation is evident.

4

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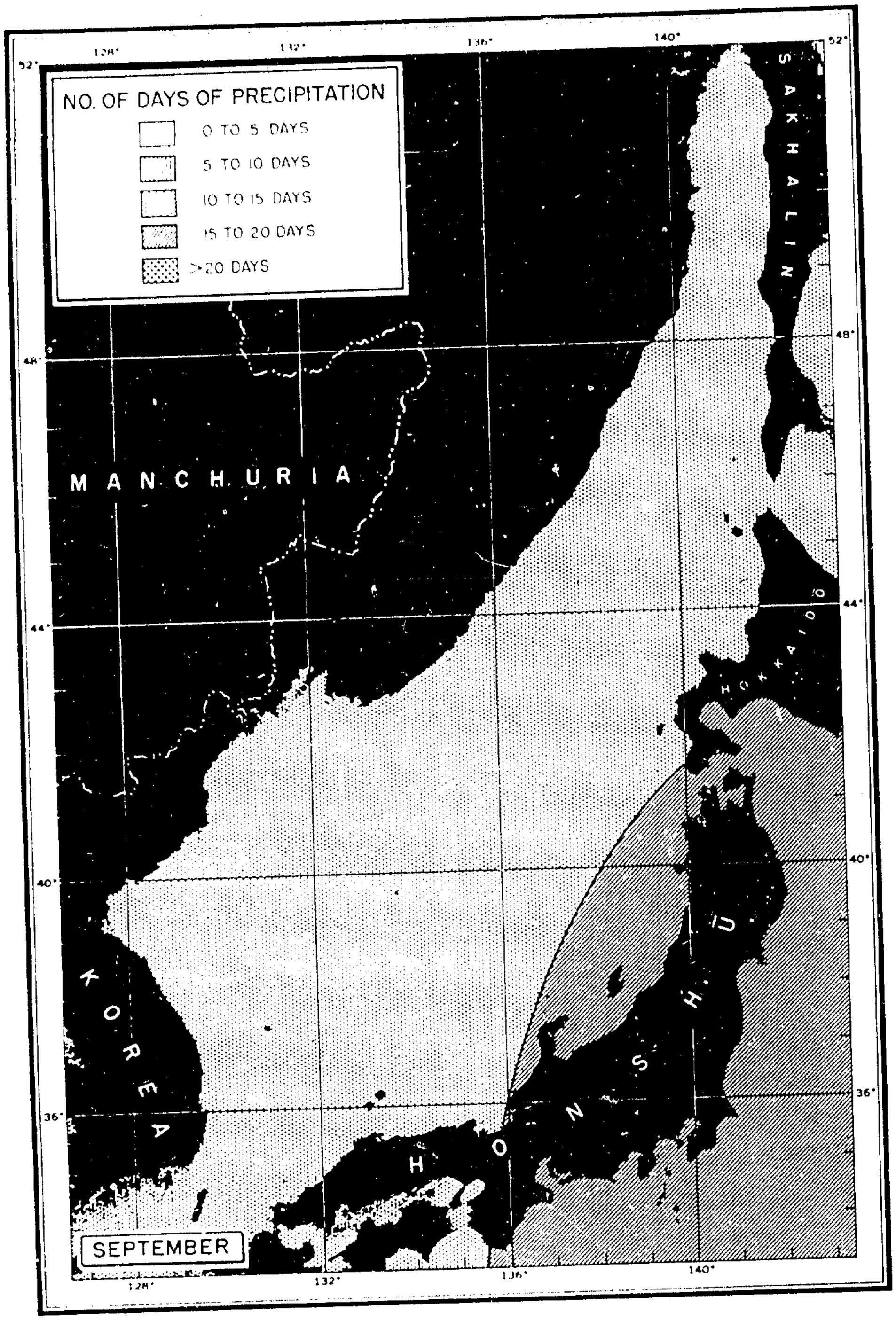
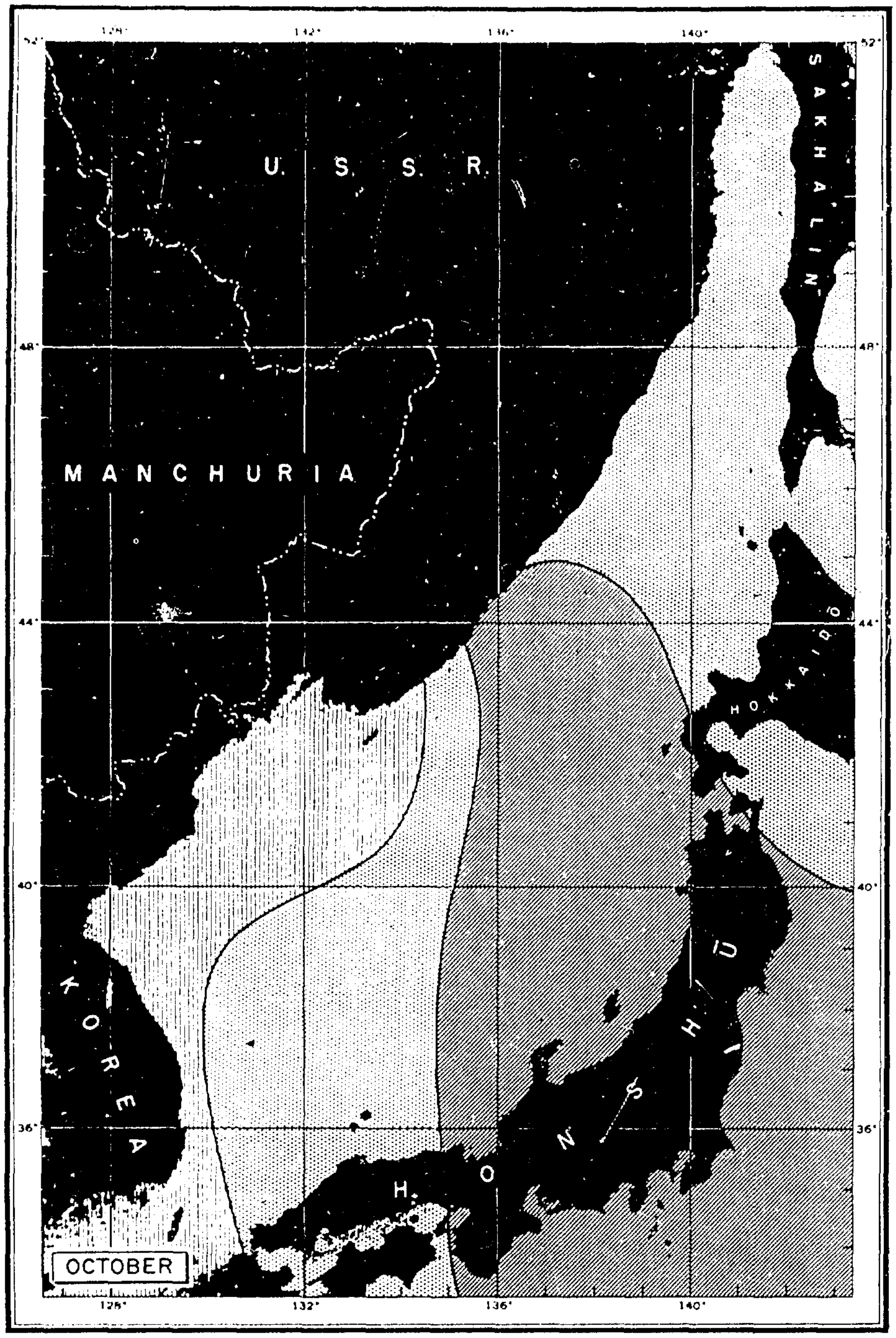
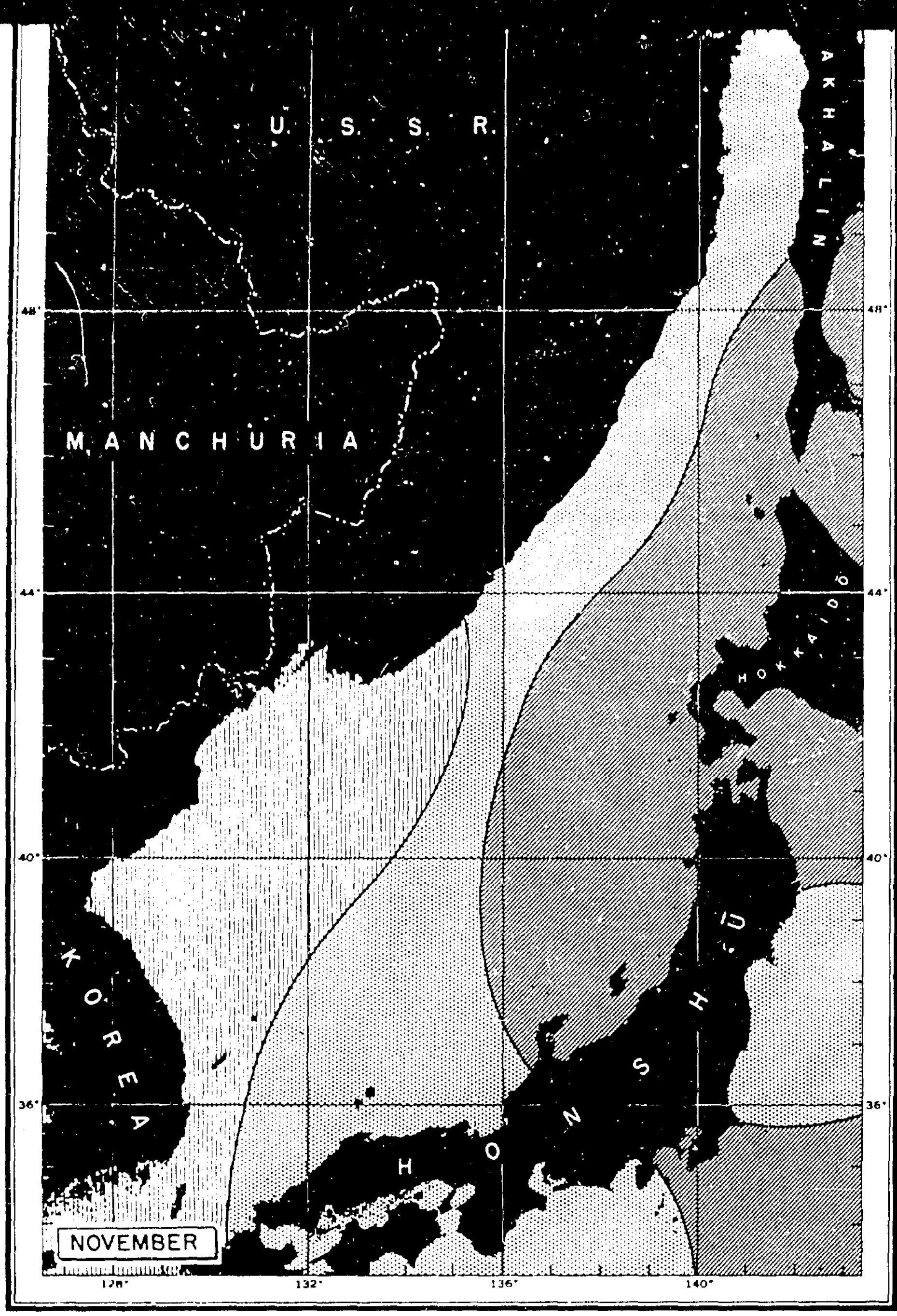


NO. OF DAYS OF PRECIPITATION
0 TO 5 DAYS
5 TO 10 DAYS
10 TO 15 DAYS
15 TO 20 DAYS
>20 DAYS
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
SEPTEMBER
128°
132°
136°
140°
52°
48°
44°
40°
36°


U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDO
HONSHU
KOREA
OCTOBER
128°
132°
136°
140°
52°
48°
44°
40°
36°




During September, October, and November, the frequency of
along the islands of Japan increase in a northerly direction to
easterly pattern of storm movement is evident in the areas of h
20 days per month) which follow the west coast of Japan north
der of the Sea of Japan has a lower frequency of occurrence of

References:

Great Britain, Meteorological Office, "Weather in the China Se North Pacific Ocean," (M. O. 404b), Air Ministry, Vol. 1-11, H. M. Stationery Office, London, 1937.

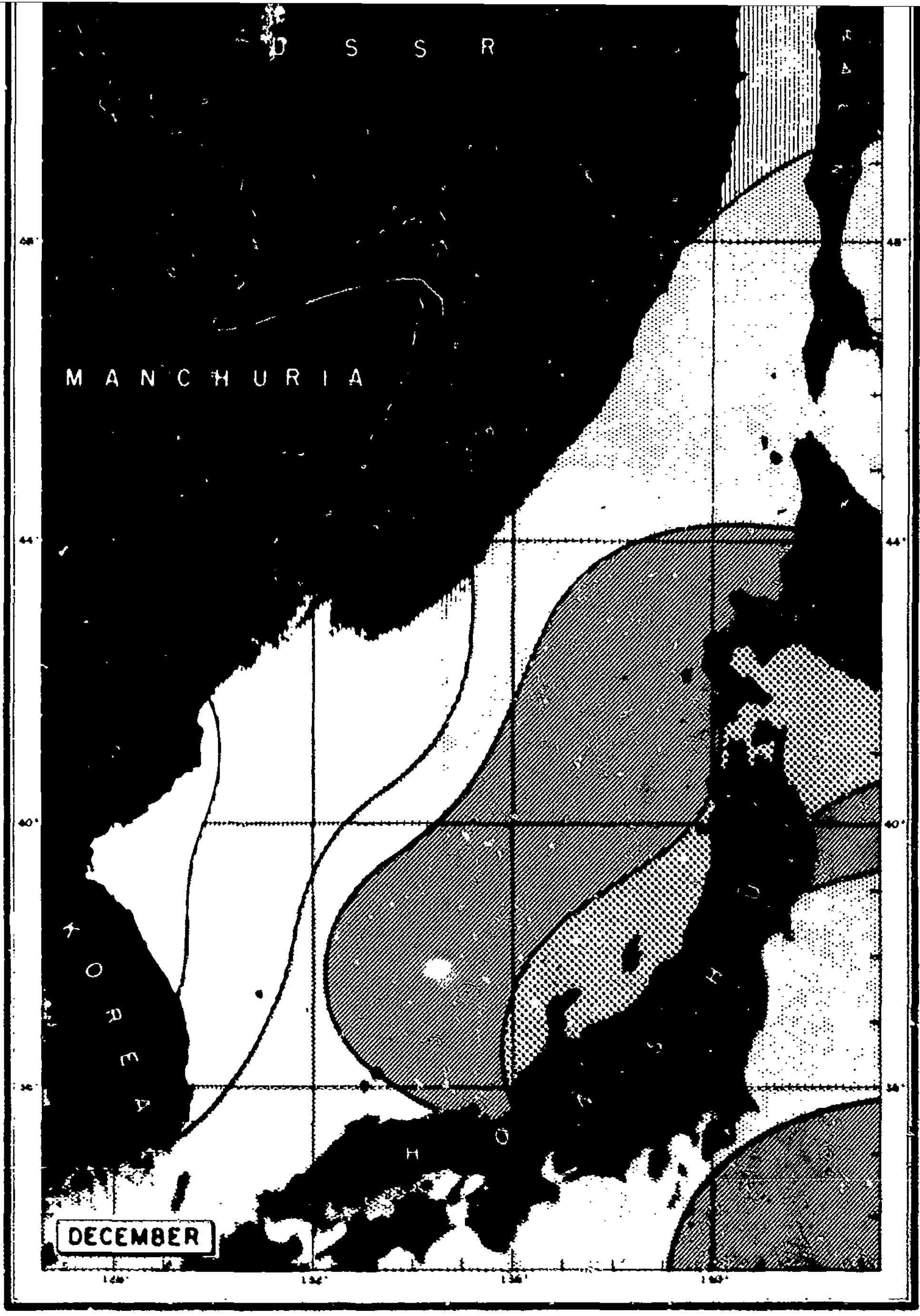
Kendrew, W. G., "The Climates of the Continents," Oxford Uni

U. S., Navy, "Climatic Atlas of Japan and her Neighbouring C reprint from Japanese sources, September 1943.

————, Navy, Pacific Fleet and Pacific Ocean Areas, "C Operational Areas of the Western Pacific," (CINCPAC- Vol. 1, March 10, 1945.

3

2



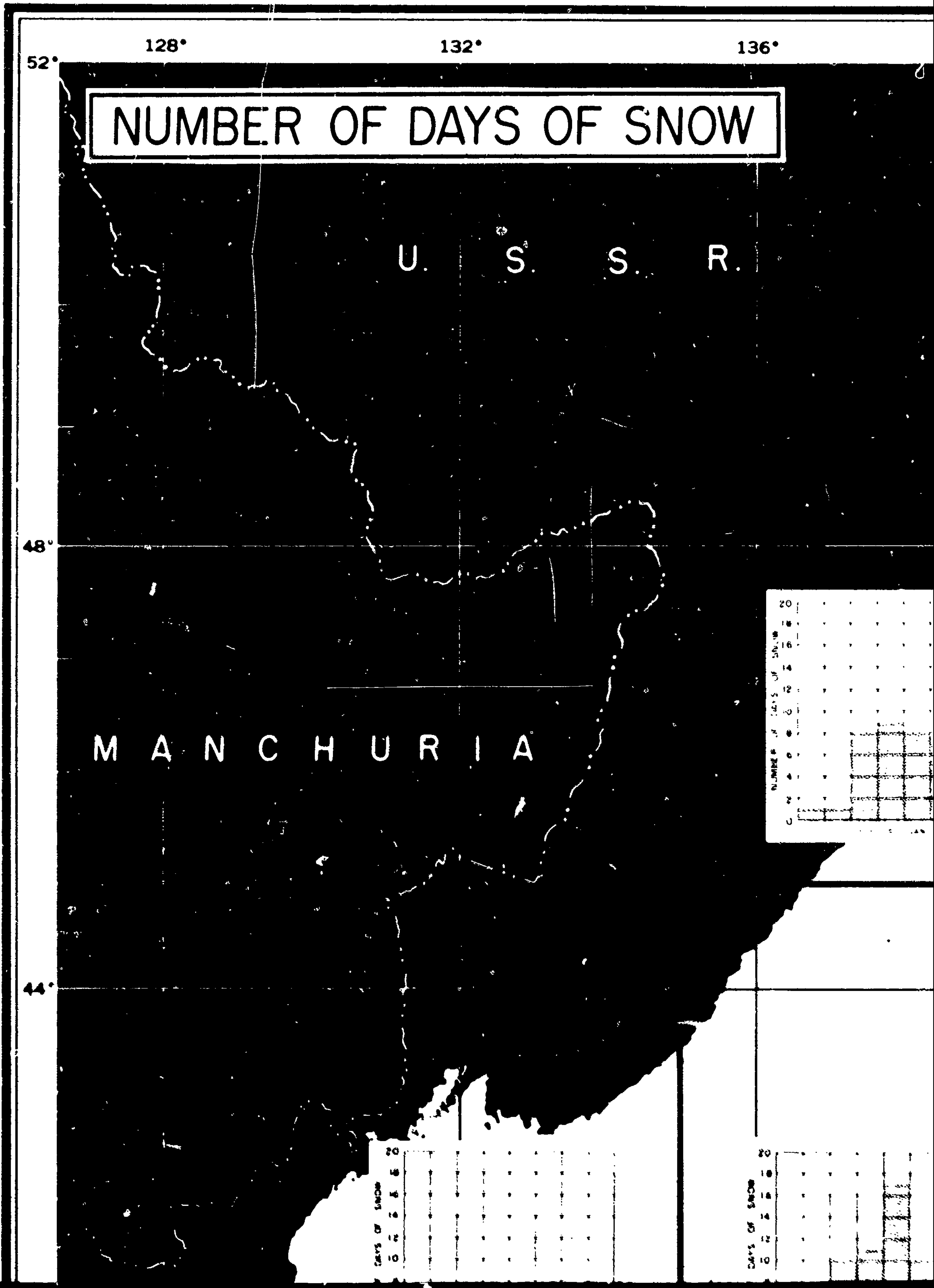

y of ... nd November, the frequency of extratropical disturbances n to... se in a northerly direction toward Sakhalin. This north- of h... nt is evident in the areas of high frequency of rainfall (15 to orth... the west coast of Japan northward to Hokkaido. The remain- e of... er frequency of occurrence of about 8 to 12 days per month.

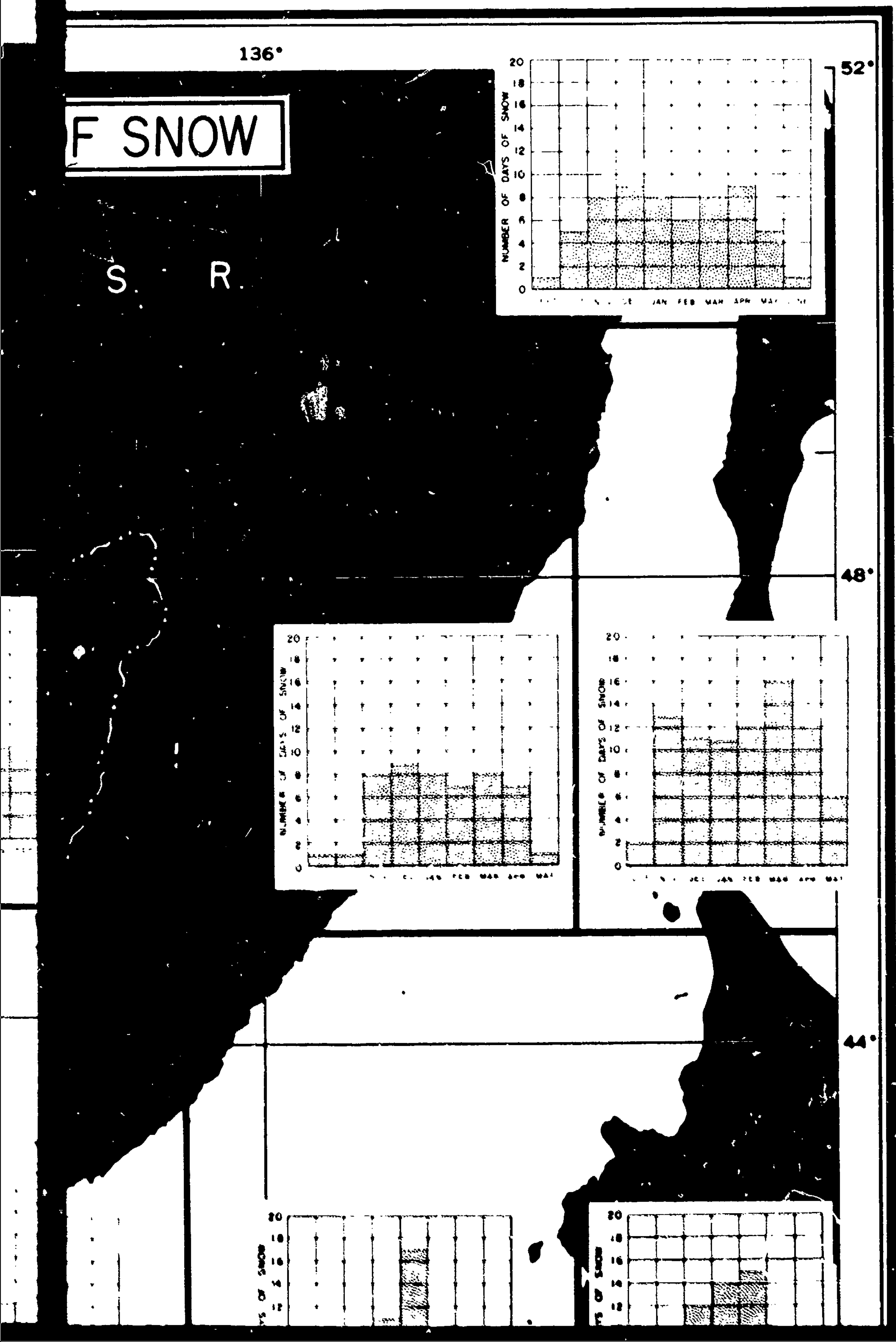
a Se... ice, "Weather in the China Seas and in the Western Part of the
Vol. ... O. 404b), Air Ministry, Vol. II, Local Information, Parts
... ice, London, 1937.

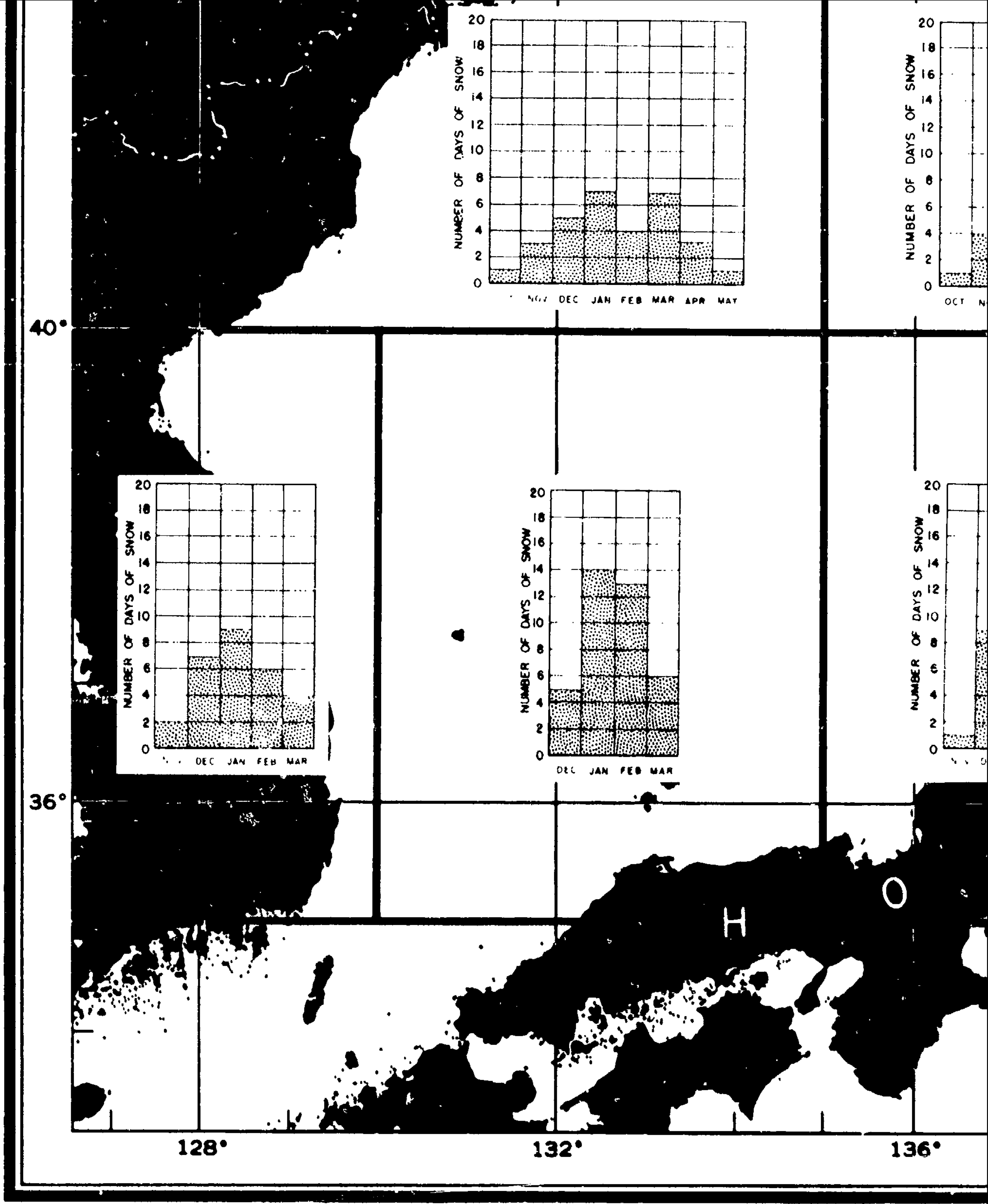
Un... f the Continents," Oxford University Press, New York, 1942.

g C... apan and her Neighbouring Countries," NAVAER, U. S. Navy
... rces, September 1943.

"C... and Pacific Ocean Areas, "Climatology and Oceanography of
AC-... Western Pacific," (CINCPAC-CINCPOA Bulletin No. 4-45),


128°
132°
136°
52°
48°
44°
NUMBER OF DAYS OF SNOW
U. S. S. R.
MANCHURIA


136°
F SNOW
S R
52°
48°
44°
NUMBER OF DAYS OF SNOW
JAN FEB MAR APR MAY
NUMBER OF DAYS OF SNOW
JAN FEB MAR APR MAY
NUMBER OF DAYS OF SNOW
JAN FEB MAR APR MAY



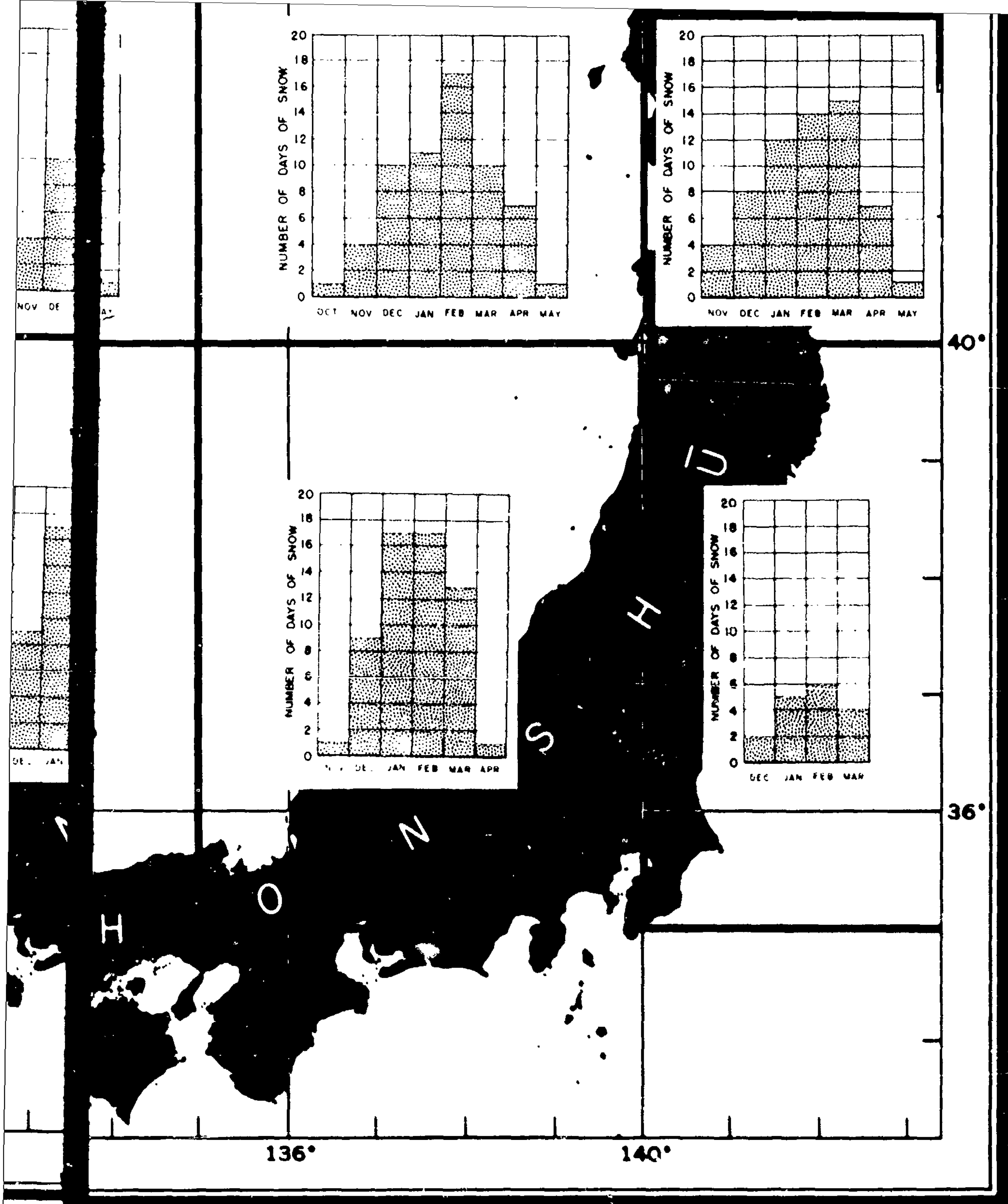

During the winter when the cold continental high pressure center dominates Asia, winds usually flow southward and eastward from the continent. The air is cold and relatively dry as it leaves the continent but by the time it reaches the west coast of the Japanese islands it has picked up a great deal of moisture from the Sea of Japan. This moisture is dropped as either rain or snow, depending on the temperature of the air as it rises upon approaching the mountains of western Honshu. Though snow does fall along the east coast of the continent, the frequency is approximately half that immediately west of Honshu. From 35° to 40°N. along the east Korea coast, snow falls 6 to 9 days per month during the months of December, January, and February, while during this same period snow falls 9 to 17 days per month along the eastern side of the Sea of Japan.

The nu
only July
October is
snow.

No data

Reference:

U. S., Nav
Ope
Vol.




The number of months in which snow occurs increases in higher latitudes. North of 50°N. only July and August are free of snow, while south of 40°N. the entire period of May through October is snow free. East of Honshu, however, the period from April to November is free of snow.

No data are available as to the amount of snowfall over the Sea of Japan.

Reference:


U. S., Navy, Pacific Fleet and Pacific Ocean Area, "Climatology and Oceanography of Operational Areas of the Western Pacific," (CINCPAC-CINCPOA Bulletin No. 4-45), Vol. 1, March 1945.


4

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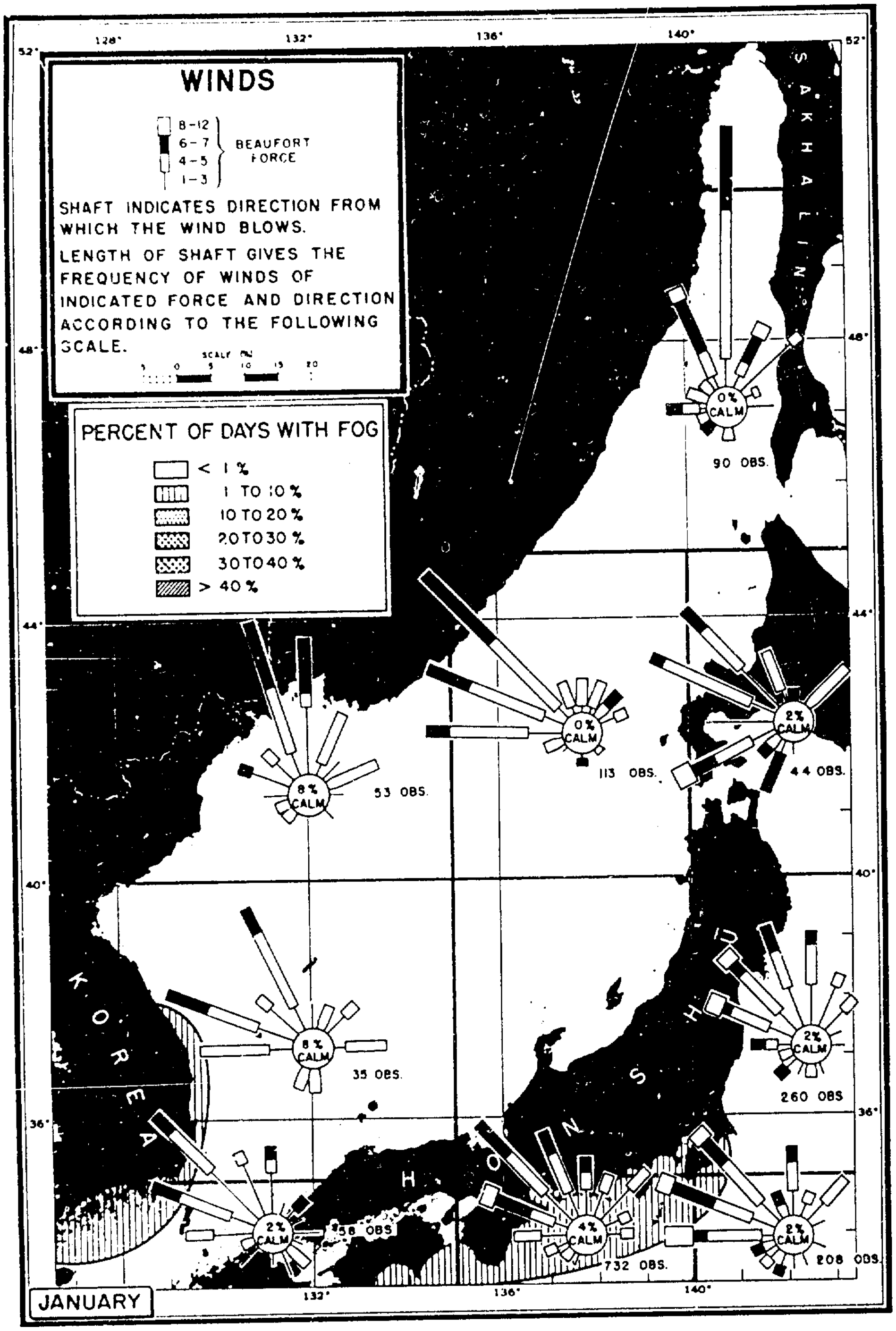
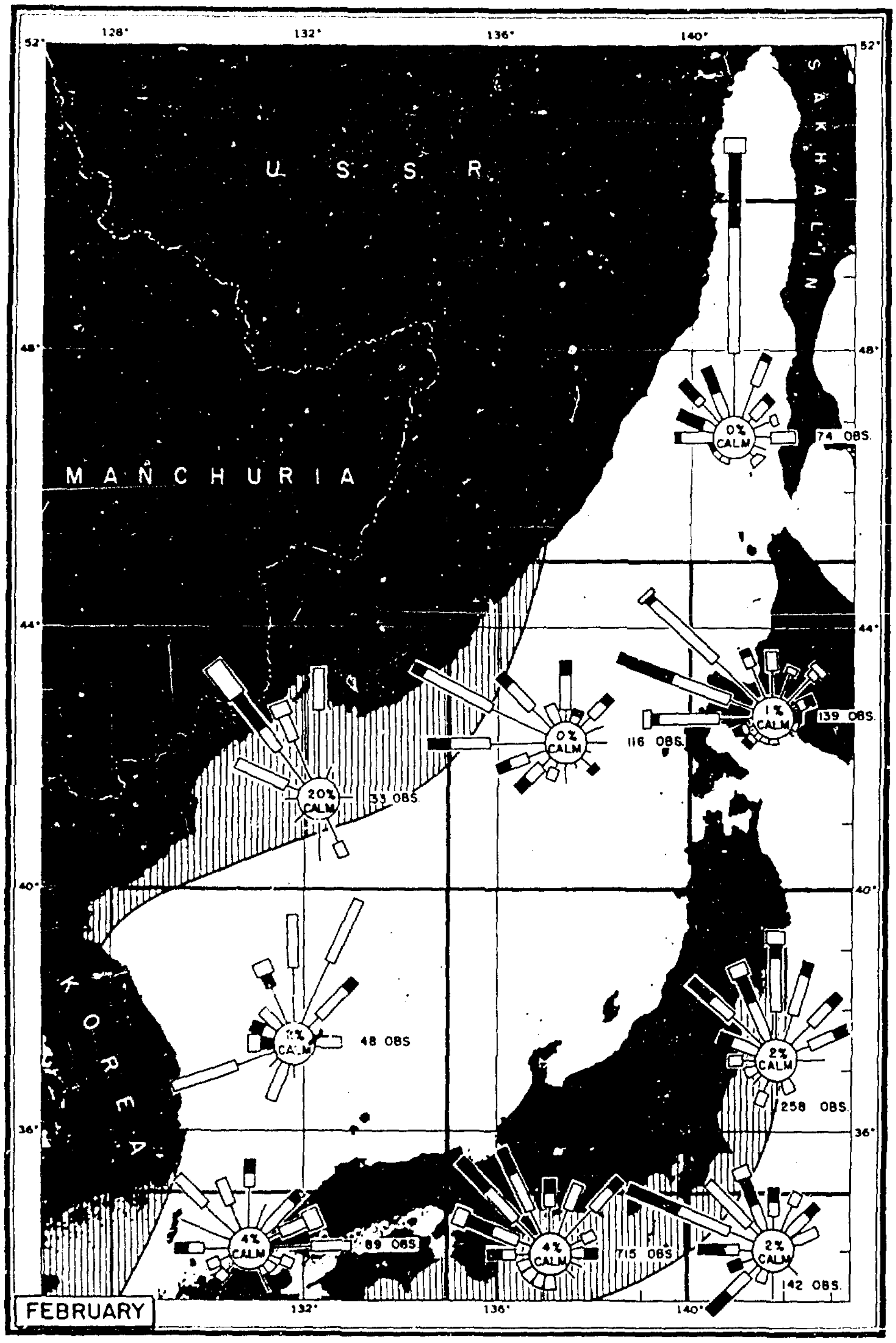
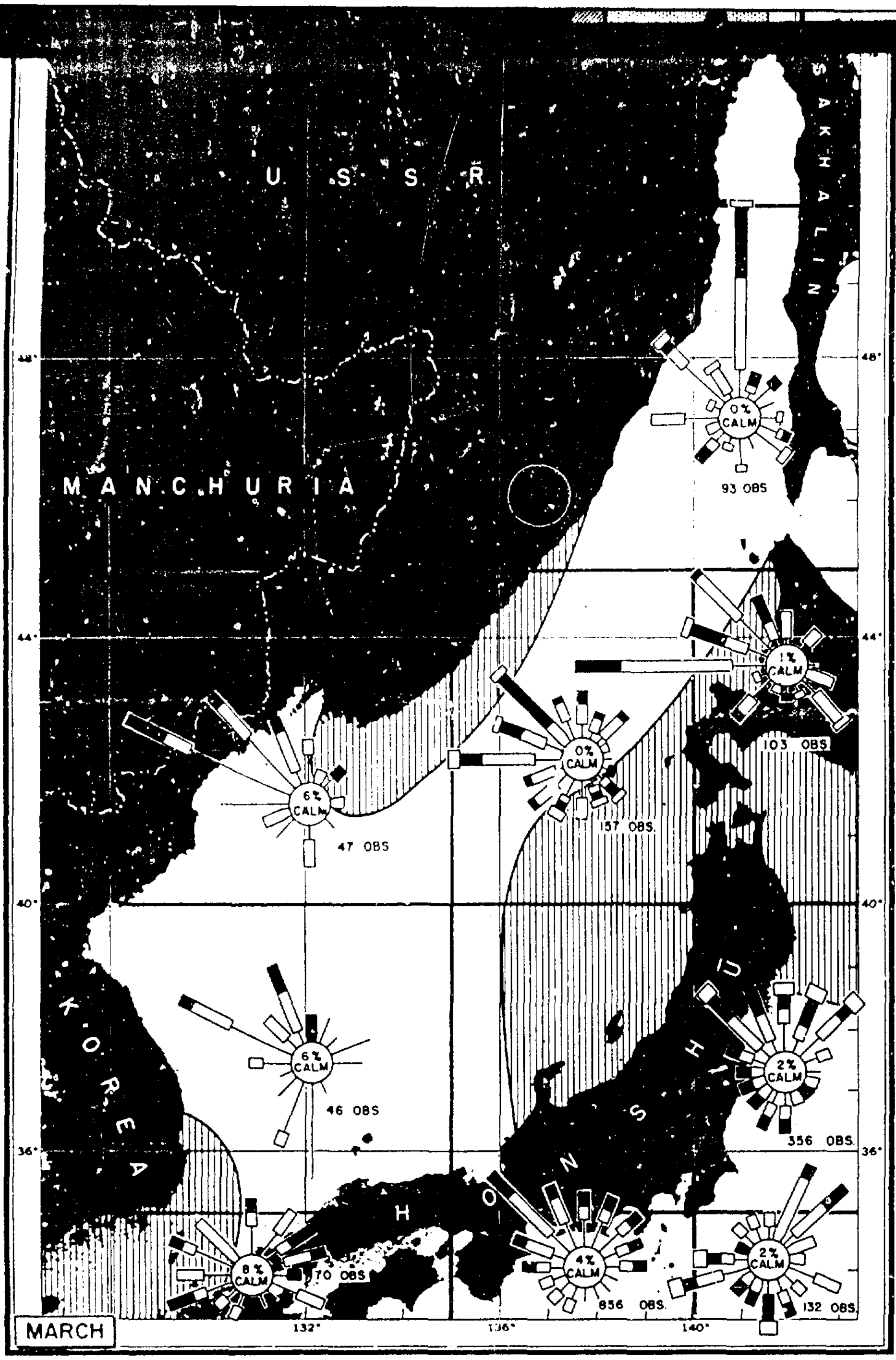

WINDS
8-12
6-7
4-5
1-3
BEAUFORT FORCE
SHAFT INDICATES DIRECTION FROM WHICH THE WIND BLOWS.
LENGTH OF SHAFT GIVES THE FREQUENCY OF WINDS OF INDICATED FORCE AND DIRECTION ACCORDING TO THE FOLLOWING SCALE.
PERCENT OF DAYS WITH FOG
< 1 %
1 TO 10 %
10 TO 20 %
20 TO 30 %
30 TO 40 %
> 40 %
SAKHALIN
KOREA
HONSHU
0% CALM
90 OBS.
0% CALM
113 OBS.
2% CALM
44 OBS.
8% CALM
53 OBS.
8% CALM
35 OBS.
2% CALM
260 OBS
2% CALM
58 OBS
4% CALM
732 OBS.
2% CALM
208 OBS.
128°
132°
136°
140°
52°
48°
44°
40°
36°
JANUARY

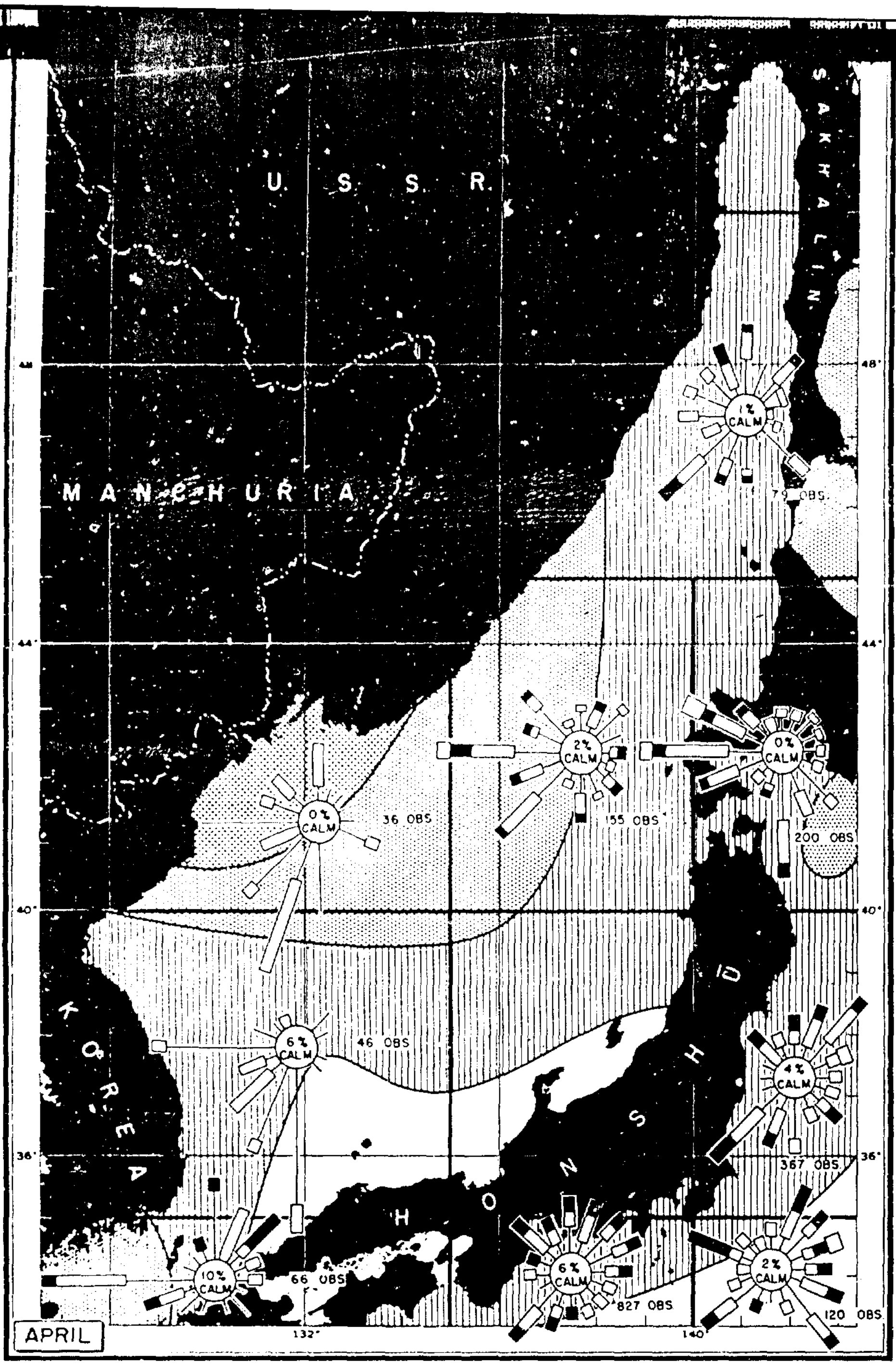

U. S. S. R.
SAKHALIN
MANCHURIA
KOREA
0% CALM
74 OBS.
1% CALM
139 OBS.
0% CALM
116 OBS.
20% CALM
33 OBS.
48 OBS.
2% CALM
258 OBS.
4% CALM
89 OBS.
4% CALM
715 OBS.
2% CALM
142 OBS.
FEBRUARY




## WINDS

The persistent and at times forceful wind generated by the immense Asiatic high pressure area is often called the winter or northerly monsoon. From early October to early April northwest winds generally prevail over the Sea of Japan and neighboring waters. Coastal mountain effects may alter the prevailing direction at times near lee shores.

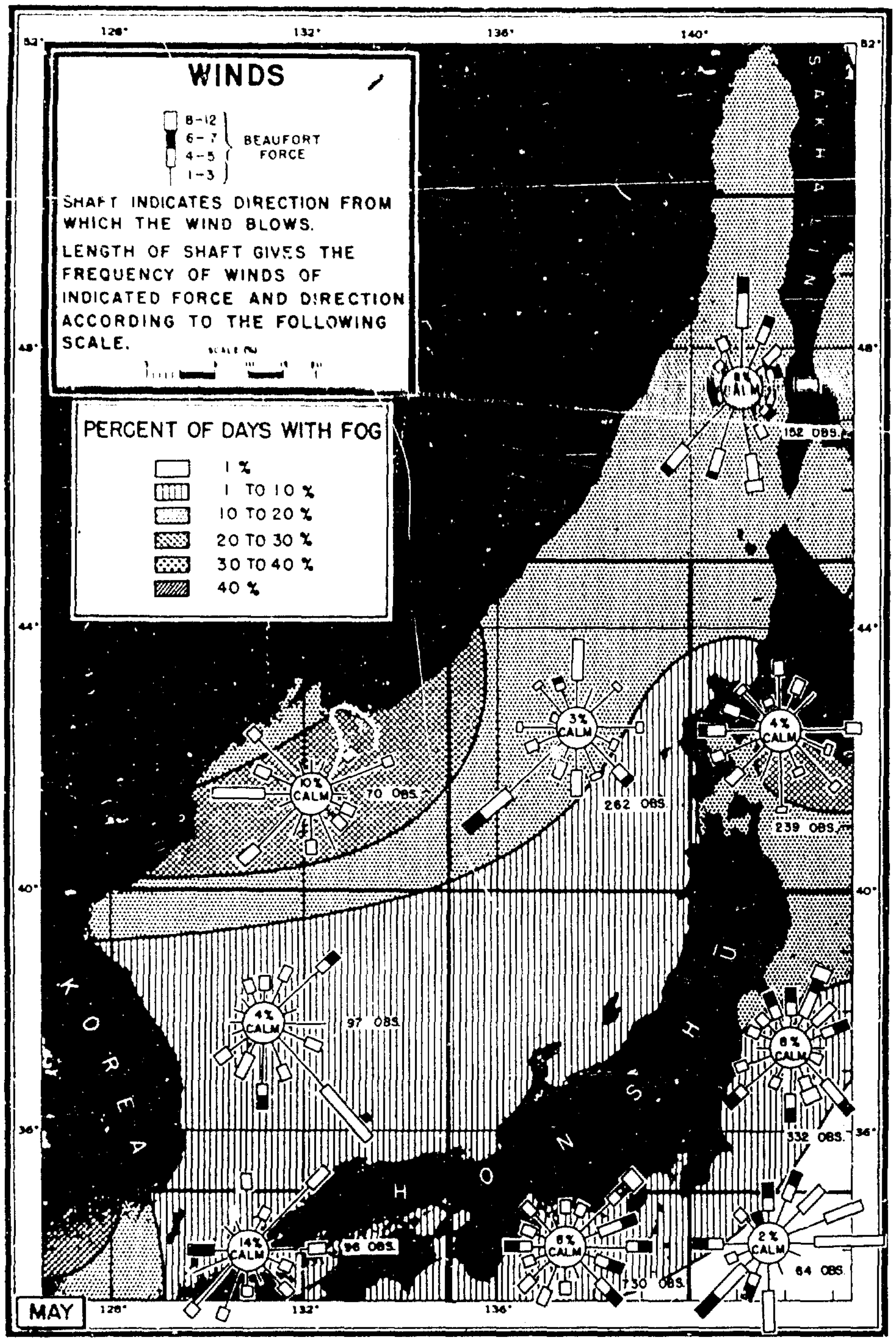
These are also the months when gales are most likely to occur, especially during the winter months of December, January, and February. Most gales, too, blow from a northwesterly quarter. Winds of force 8 or higher may be expected on 2 days of each winter month south of about the 45th parallel. North of the 45th parallel the incidence of gales increases. In exposed portions of the Gulf of Tatary, up to 4 or 5 days per month of such gales are common from October through February, 3 in March, and 2 in April and in September. Gales are even more frequent east of Sakhalin and Hokkaido.




By late May or June, the prevailing wind has backed to southwest and south. By late July a southerly monsoon dominates most of the area with moderate persistence and, at times, some force, 7 to 15 knots being a mean speed of the monsoon wind over open waters. During this southerly monsoon period, light, variable winds occur more frequently than stronger, persistent winds from other directions. Summertime calms, as a general rule, are less frequent well away from the mainland, particularly in the waters east of Japan.

During the summer, gales are less frequent over the Sea of Japan proper. However, many days with gales are recorded all year round off the eastern tip of Hokkaido. For additional information on summer gales, especially in August and September, see charts on typhoons.

# WINDS AND FOG—Continued



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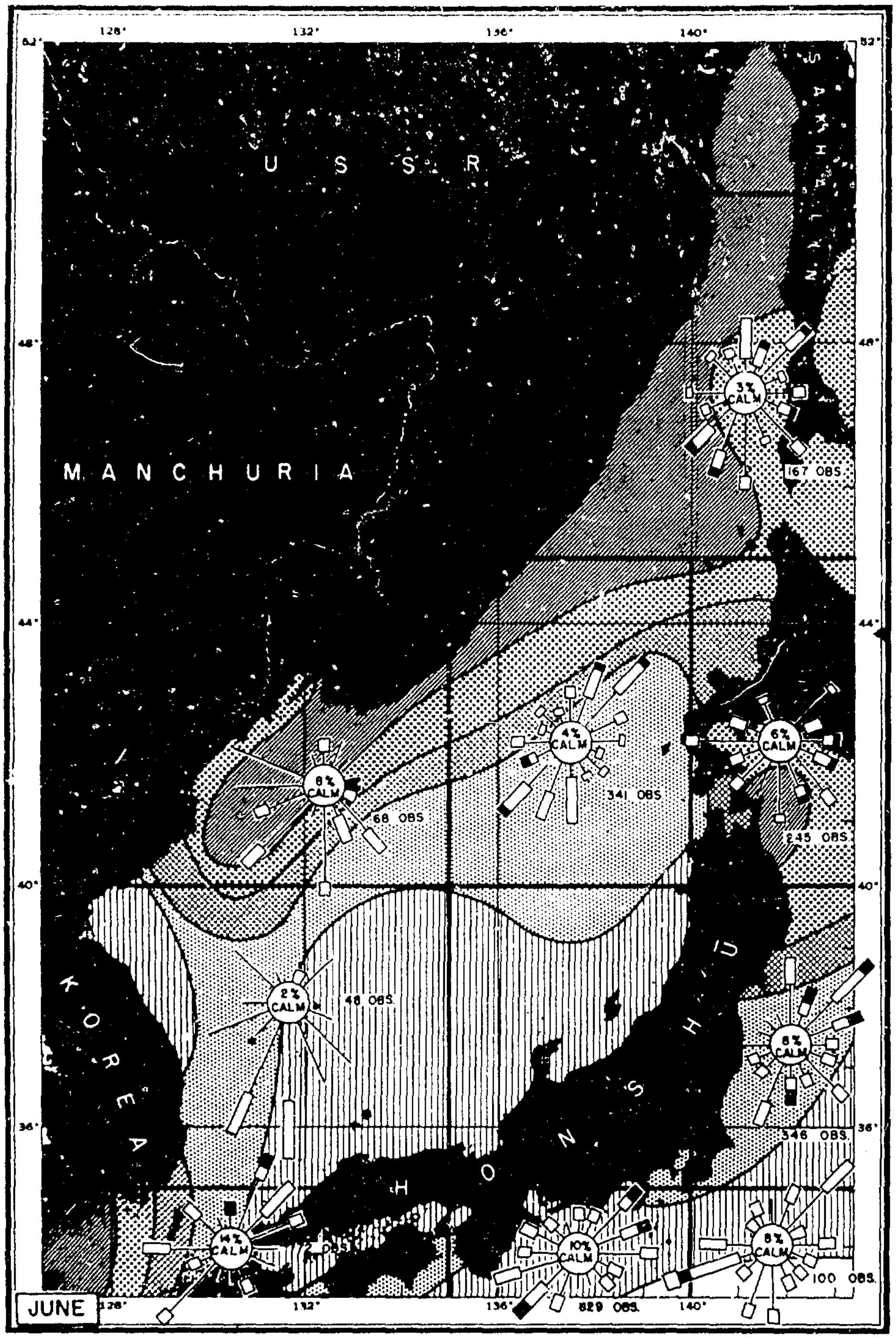
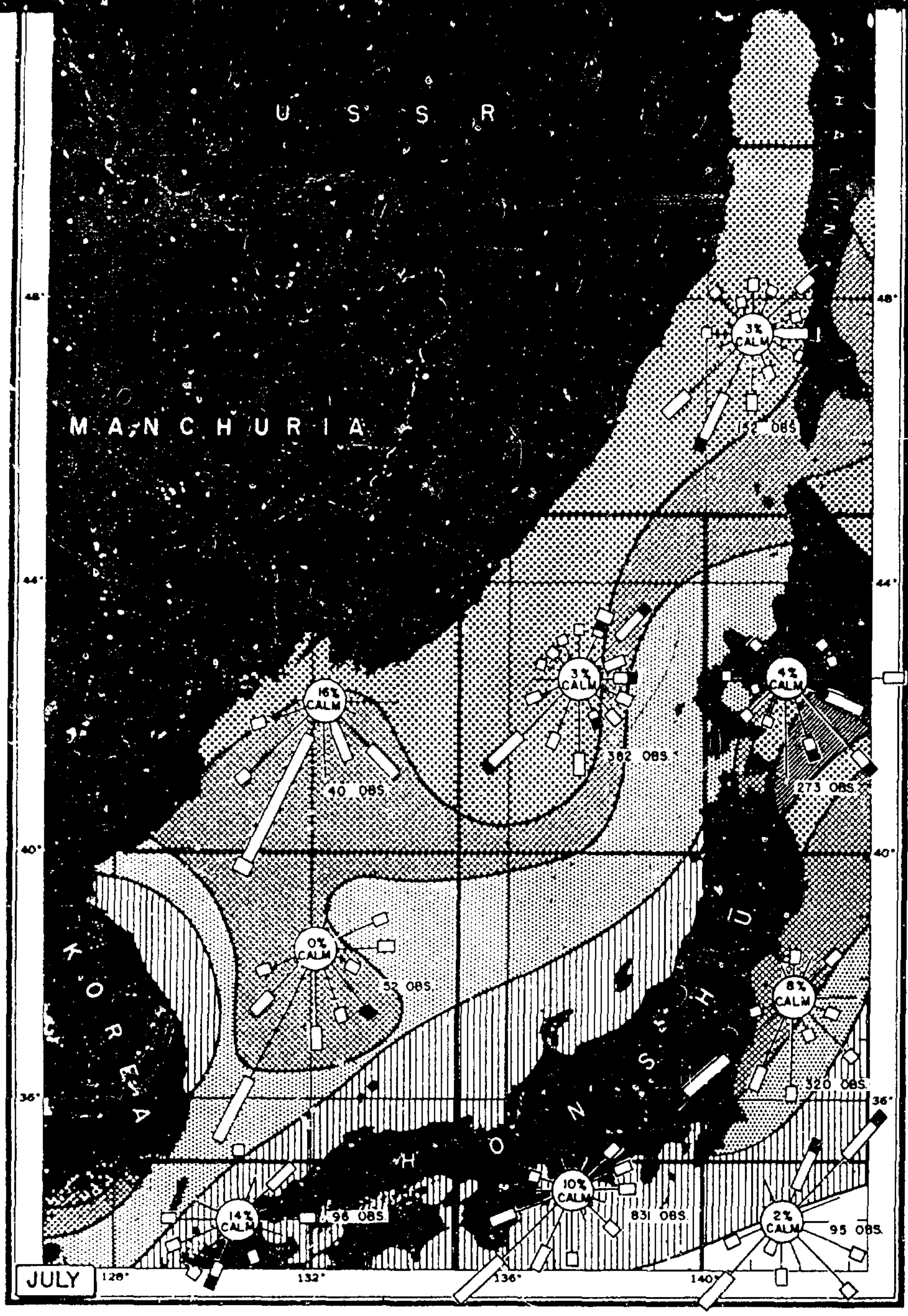


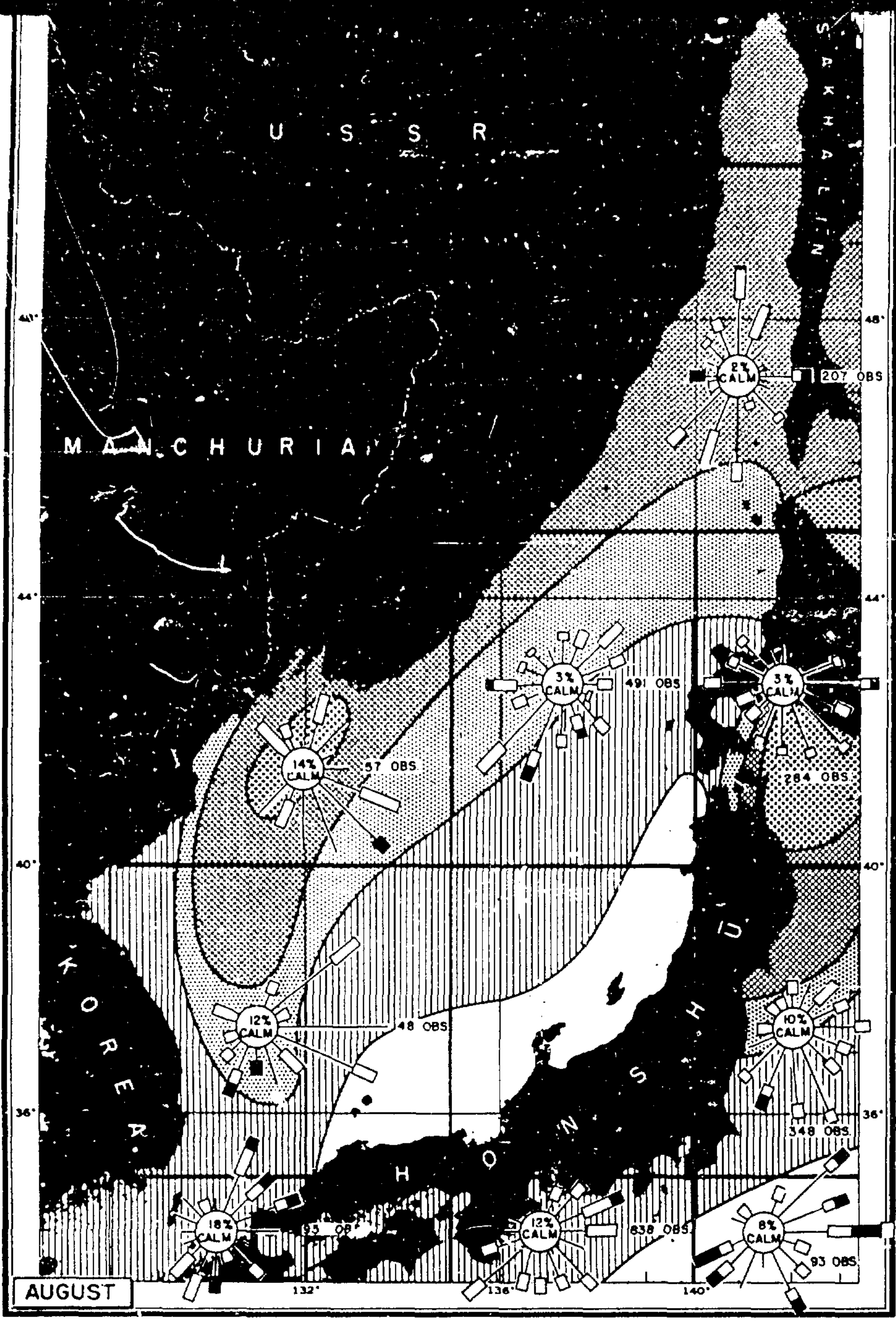
U S S R
MANCHURIA
KOREA
HONSHU
SAKHALIN
128°
132°
136°
140°
52°
48°
44°
40°
36°
3% CALM
167 OBS.
8% CALM
68 OBS
4% CALM
341 OBS
6% CALM
245 OBS
2% CALM
48 OBS
8% CALM
346 OBS
14% CALM
10% CALM
829 OBS
8% CALM
100 OBS
JUNE




## FOG

Seasonal changes in winds, and in the characteristics of air brought in by the winds, are in greatest measure responsible for the pattern of fog throughout the year over the Sea of Japan. In general, the waters nearest the coast of U.S.S.R. are influenced by the cold Liman Current. Therefore, air transported in a northwesterly direction across the Sea of Japan becomes chilled at low levels by contact with the colder water in approaching the shore. Whenever this air is quite humid, the lowest layers may be chilled down to the dew point, a process which results in the formation of advection fog.

Farther offshore from the Russian coast (about 100 to 300 nautical miles or more in February or March) the warm Tsushima Current holds sway. Thus, whenever the shoreward borne air is initially cooler than the warm surface water, it will absorb moisture during its passage over the Sea of Japan. Intense fog would be expected to form under these conditions, and to continue as long as the onshore breeze continues. From late April to early September, the northward extension of the Pacific high pressure area guides the general circulation of air northwestward and northward across subtropical waters, thence northwestward to northeast-




ward at times across the waters of the Sea of Japan. Accordingly, the fog season here will be in summer and early autumn.

The greatest incidence of fog is to be expected within 100 to 300 nautical miles of the northern and northwestern shores of the Sea of Japan, where humid air has been cooled most by prolonged exposure to successively colder surface waters. From late April to late August, fog occurs normally from 3 to 8 days per month over the northwestern and northern one-third of the Sea of Japan, reaching a frequency of 12 days per month in June and much of July. If an onshore breeze is present during these two months, fog at times may tend to persist for 2 days or more. Very near shore, especially southward of Vladivostok, there may be a temporary dissipation during mid-afternoon, caused by the heating of land surfaces. Along the east coasts of Japan, the cold water currents from the Sea of Okhotsk make their way southward along a good part of the Honshu coast. Thus, the ports and coasts of eastern Japan, from the 39th parallel northward, are subject to more winter fog than the shores of the Sea of Japan.

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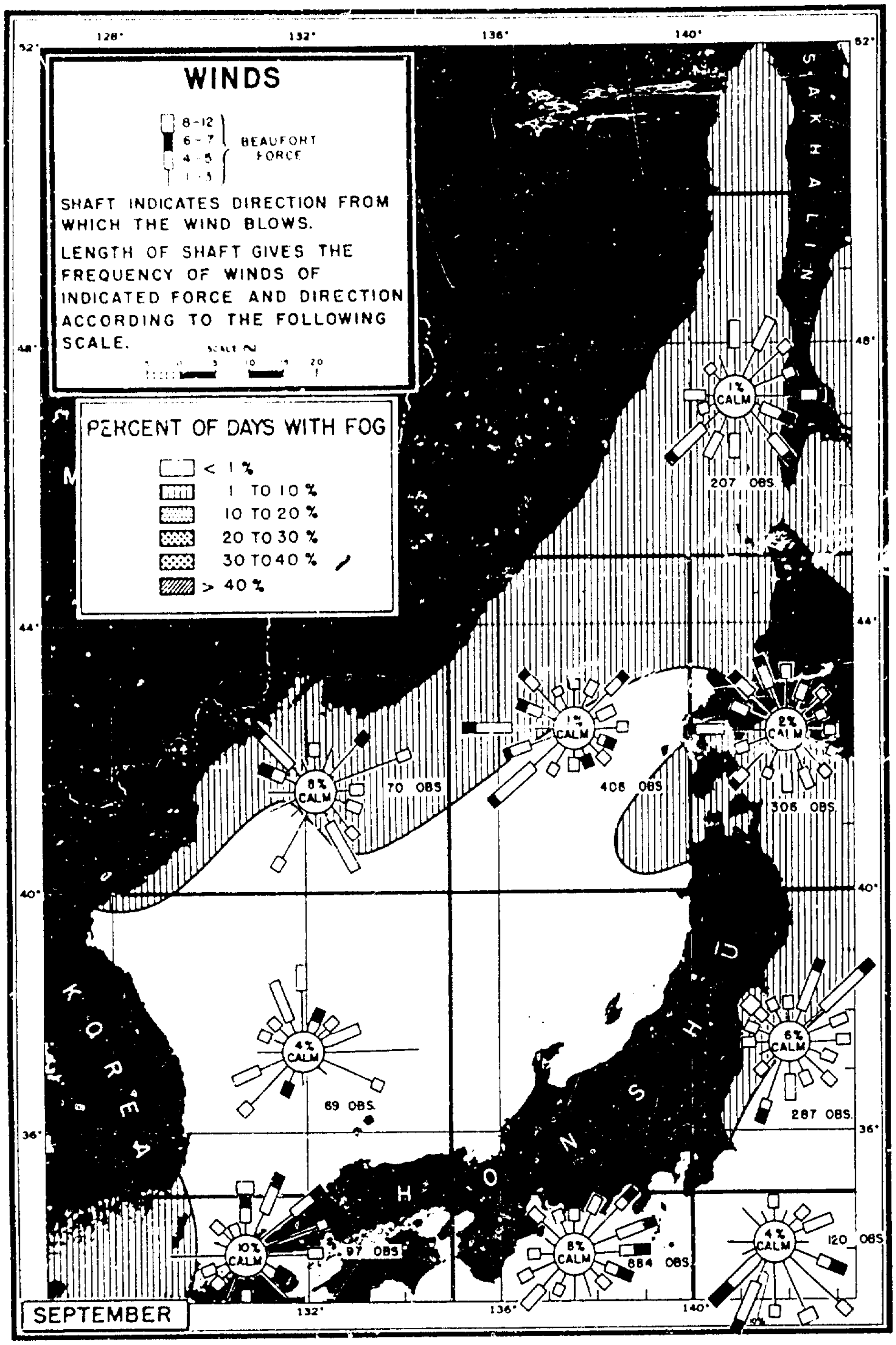
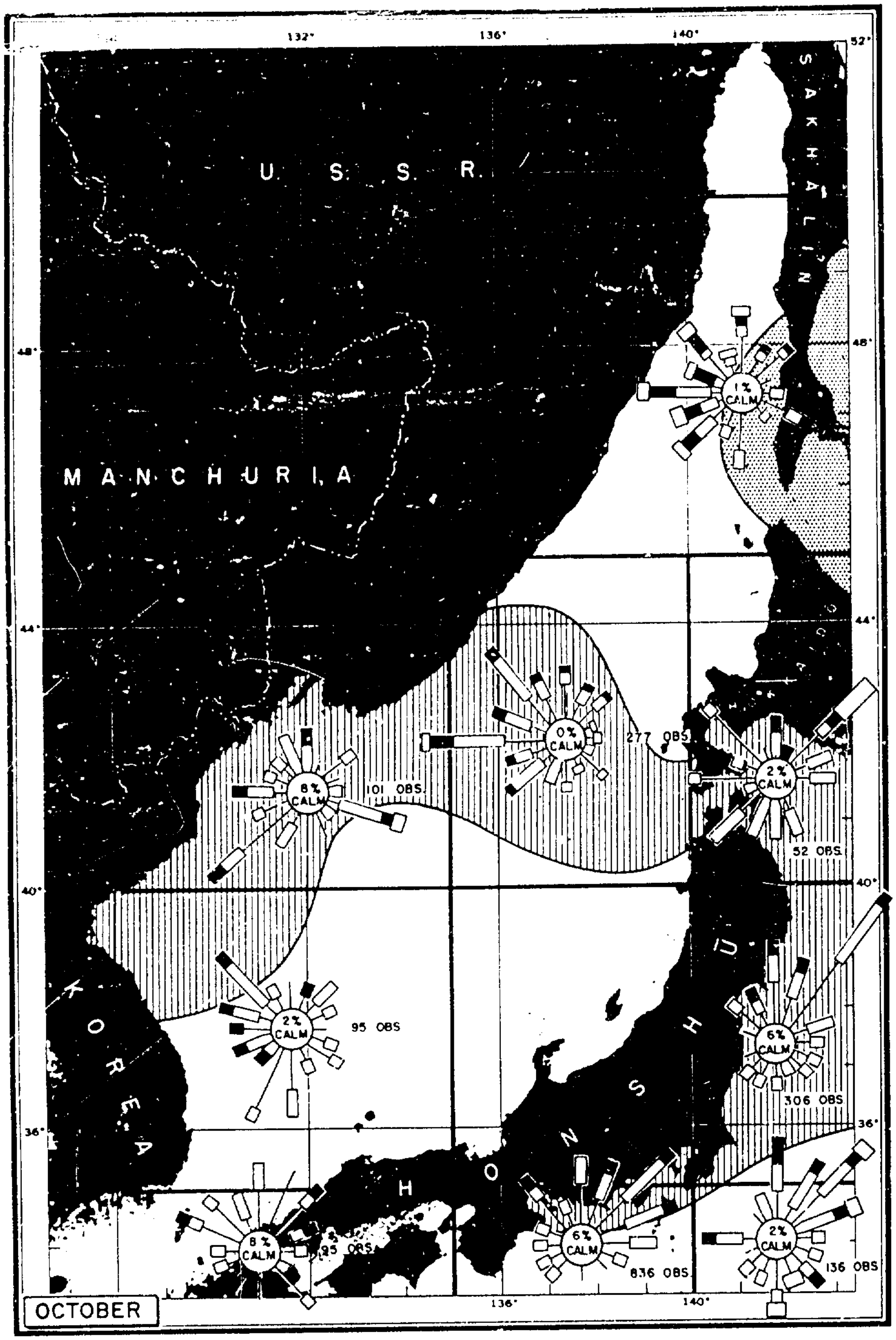
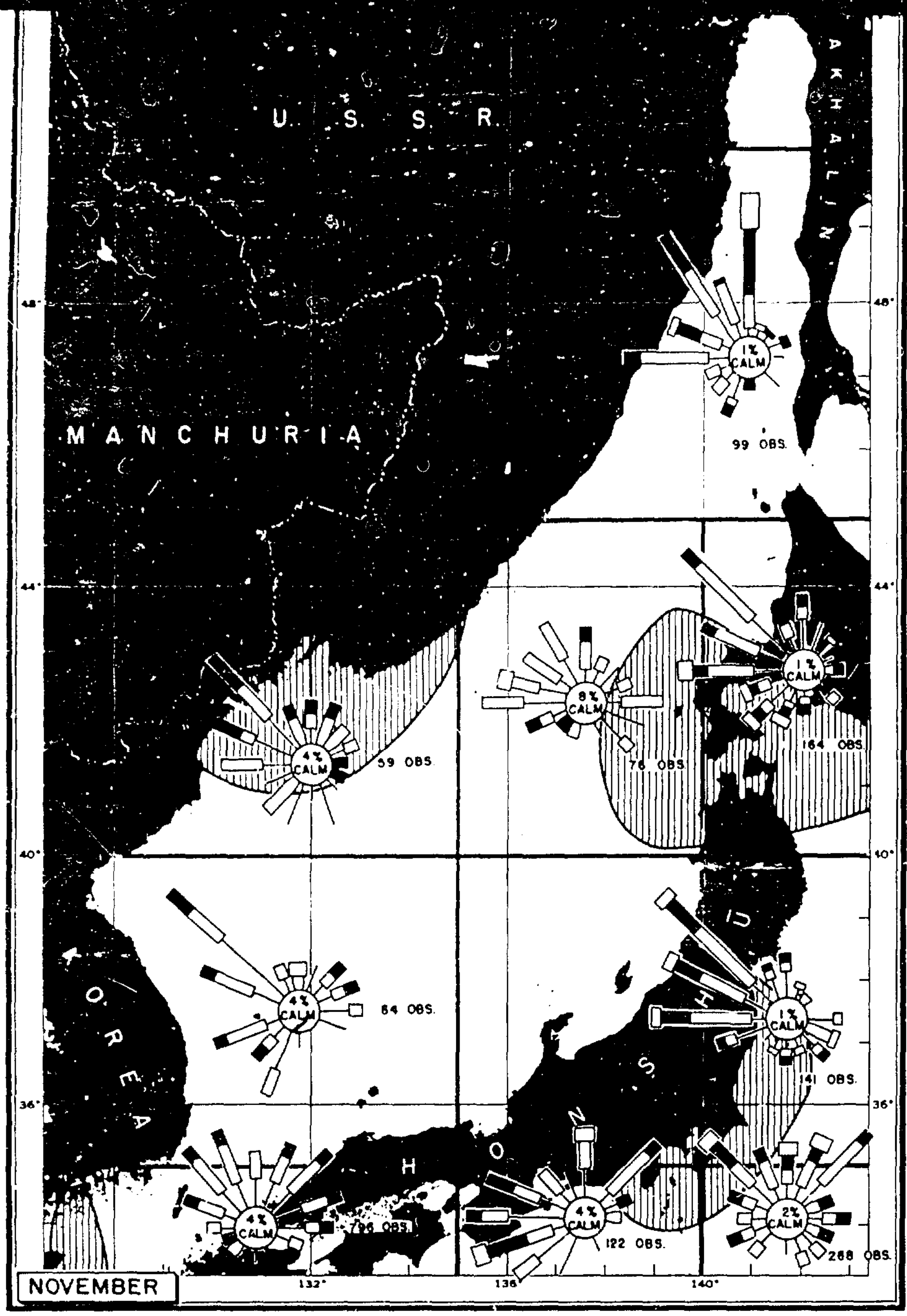


WINDS
8-12
6-7
4-5
1-3
BEAUFORT FORCE
SHAFT INDICATES DIRECTION FROM WHICH THE WIND BLOWS.
LENGTH OF SHAFT GIVES THE FREQUENCY OF WINDS OF INDICATED FORCE AND DIRECTION ACCORDING TO THE FOLLOWING SCALE.
PERCENT OF DAYS WITH FOG
< 1 %
1 TO 10 %
10 TO 20 %
20 TO 30 %
30 TO 40 %
> 40 %
128°
132°
136°
140°
52°
48°
44°
40°
36°
SAKHALIN
KOREA
HONSHU
1% CALM
207 OBS
8% CALM
70 OBS
1% CALM
408 OBS
2% CALM
306 OBS
4% CALM
69 OBS
6% CALM
287 OBS
10% CALM
97 OBS
8% CALM
884 OBS
4% CALM
120 OBS
SEPTEMBER


132°
136°
140°
52°
48°
44°
40°
36°
U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HONSHU
1% CALM
0% CALM
277 OBS.
8% CALM
101 OBS.
2% CALM
52 OBS.
2% CALM
95 OBS
6% CALM
306 OBS.
8% CALM
95 OBS.
6% CALM
836 OBS.
2% CALM
136 OBS
OCTOBER

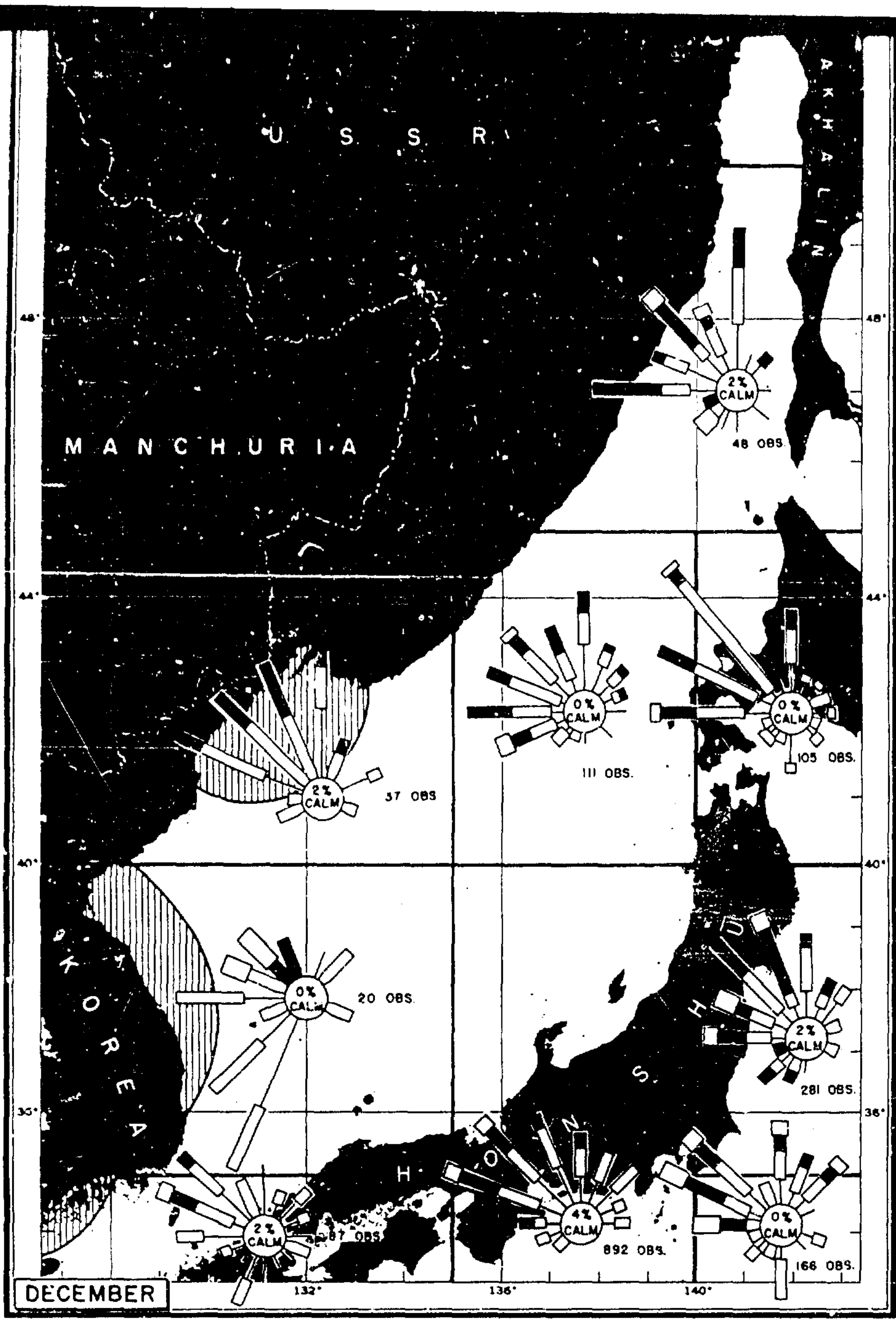



A lower incidence of fog is found over western and southwestern waters of the Sea of Japan, in part due to the fact that humid air, brought from south-southwesterly to northeasterly directions, tends to lose moisture in the form of rainfall while crossing over the high mountains of Hokkaido and Honshu. Thus, fog forms with greater frequency in summer east of Hokkaido and Honshu than it does west of these islands. Off the east and southeast coast of Hokkaido it averages up to 18 days per month in June and July. However, off the southeast coast of Honshu, the warm Kuroshio sets close to the coast and insufficient cold surface water is present to develop much advection fog [illegible]. The same holds true with the Tsushima Current over the southern and eastern portions of the Sea of Japan.

In autumn, winter, and early spring, the building of strong and persistent high barometric pressure over the Asiatic mainland guides the flow of air to the southeast and south, so that little fog is observed over the Sea of Japan and neighboring waters.

Radiation fog sometimes occurs in coastal areas, especially along the Asiatic mainland, during the winter. This type of fog results from the cooling of land surfaces at night under conditions of open sky and light breeze, provided the lowest layer of air is humid. Radiation fog seldom carries more than a few miles out to sea and, in fact, fails frequently to form on the immediate coast line since water surfaces do not cool rapidly at night.

3





References:

Great Britain, Meteorological Office, "Weather in the China Seas and in the Western Part of the North Pacific Ocean," (M. O. 404b), Air Ministry, Vol. II, Local Information, Parts 1-11, H. M. Stationery Office, London, 1937.

Japan, Hydrographic Department, "The Current and Meteorological Charts of the Seas Near Japan," (Pub. No. 6042), 1925, (in Japanese).

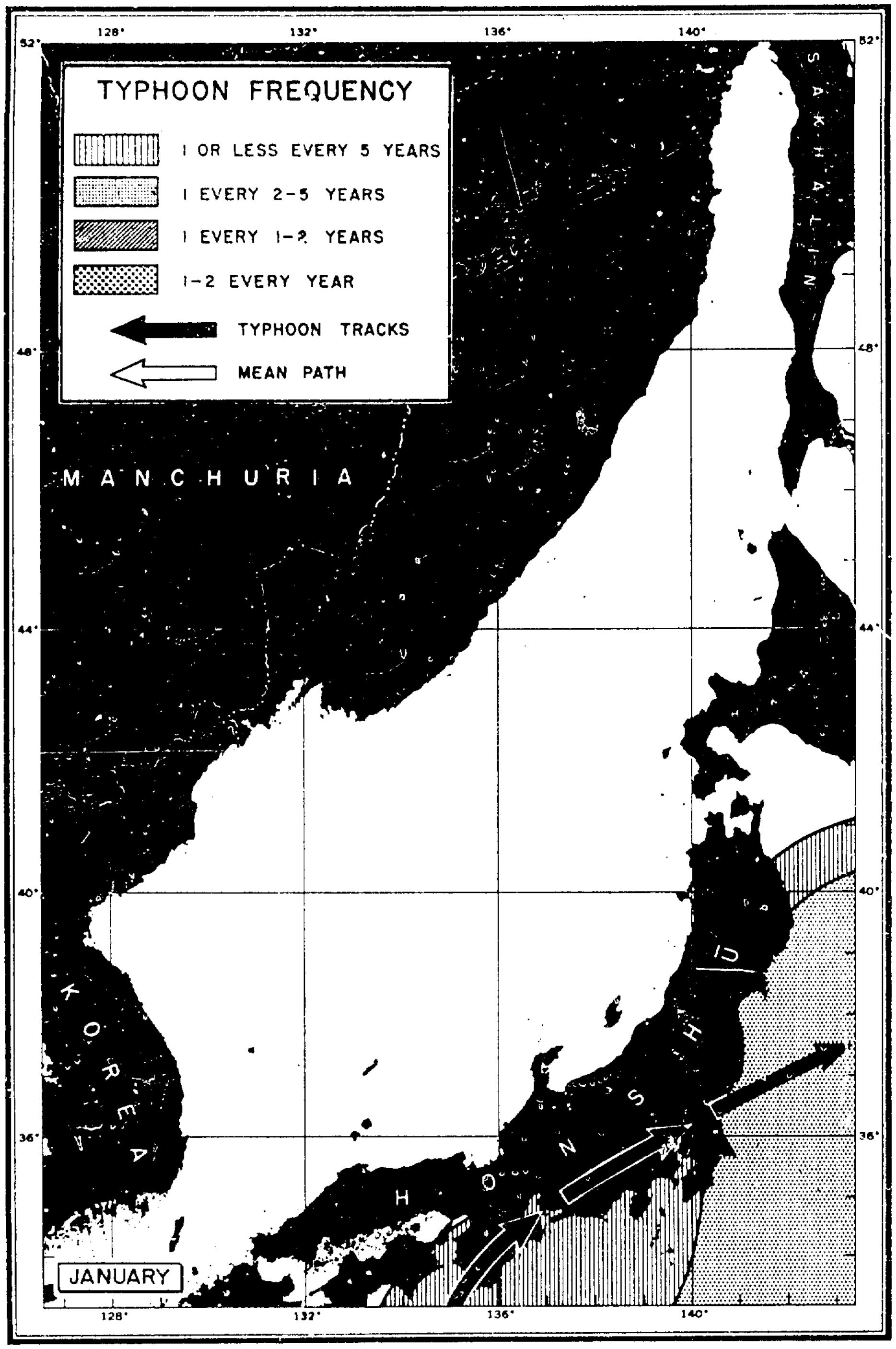
————, "Military Weather Charts, Northern North Pacific," (Pub. No. 2771), December 1943.

Royal Netherlands, Meteorological Institute No. 115, "Oceanographic and Meteorological Observations in the China Seas and in the Western Part of the North Pacific Ocean," 1935, Government Printing Office, The Hague, (NAVAER 50-1R-173, U. S. Navy Reprint, CNO, Aerology Section, Washington, D. C., May 1945).

U. S., Navy, "Climatic Atlas of Japan and her Neighbouring Countries," NAVAER, U. S. Navy reprint from Japanese sources, September 1943.

————, Navy, Pacific Fleet and Pacific Ocean Areas, "Climatology and Oceanography of Operational Areas of the Western Pacific," (CINCPAC-CINCPOA Bulletin No. 4-45), Vol. 1, March 10, 1945.

# TYPHOON FREQUENCY



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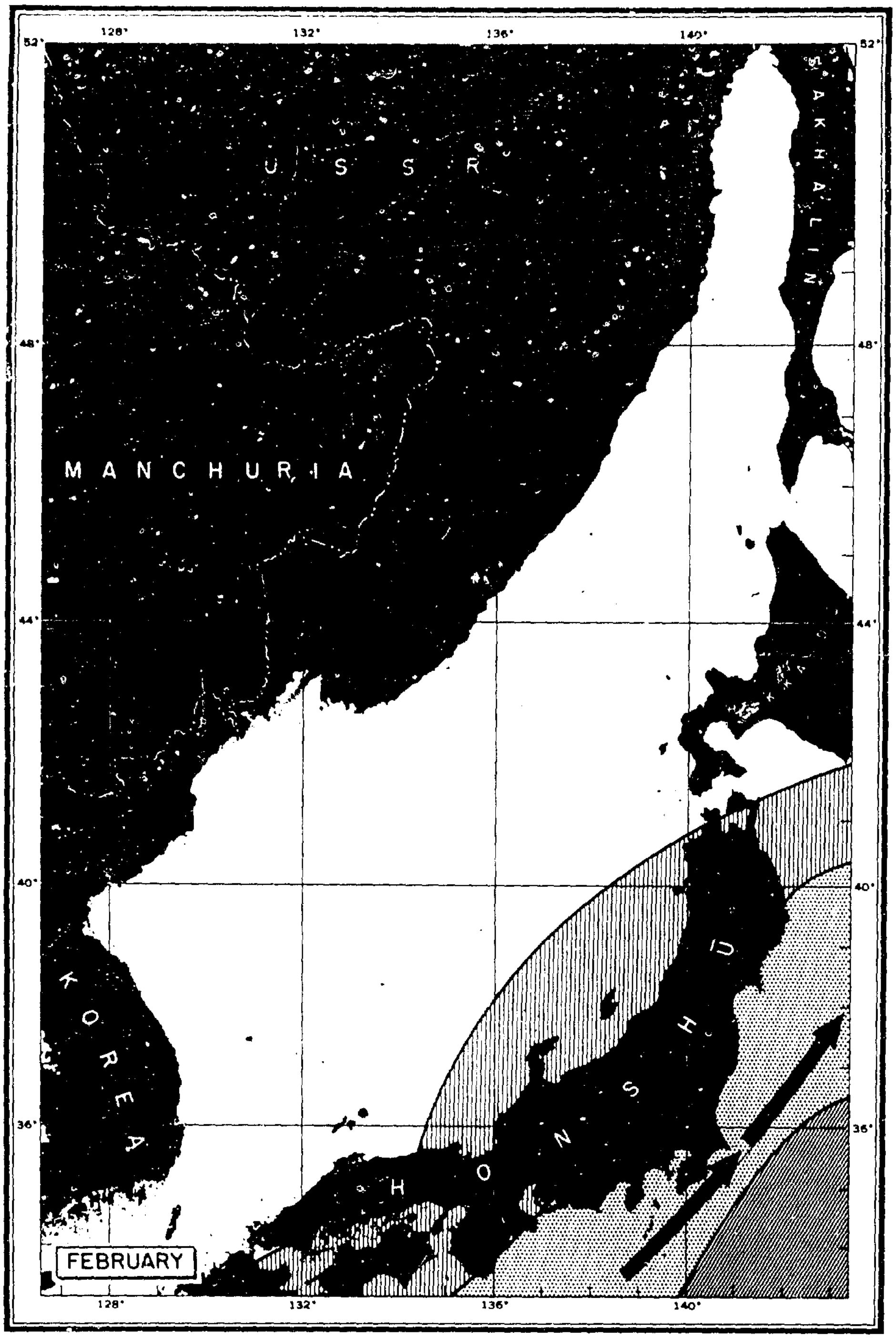
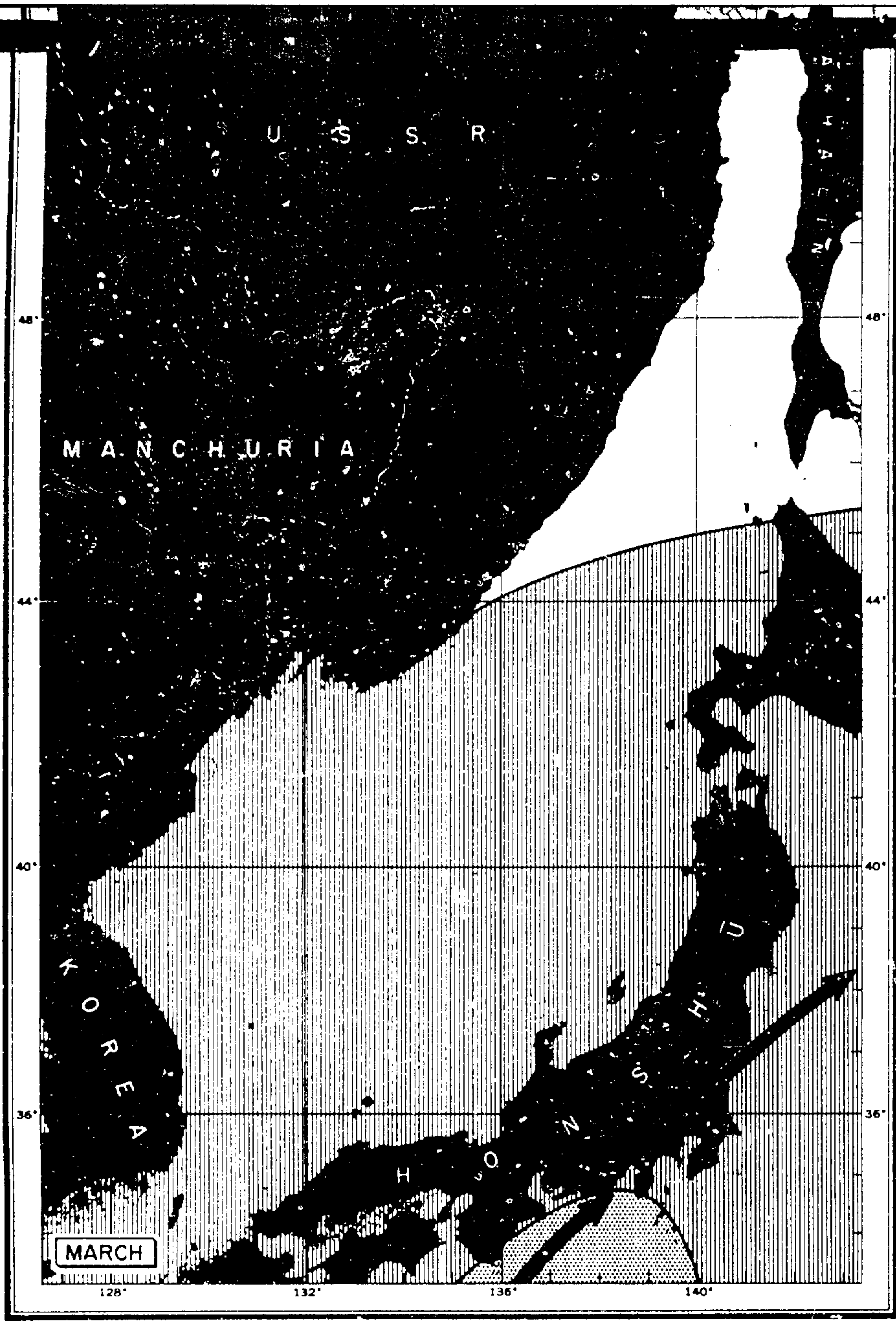
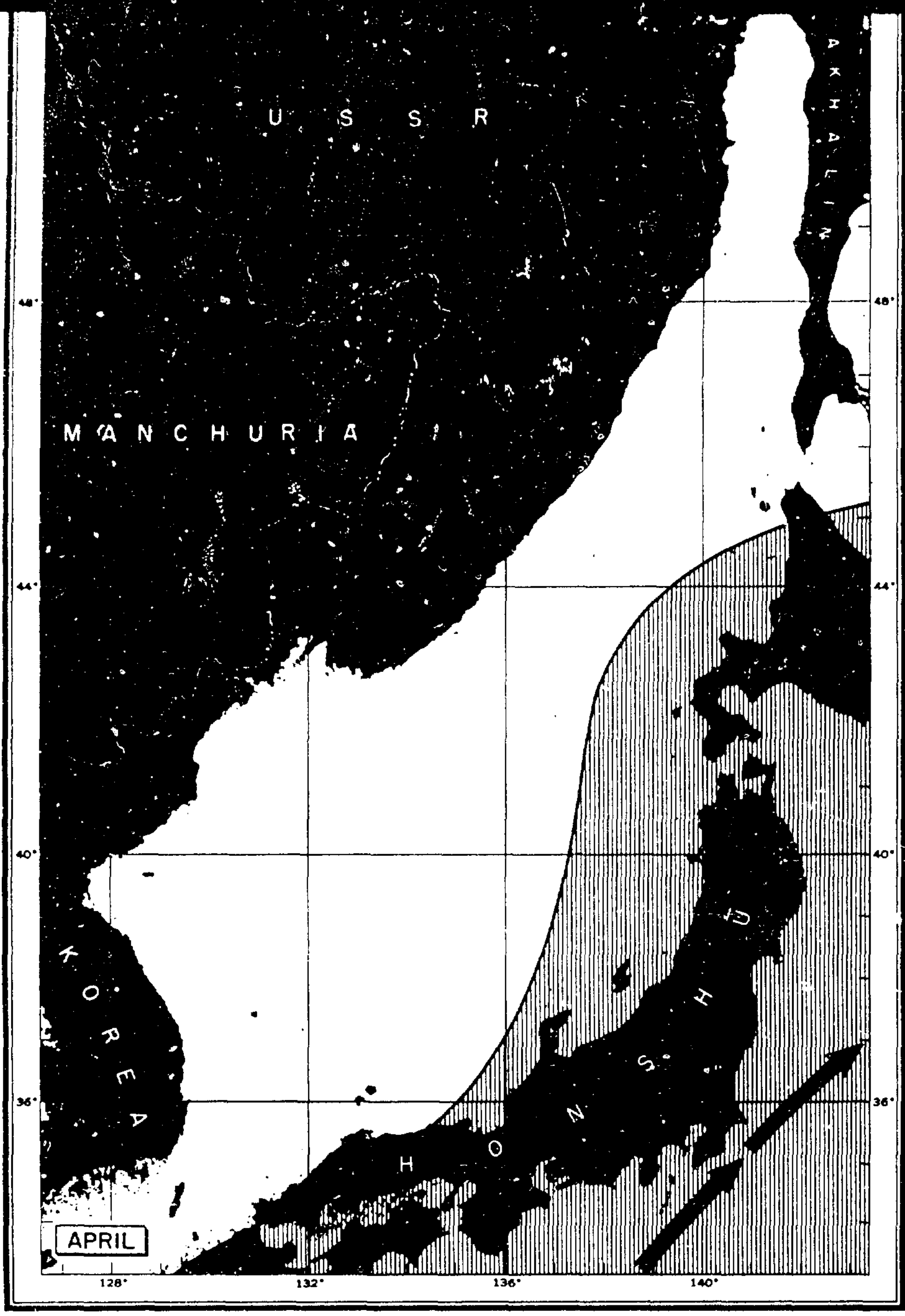

128°
132°
136°
140°
52°
48°
44°
40°
36°
U S S R
SAKHALIN
MANCHURIA
KOREA
HONSHU
FEBRUARY




Approximately 66 percent of all Pacific typhoons originate within a radius of 500 miles from the islands of Guam and Yap between latitudes of 5° and 20°N., t few have formed within 2° or 3° of the equator. Mean latitudes of formation of ty vary from 6°30'N. during March to 16°5'N. in August.

In their early westward movement typhoons sometime take on speeds of 20 kn the average is more nearly 10 or between 6 and 12 knots before they recurve in a toward the northeast. From January to August the area of recurvature gradually s the northern and western extremes of 30°N. and 115°E. The southern and easter during the winter are found near 15°N. and 140°E. Many typhoons do not recurve but continue in a northwest direction into South China. Those that do recurve in mean speed of movement gradually to about 25 knots by the time they reach latitu 40°N. Normal speed limits of movement of typhoons may deviate from the mean a 7 knots before they recurve and up to 12 knots after they recurve.

During any one month from January through April an average of only 1 typhoon years ever reaches the Sea of Japan. At this time of the year most typhoons tha far north as 30°N. pass well to the southeast of Japan as a result of recurving w 15°N. and 140°E.




Pacific typhoons originate within a radius of about
ınd Yap between latitudes of 5° and 20°N., though a
ıe equator. Mean latitudes of formation of typhoons
°5'N. in August.

typhoons sometime take on speeds of 20 knots, though
veen 6 and 12 knots before they recurve in a parabola
to August the area of recurvature gradually shifts toward
30°N. and 115°E. The southern and eastern extremes
I. and 140°E. Many typhoons do not recurve, however,
into South China. Those that do recurve increase their
about 25 knots by the time they reach latitudes 35° to
ıent of typhoons may deviate from the mean as much as
12 knots after they recurve.

ry through April an average of only 1 typhoon every 5
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southeast of Japan as a result of recurving west of

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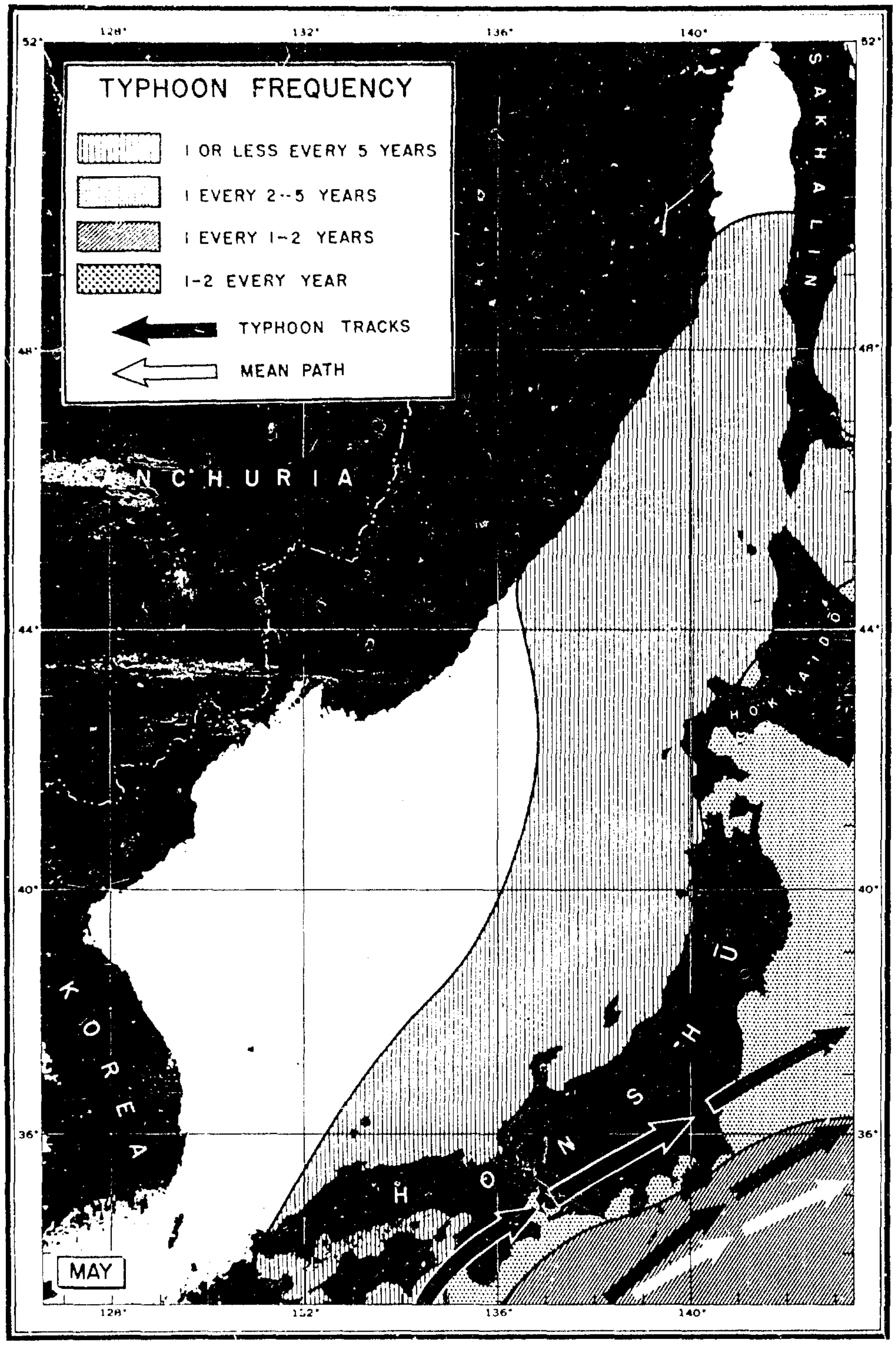
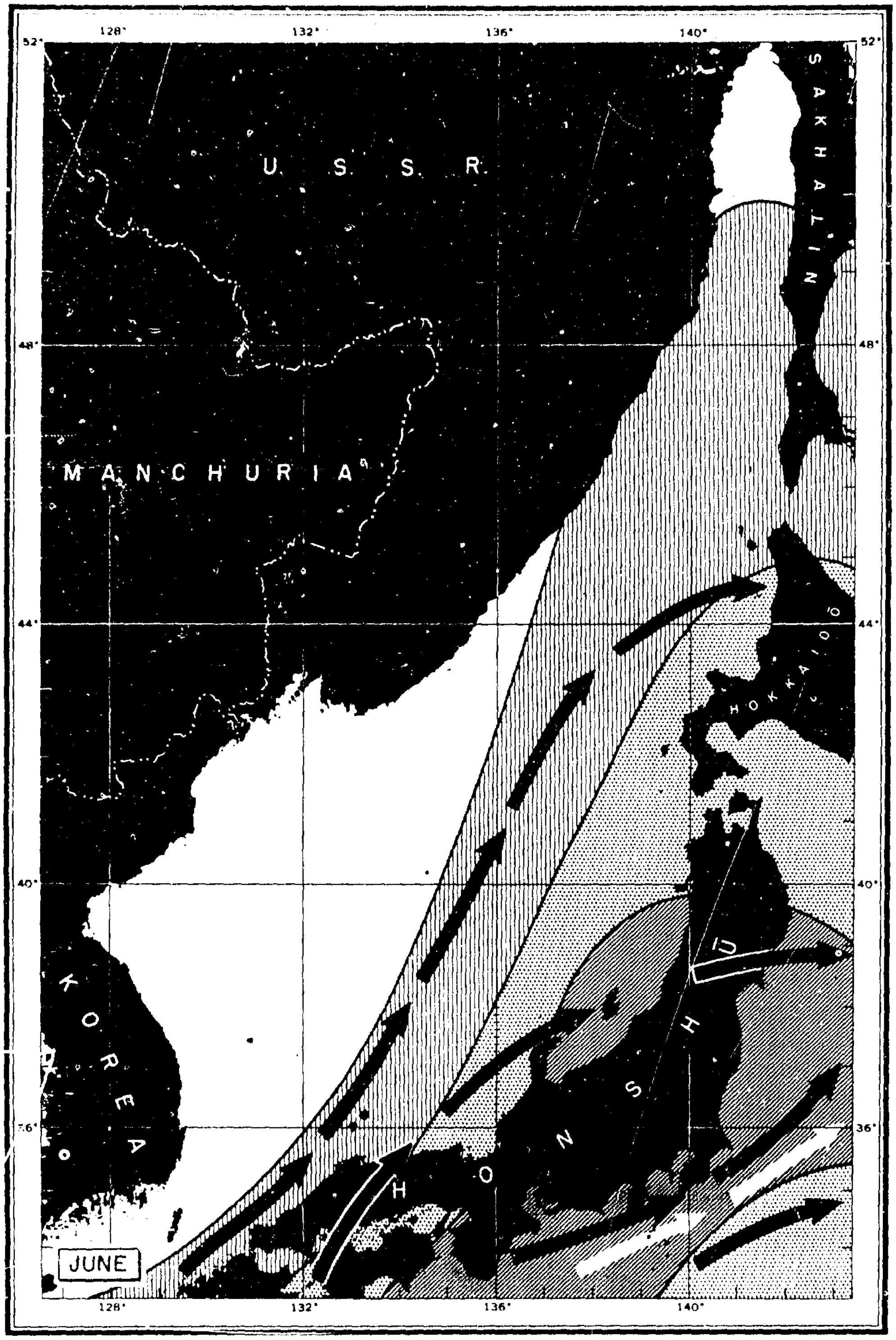
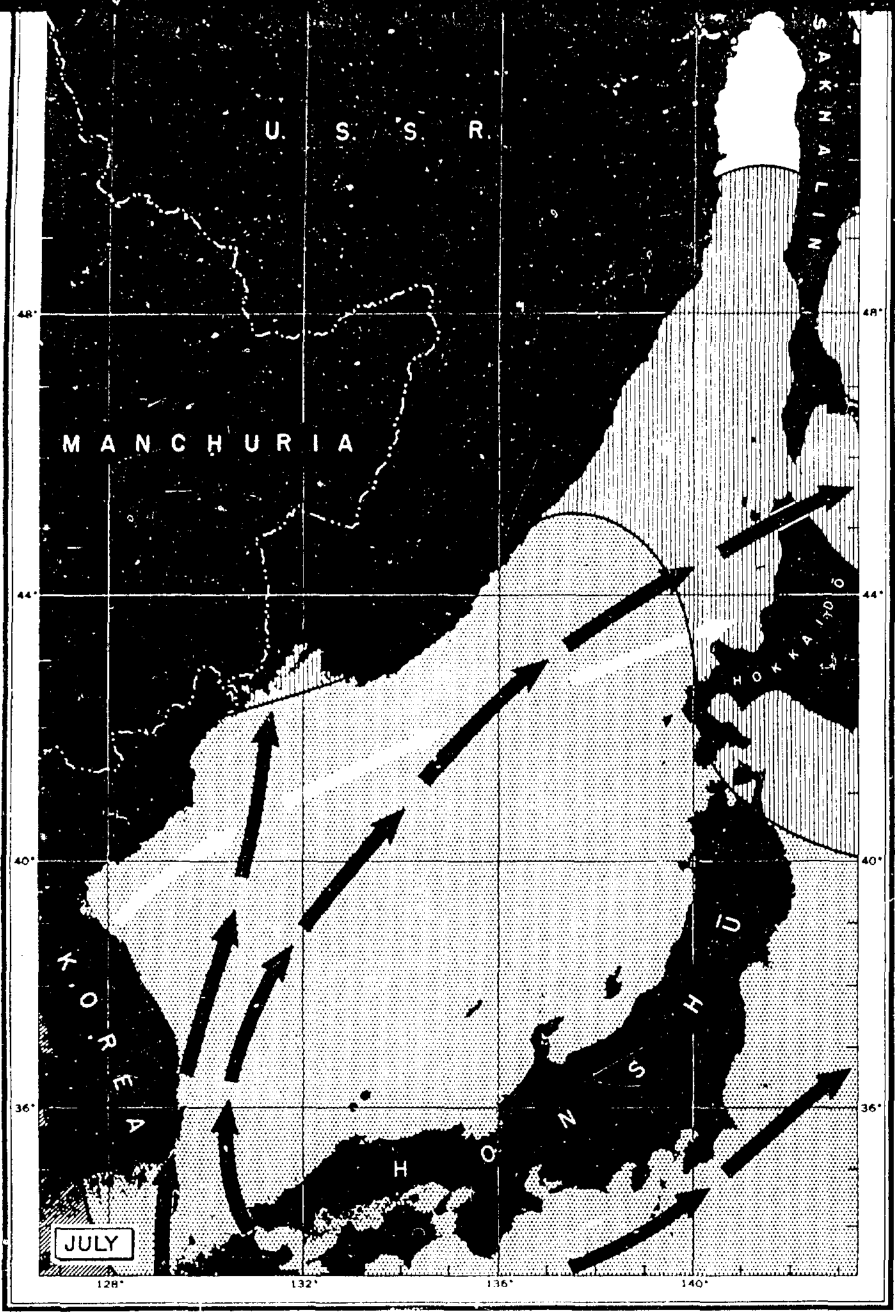
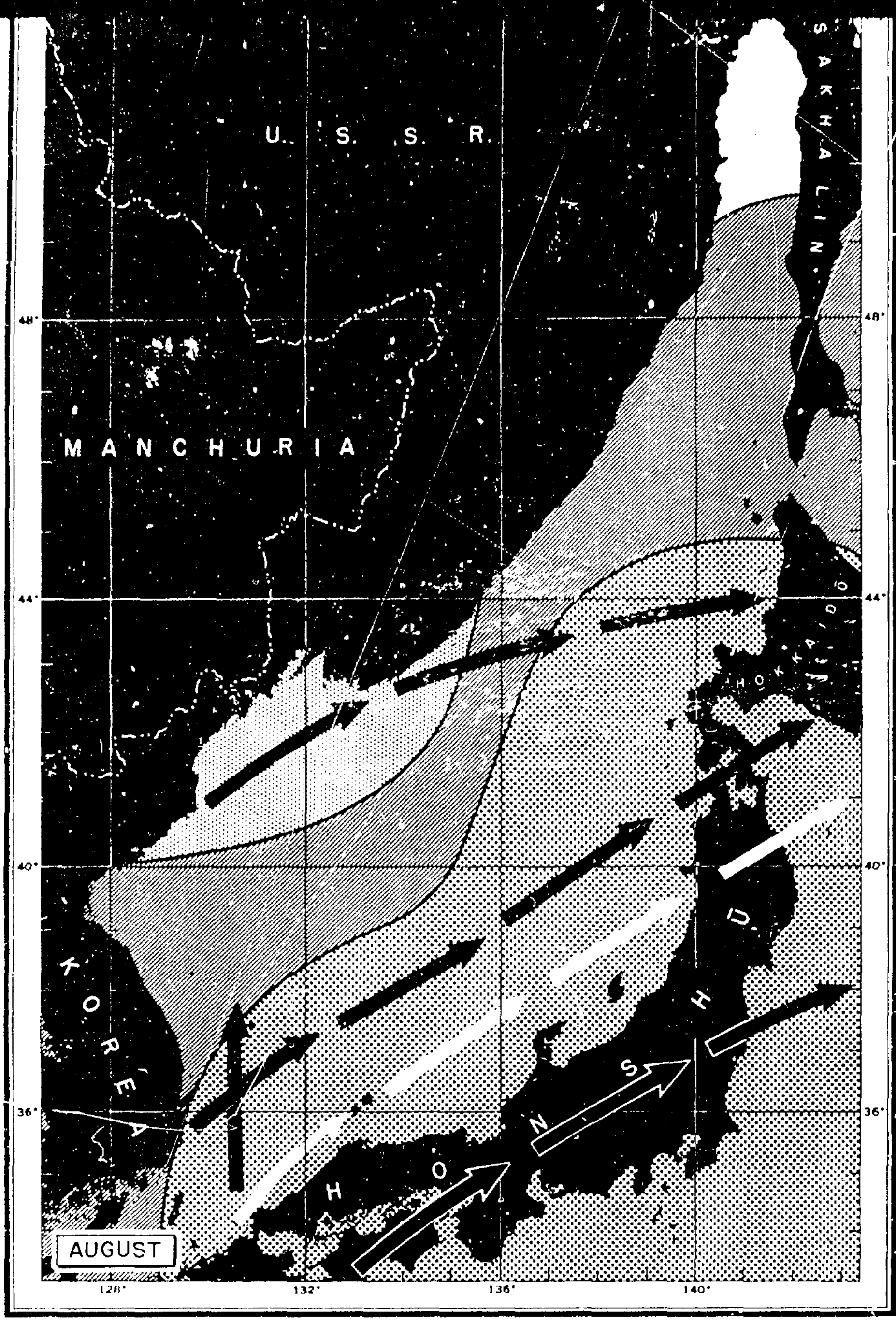


TYPHOON FREQUENCY
1 OR LESS EVERY 5 YEARS
1 EVERY 2--5 YEARS
1 EVERY 1-2 YEARS
1-2 EVERY YEAR
TYPHOON TRACKS
MEAN PATH
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
MAY
128°
132°
136°
140°
52°
48°
44°
40°
36°


U. S. S. R.
SAKHALIN
MANCHURIA
HOKKAIDO
KOREA
HONSHU
JUNE
128°
132°
136°
140°
52°
48°
44°
40°
36°




From May the number of typhoons affecting the area gradually increases until the yp maximum frequency of 1 to 2 per year during the month of August. Most of these typh p follow a parabolic curve, passing east of the Philippines, through Tsushima Kaikyo, ss the west coast of Honshu, and southeast of Hokkaido. Once every 1 to 2 years durin nd August a typhoon penetrates into Siberia as far north as the southern half of the Gulf ir Tatary.

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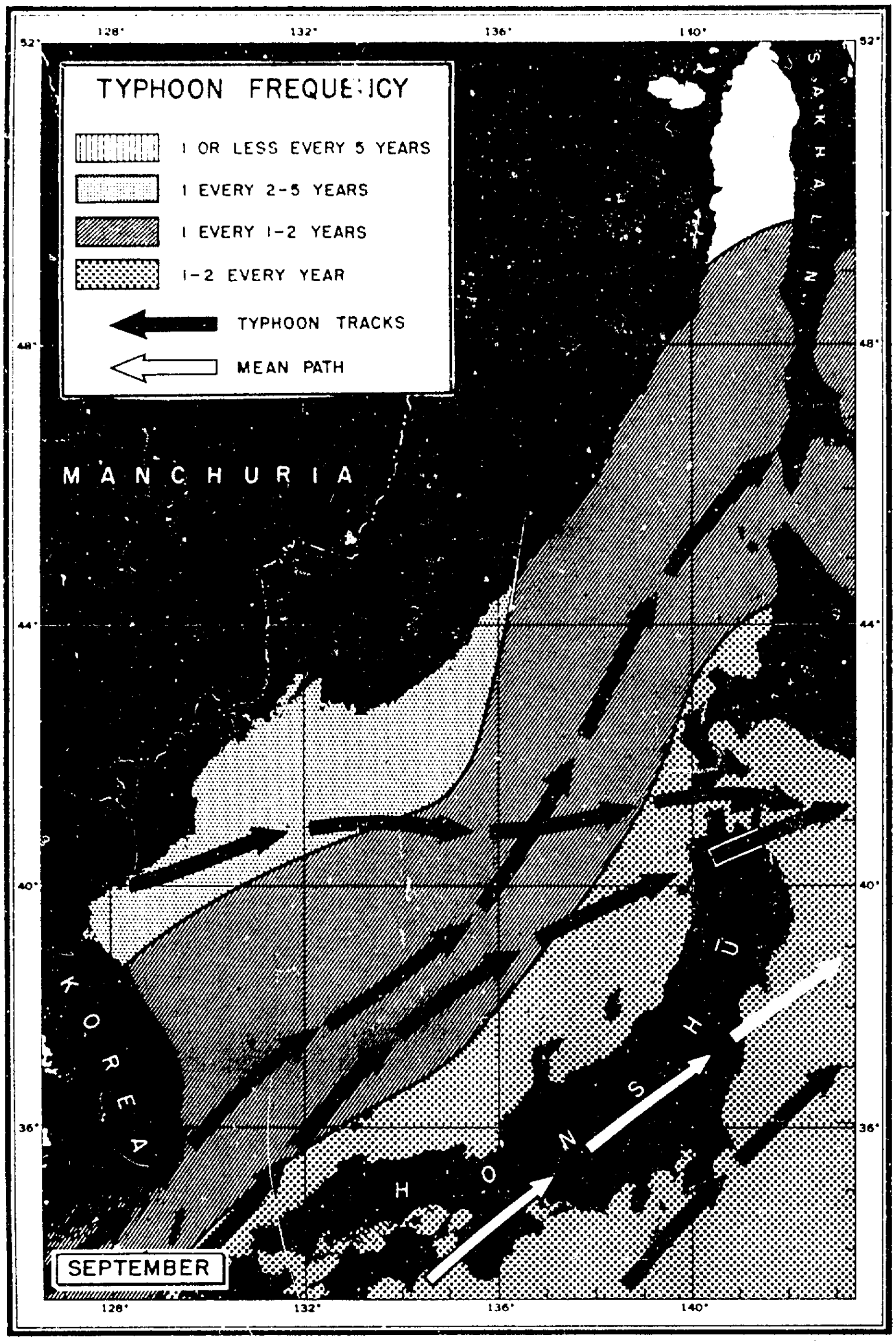
per year during the month of August. Most of these typhoons
ssing east of the Philippines, through Tsushima Kaikyo, along
nd southeast of Hokkaido. Once every 1 to 2 years during
into Siberia as far north as the southern half of the Gulf of

4

# TYPHOON FREQUENCY—Continued



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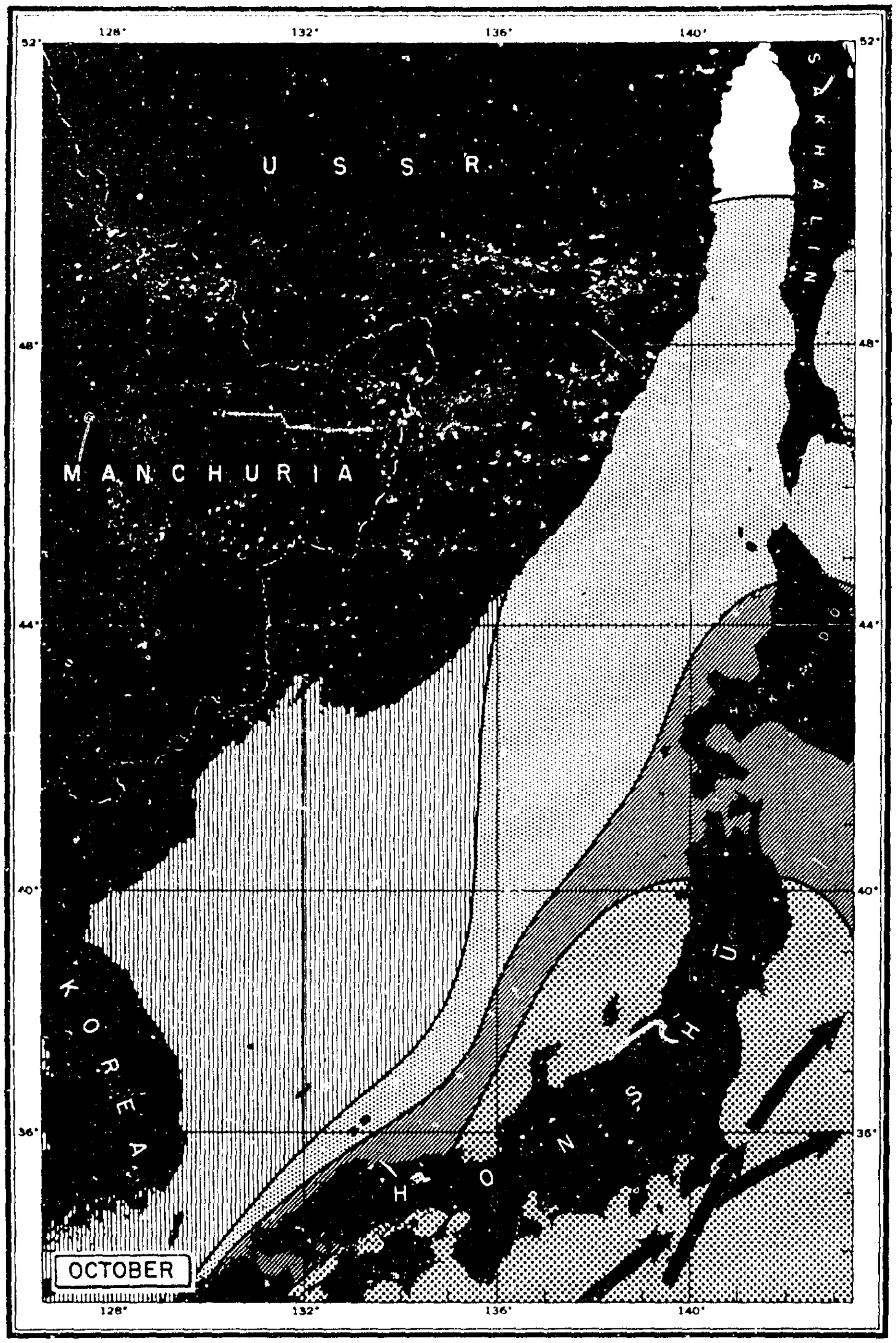
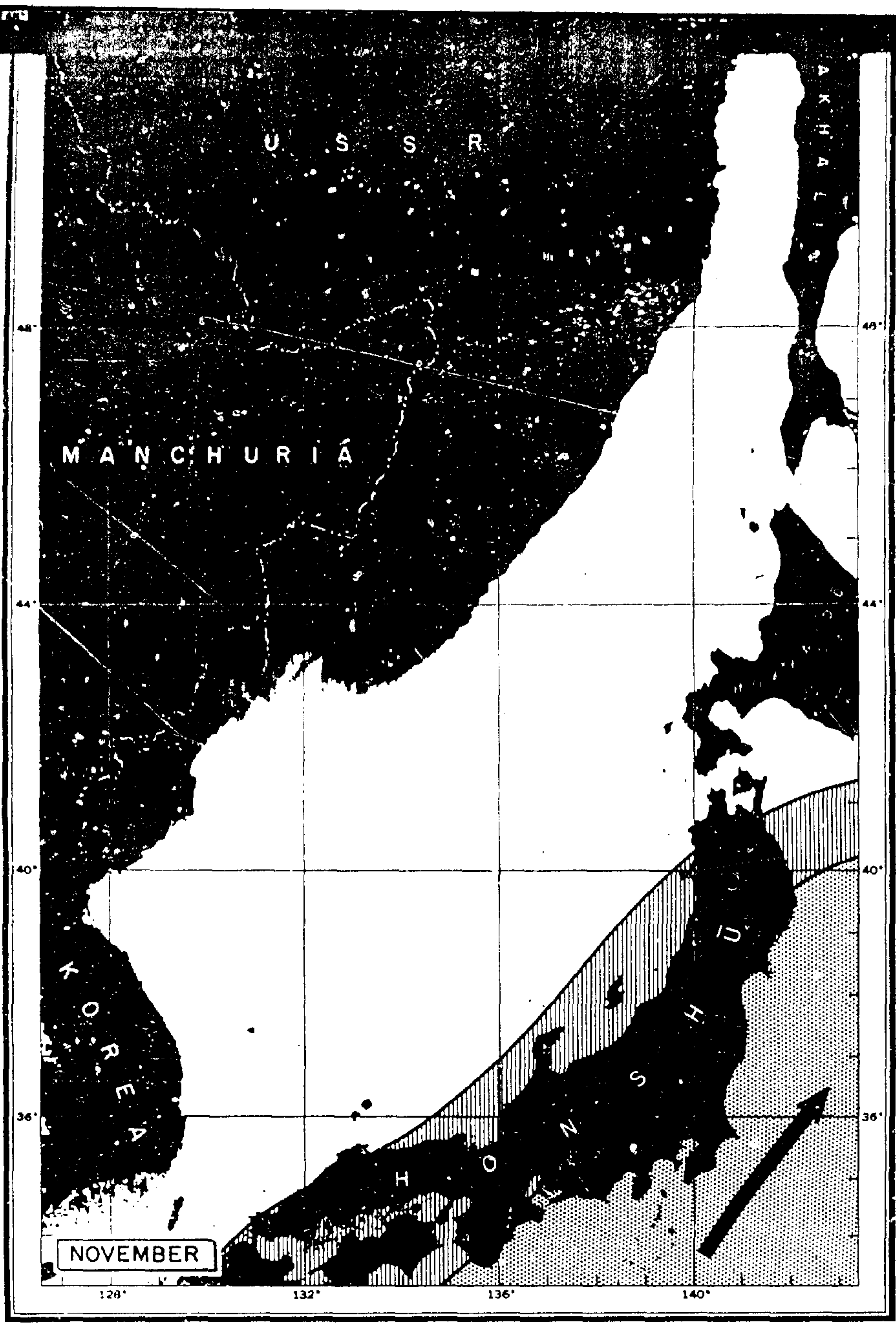

U S S R
MANCHURIA
SAKHALIN
KOREA
HOKKAIDO
HONSHU
OCTOBER
128°
132°
136°
140°
52°
48°
44°
40°
36°




In September conditions are much the same as in August. By about the mic month, however, typhoons are becoming less frequent in the Sea of Japan comp area east of Japan. By October less than 1 typhoon every 5 years penetrates part of the Sea of Japan. In November and December most of the typhoons pas east of Japan, so that only 1 typhoon every 5 years affects the west coast of these months.

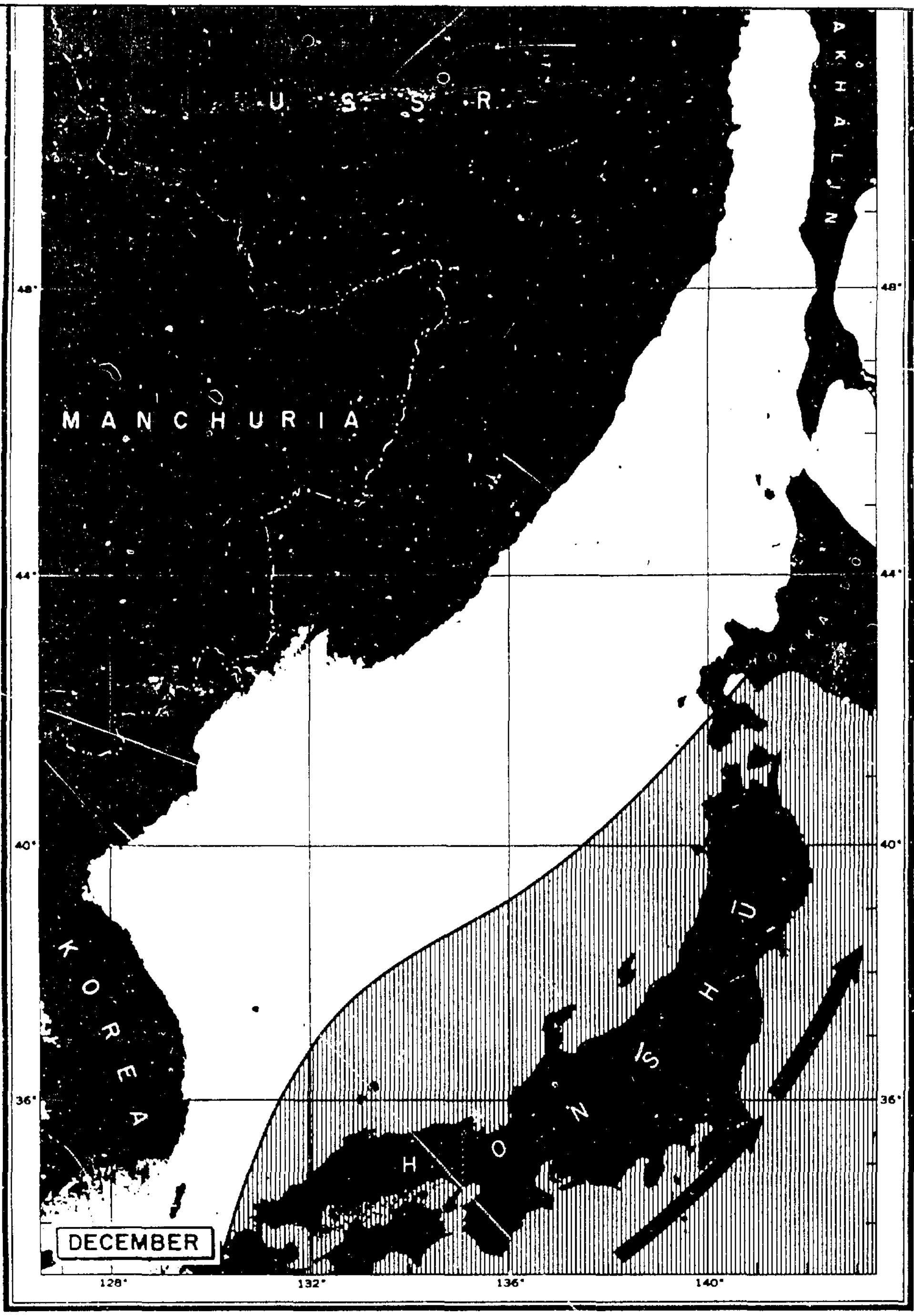
References:

Froc, Louis, "Atlas of the Tracks of 620 Typhoons, 1893-1918," Chang-Hai, Ir l'Orphelinat de T'ou-Se-We, Zi-Ka-Wei, 1920.

Royal Netherlands Meteorological Institute No. 115, "Oceanographic and Metec Observations in the China Seas and in the Western Part of the North Pac 1935, Government Printing Office, The Hague, (NAVAER 50-1R-173, U. Reprint, CNO, Aerology Section, Washington, D. C., May 1945).

U. S., Army Air Forces, Weather Division, "Weather and Climate of China," Pa Report 890, Headquarters, Army Air Forces, March 1945.

———, Navy, Pacific Fleet and Pacific Ocean Areas, "Climatology and C of Operational Areas of the Western Pacific, " Vol. 1, (CINCPAC-CINCF No. 4-45), 10 March 1945.

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less than 1 typhoon every 5 years penetrates the western
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phoon every 5 years affects the west coast of Honshu during

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Seas and in the Western Part of the North Pacific Ocean,"
Office, The Hague, (NAVAER 50-1R-173, U. S. Navy
ection, Washington, D. C., May 1945).

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and Pacific Ocean Areas, "Climatology and Oceanography
e Western Pacific, " Vol. 1, (CINCPAC-CINCPOA Bulletin

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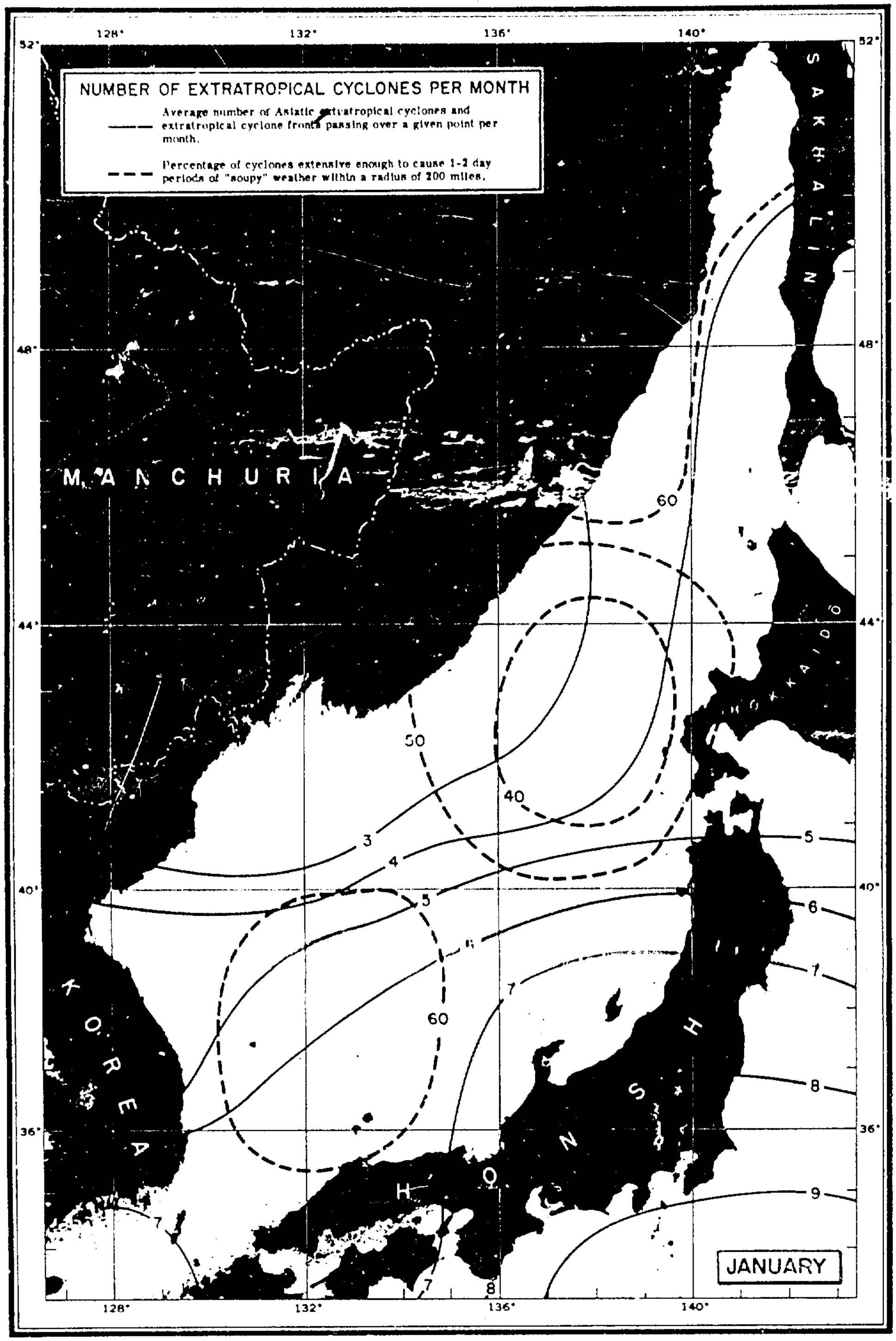
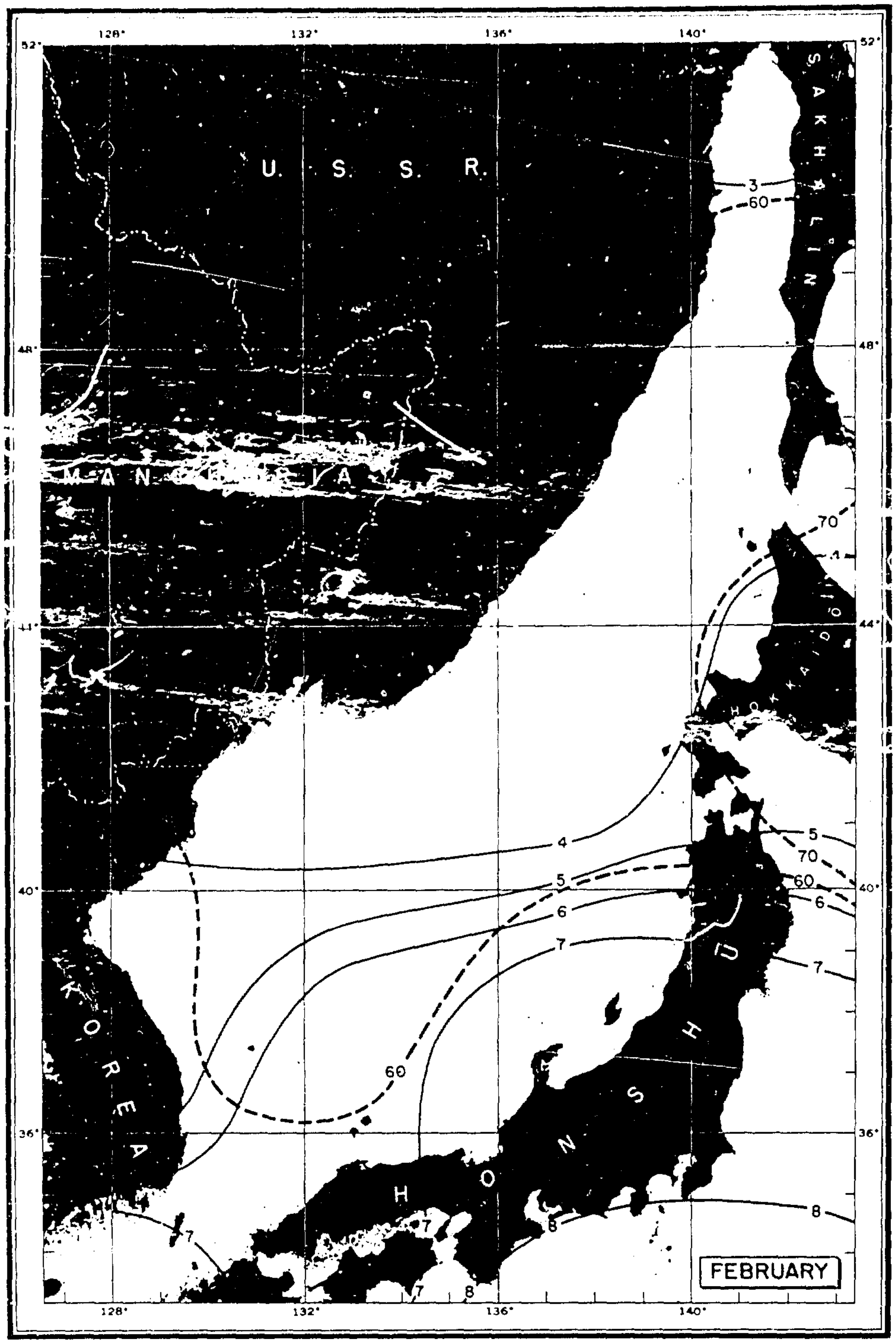
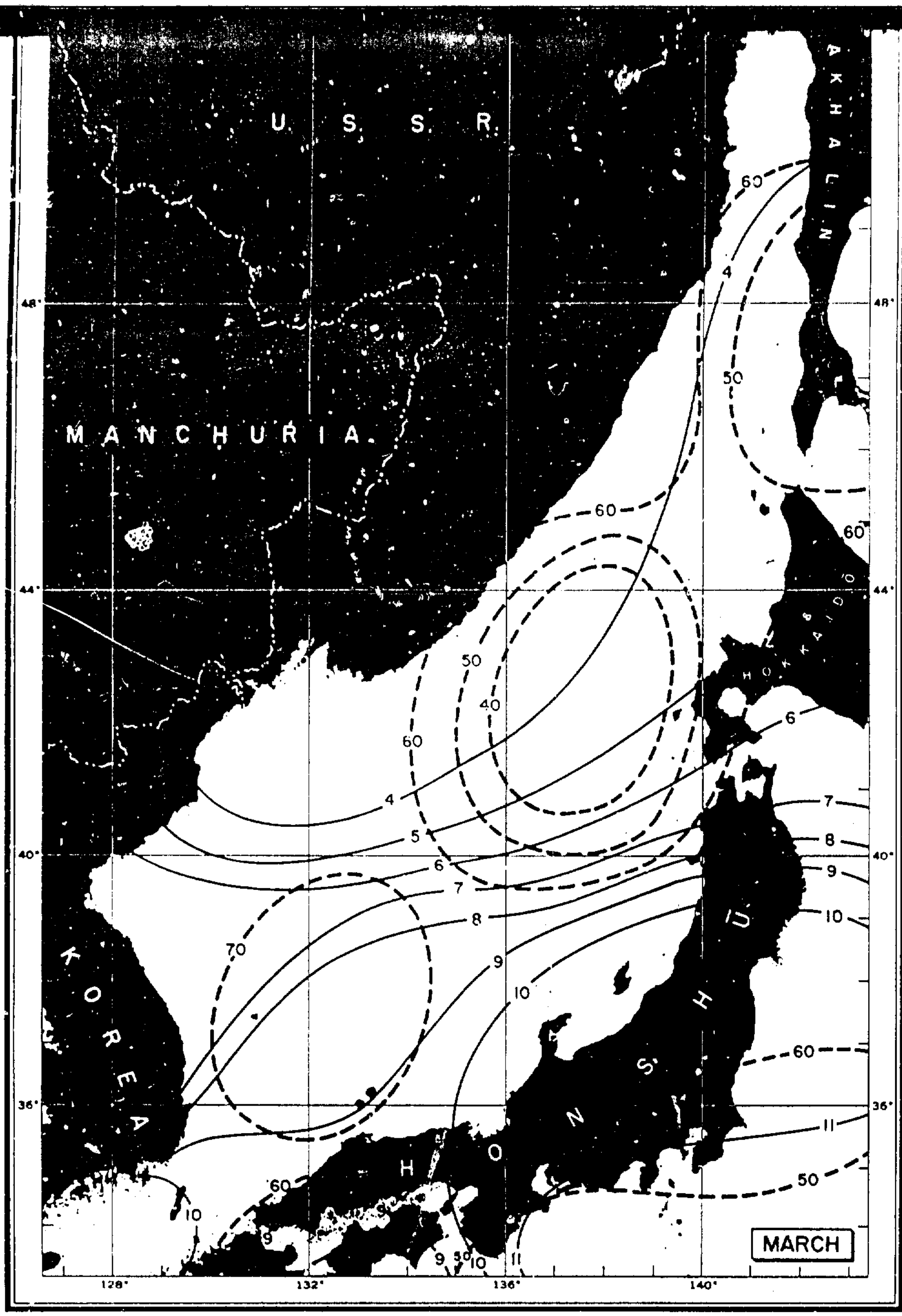

NUMBER OF EXTRATROPICAL CYCLONES PER MONTH
Average number of Asiatic extratropical cyclones and extratropical cyclone fronts passing over a given point per month.
Percentage of cyclones extensive enough to cause 1-2 day periods of "soupy" weather within a radius of 200 miles.
128°
132°
136°
140°
52°
48°
44°
40°
36°
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
60
50
40
60
3
4
5
6
7
8
9
JANUARY

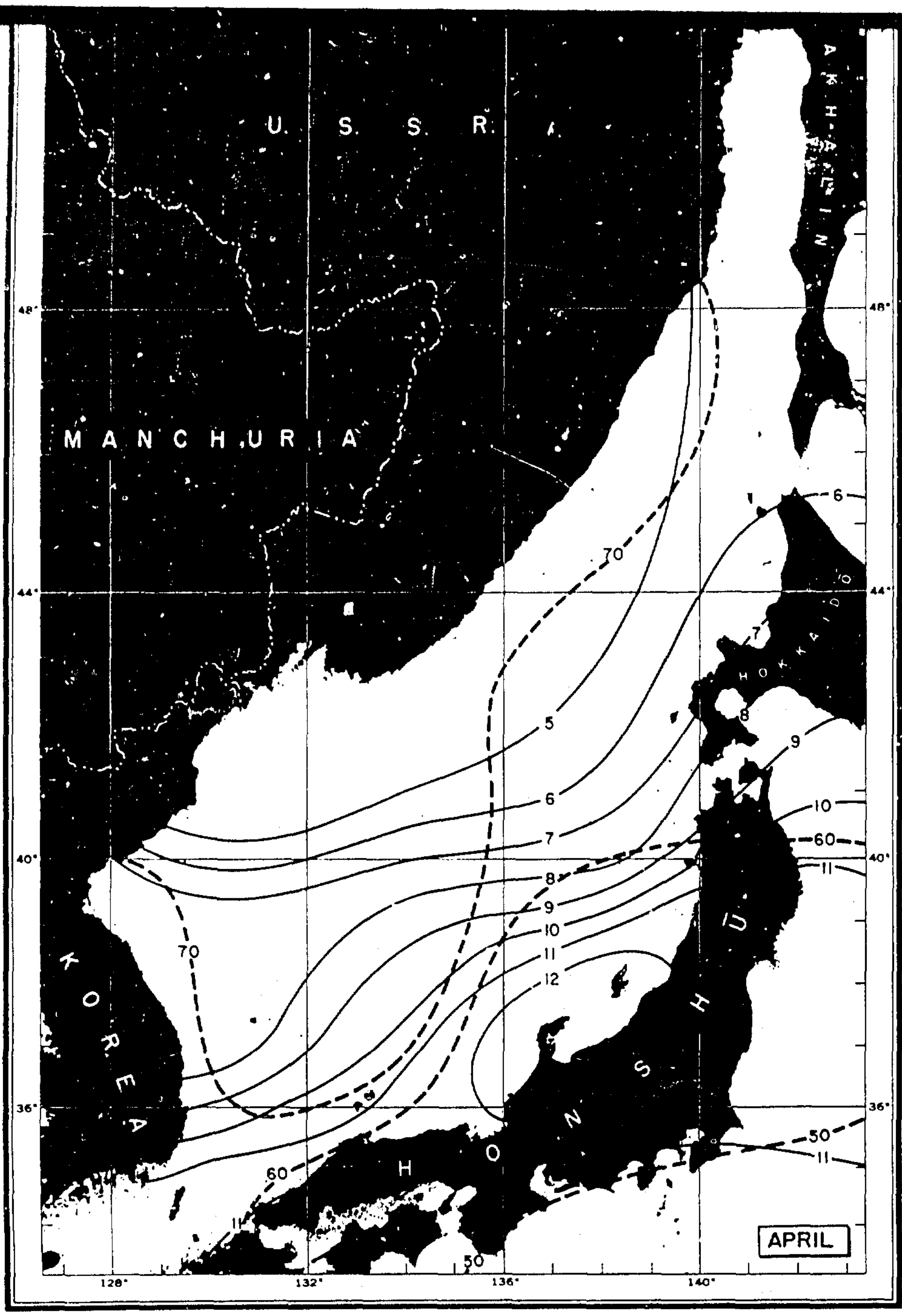

U. S. S. R.
SAKHALIN
HOKKAIDO
KOREA
HONSHU
FEBRUARY
128°
132°
136°
140°
52°
48°
44°
40°
36°
3
4
5
6
7
8
60
70




## General

Extratropical cyclones are low pressure areas that form outside the tropics. These cyclones may form in various locations, as off the east coast of China, in central and northern China, west of Lake Baikal in Russia, in southern Mongolia, and in northern Manchuria. Historical weather maps seem to indicate that there is a pronounced tendency for a large percentage of the storm tracks to converge toward the Japanese islands. Many low pressure centers deepen as they approach the coast, and intensify even more over the Pacific. A great number of extratropical disturbances enter coastal waters west of northern Korea or at the Yangtze estuary.

The solid lines on the charts are isolines indicating the average number of the two general types of cyclonic systems encountered here. The first type includes the number of cyclones, usually deep, occluded systems, which develop in the frontogenetic regions of Asia and move eastward towards Alaska or Canada. These cyclones develop outside the tropics and consist of warm and cold sectors separated by fronts. Cyclones passing over or within 200 miles of the area have been counted, as they are extensive enough to bring 1- to 2-day periods of

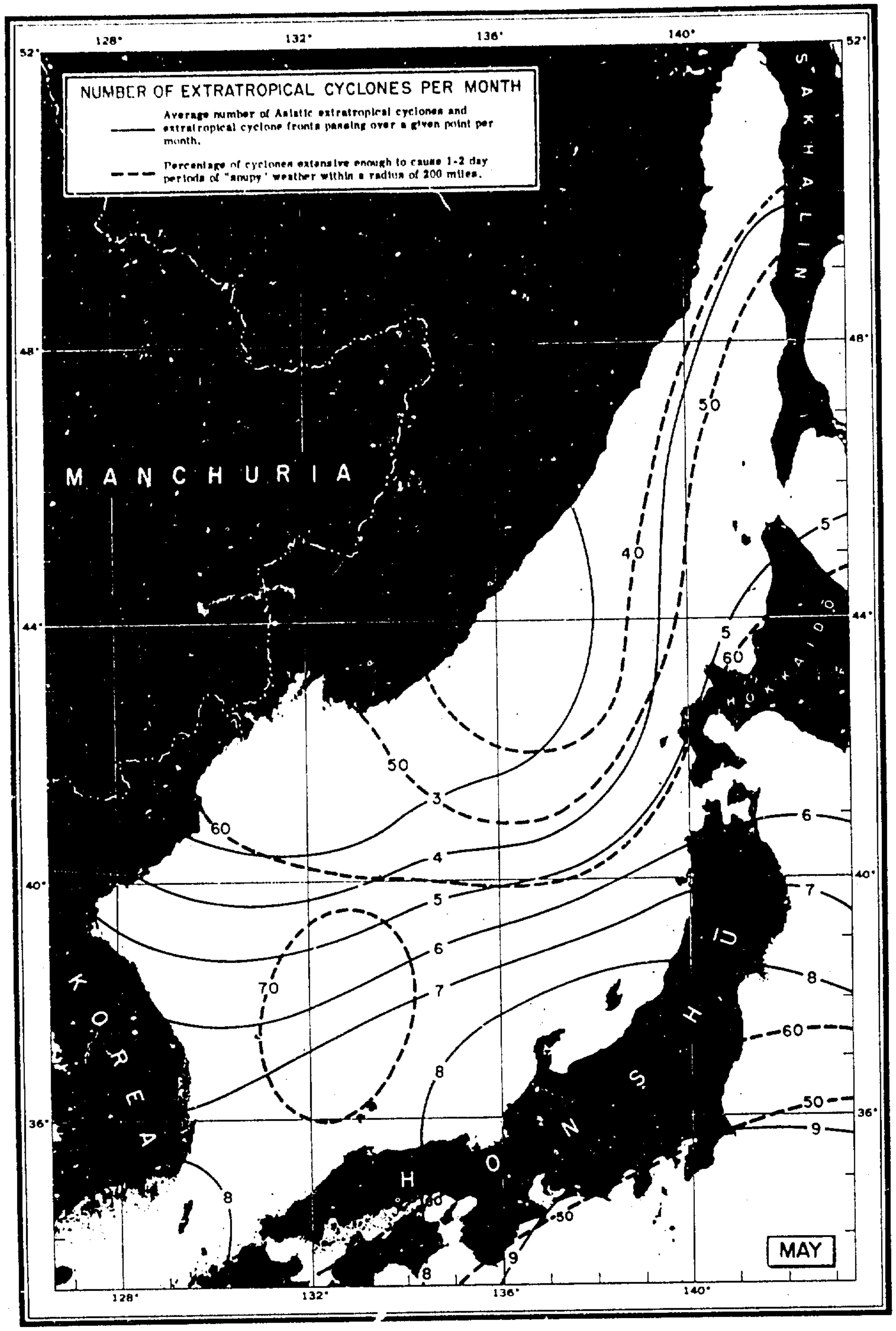


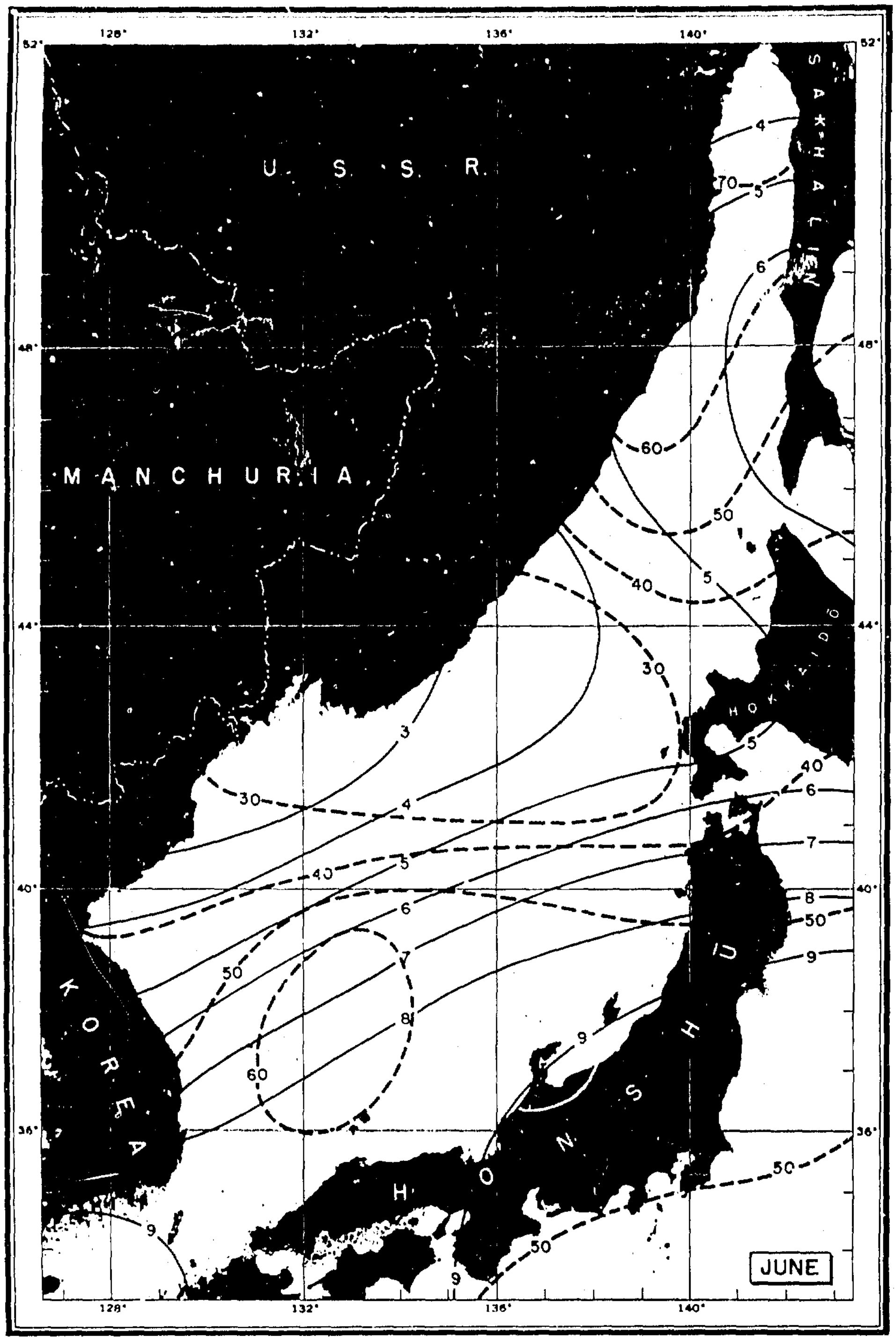

"soupy" weather. The second type includes the number of relatively weak cyclonic systems with fronts that are associated with and generally follow the extratropical cyclones which move eastward and sweep over the area. Cyclonic frontal systems of the second type are usually aligned southwest to northeast and are accompanied by increased cloudiness, precipitation, and wind shifts. As a rule they have difficulty in moving eastward across high mountains like those in Japan. Although these cyclonic systems may be weak along the east coast of Japan, they redevelop and intensify after moving several hundred miles over the ocean.

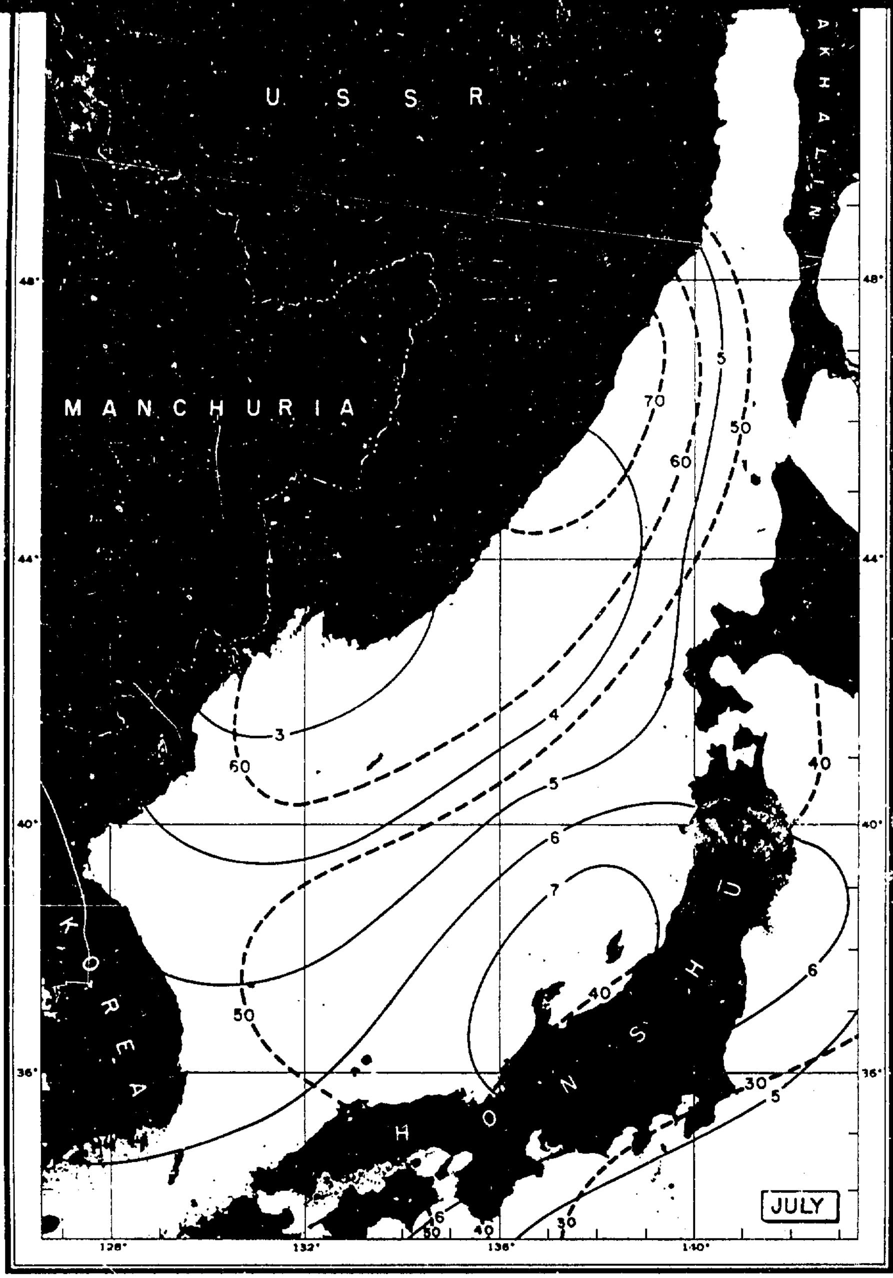
## Monthly Conditions

From January through April there is a marked increase in the number of extratropical cyclones moving across Manchuria toward Japan as the continental high pressure area breaks down. Most of the "soupy" weather lasting 1 to 2 days in the Sea of Japan is associated with these cyclones. A majority of the cyclones during the period January through March parallel the southeast coast of Honshu. By April approximately 12 systems per month pass along the west coast of Honshu.

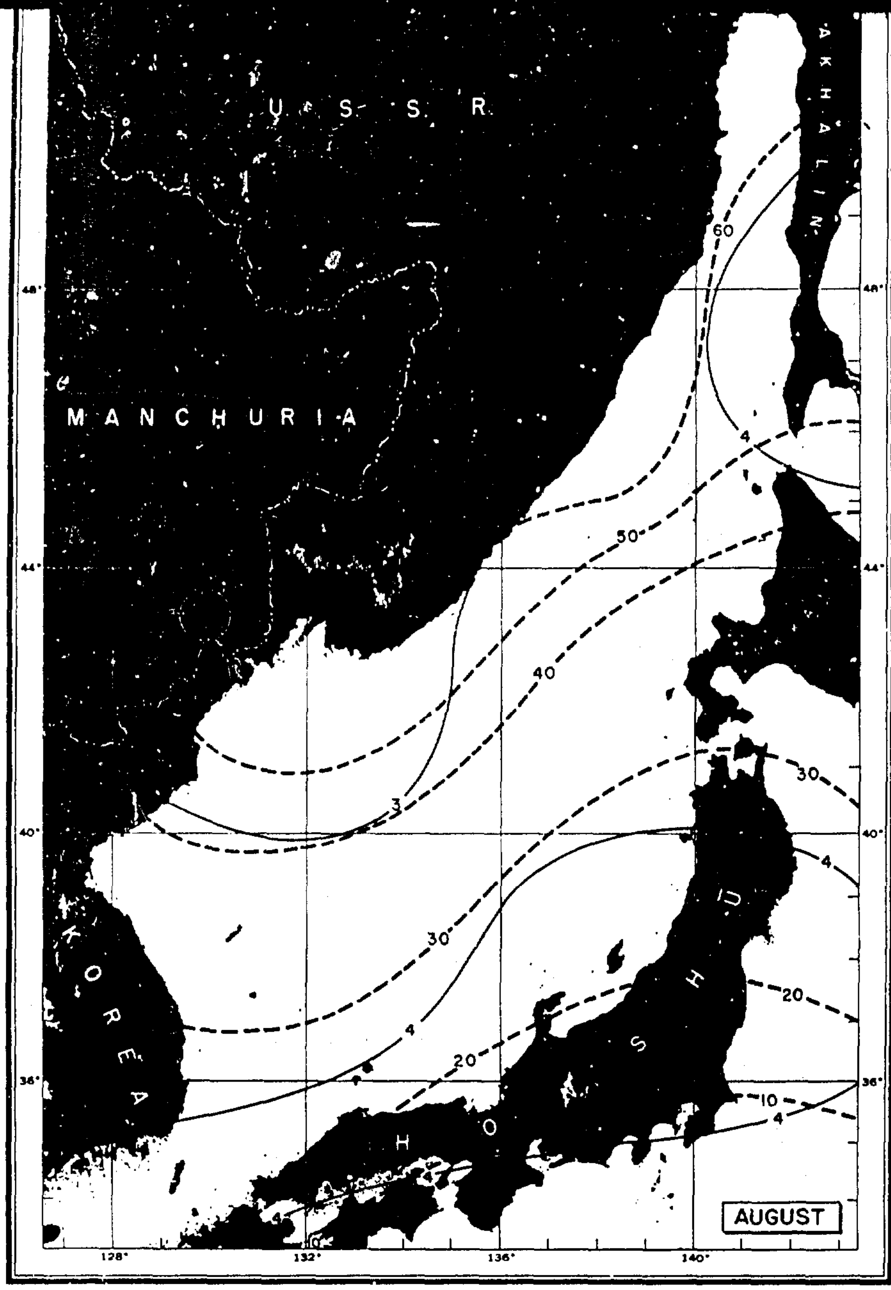
# EXTRATROPICAL CYCLONES—Continued




U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
JUNE
128°
132°
136°
140°
52°
48°
44°
40°
36°
3
4
5
6
7
8
9
30
40
50
60
70




From May through June the overall pressure gradient becomes relatively flat, wind speeds of 8 to 14 knots in the eastern part of the Sea of Japan during May to 8 knots by July. During the latter part of June and the first part of July there for low pressure centers to develop in China west of Shanghai and move in a nor rection toward the Aleutians, causing frequent rainy spells throughout Japan kno "Bai-u", meaning plum rains. From the middle of July the frequency of low pres passing through the eastern portion of the Sea of Japan decreases. During Augu extratropical cyclones on the average pass over Honshu as compared to 7 in July June. However, the low frequency of extratropical cyclones during August is off fact that this is the period of maximum frequency of typhoons.




verall pressure gradient becomes relatively flat. Resultant the eastern part of the Sea of Japan during May drop off to 2 atter part of June and the first part of July there is a tendency lop in China west of Shanghai and move in a northeasterly di- using frequent rainy spells throughout Japan known as the rom the middle of July the frequency of low pressure centers ion of the Sea of Japan decreases. During August only 4 erage pass over Honshu as compared to 7 in July and 9 during cy of extratropical cyclones during August is offset by the ximum frequency of typhoons.

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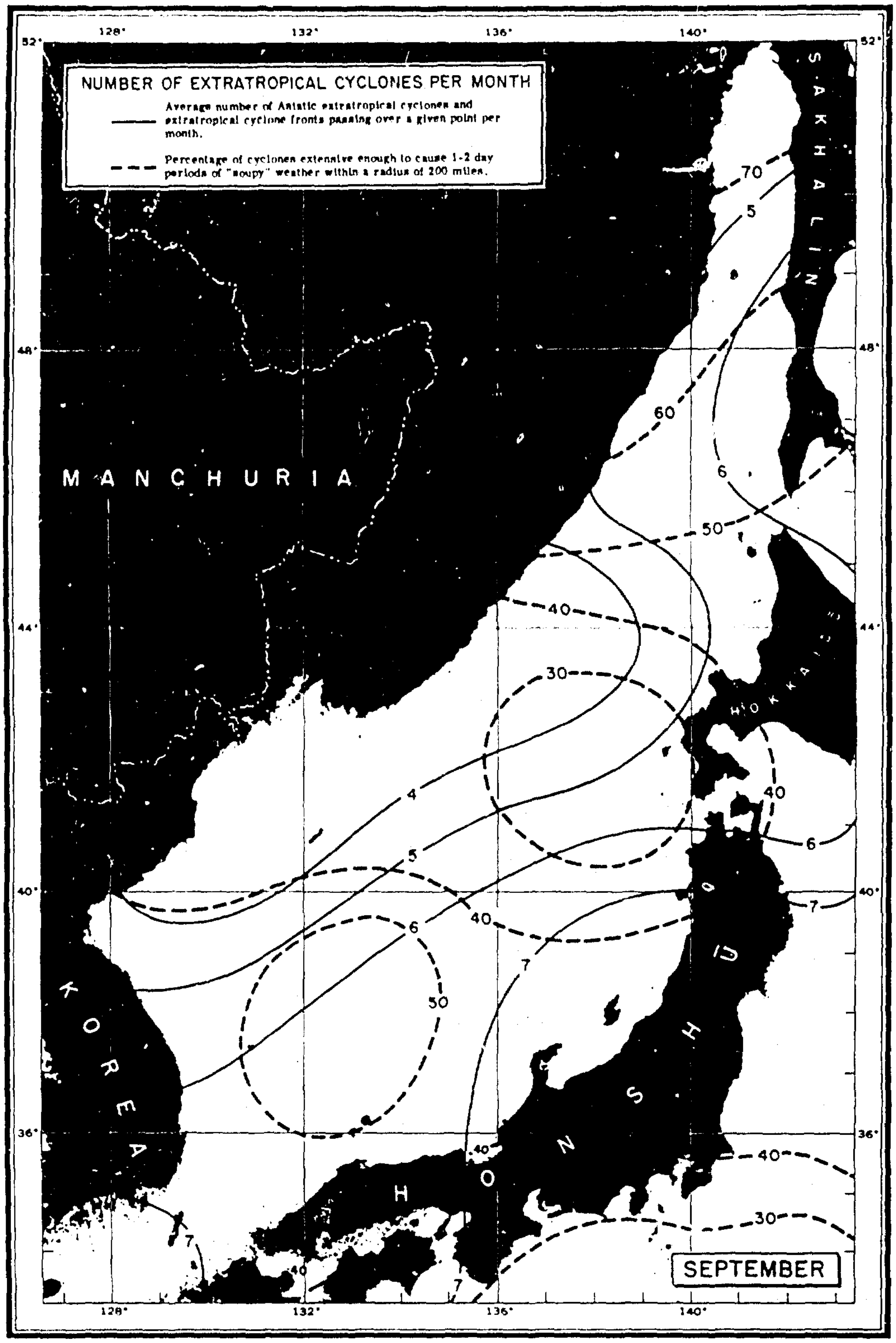
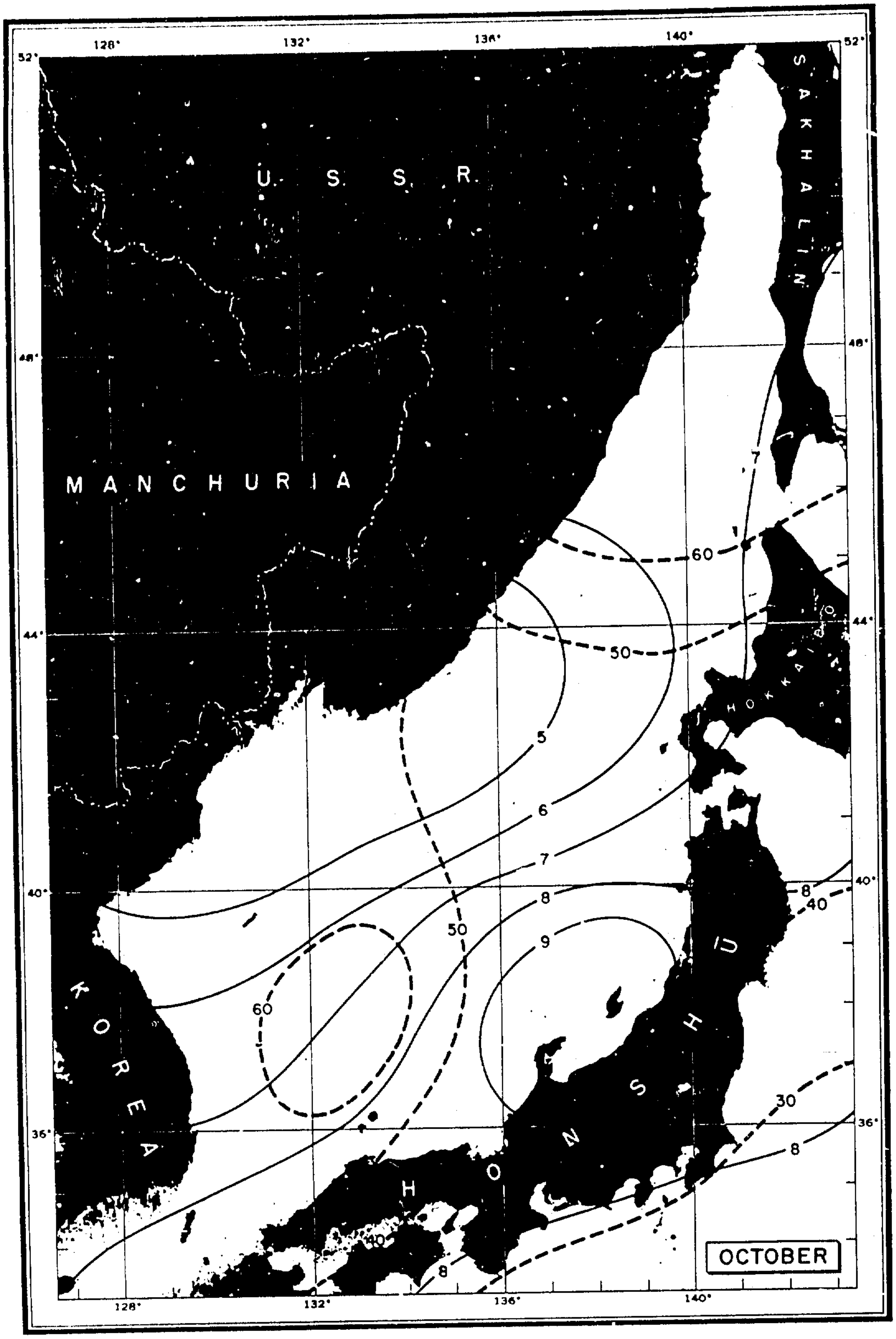
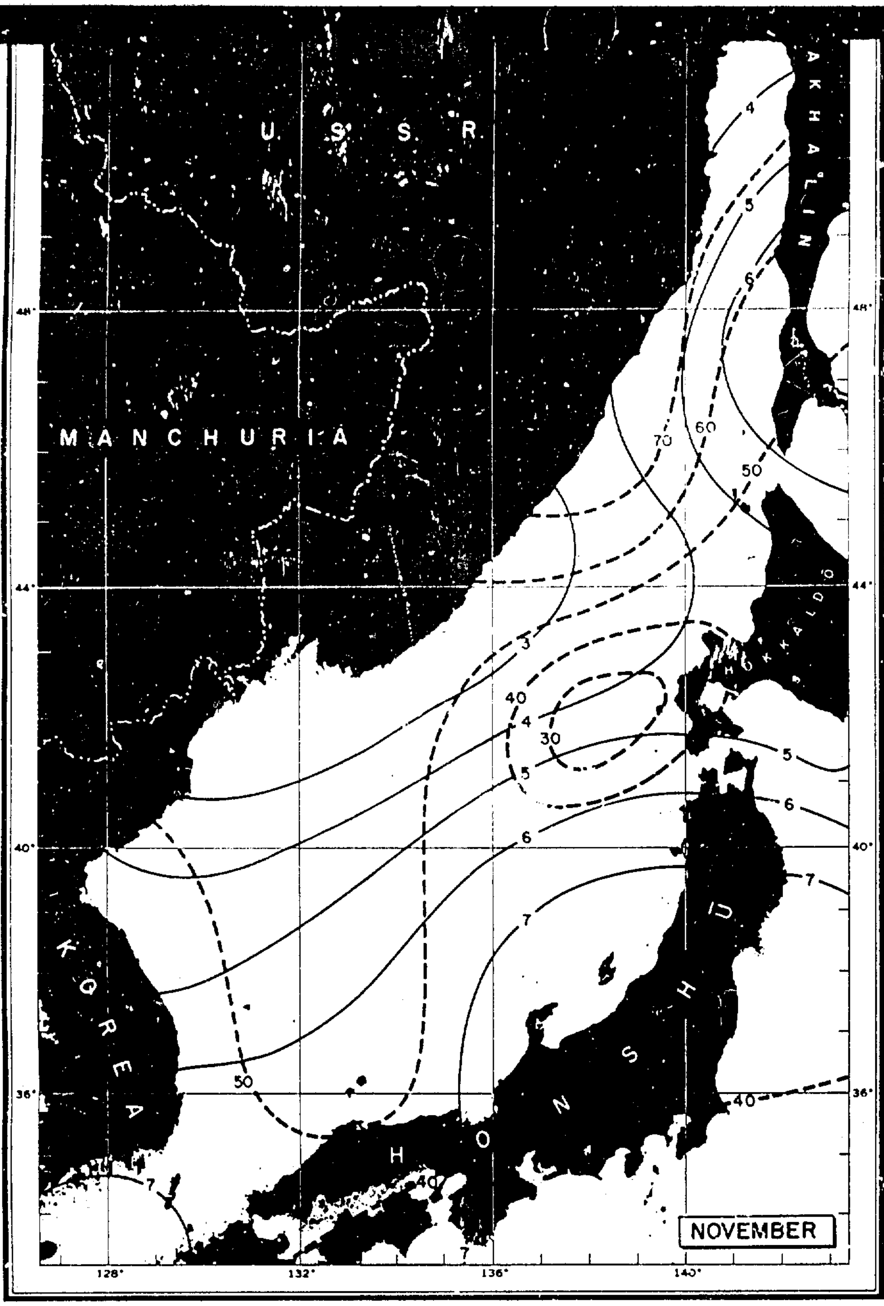

NUMBER OF EXTRATROPICAL CYCLONES PER MONTH
Average number of Asiatic extratropical cyclones and extratropical cyclone fronts passing over a given point per month.
Percentage of cyclones extensive enough to cause 1-2 day periods of "soupy" weather within a radius of 200 miles.
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
SEPTEMBER
128°
132°
136°
140°
52°
48°
44°
40°
36°


U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDO
HONSHU
KOREA
OCTOBER
128°
132°
136°
140°
52°
48°
44°
40°
36°
5
6
7
8
9
60
50
40
30




Beginning in September, the number of cyclones affecting the Sea of Japan increases u the onset of the winter monsoon. Once the continental high pressure area is well establis by October, most of the extratropical cyclones tend to move either in a northeasterly direc along the coasts of the islands of Japan or in a west-east direction generally north of 40°

References:

Japan, Hydrographic Department, "North Pacific Weather Charts," (Pub. No. 91), September 1939.

Royal Netherlands Meteorological Institute No. 115, "Oceanographic and Meteorological Observations in the China Seas and in the Western Part of the North Pacific Ocean," 1935, Government Printing Office, The Hague, (NAVAER 50-1R-173, U. S. Navy Reprint, CNO, Aerology Section, Washington, D. C., May 1945).

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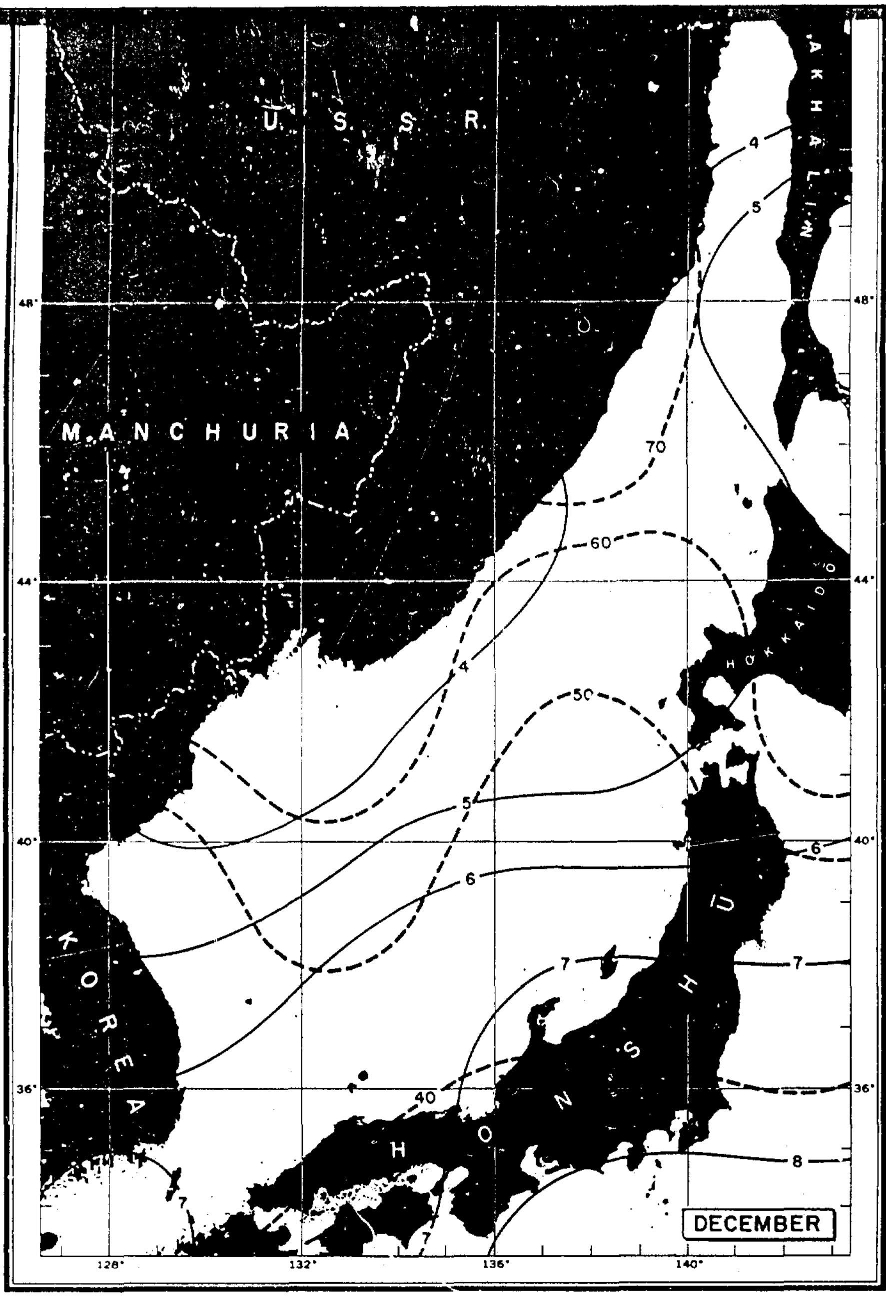
———, Navy, Pacific Fleet and Pacific Ocean Areas, "Climatology and Oceanograph of the Western Pacific," Volumes I and II, (CINCPAC-CINCPOA Bulletin No. 4-45) March 1945.




of cyclones affecting the Sea of Japan increases until the continental high pressure area is well established clones tend to move either in a northeasterly direction or in a west-east direction generally north of 40° N.

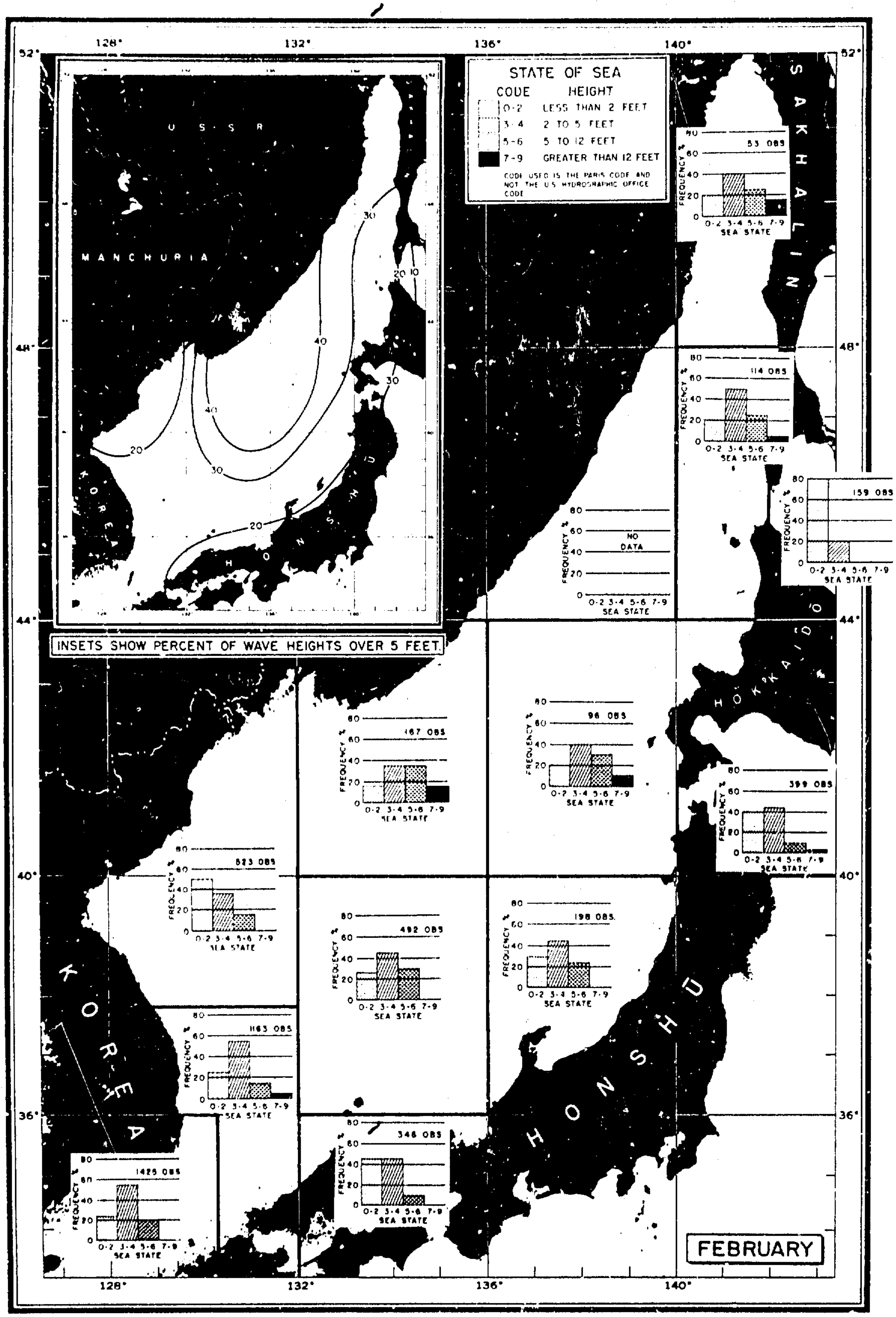
Pacific Weather Charts," (Pub. No. 91),

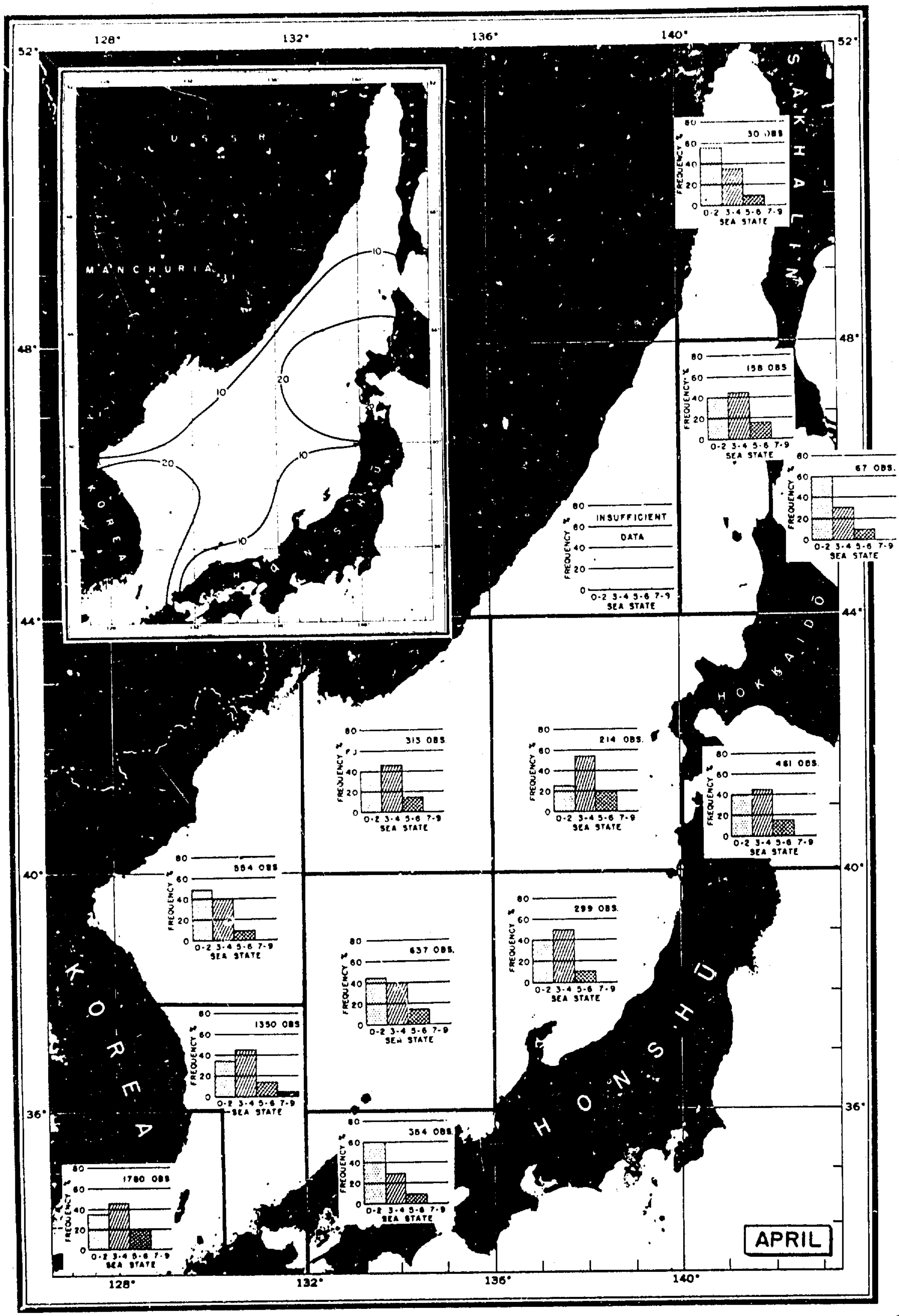
ute No. 115, "Oceanographic and Meteorological nd in the Western Part of the North Pacific ng Office, The Hague, (NAVAER 50-1R-173, U. S. ction, Washington, D. C., May 1945).

n, "Weather and Climate of China," Parts A and B, Washington, D. C., March 1945.

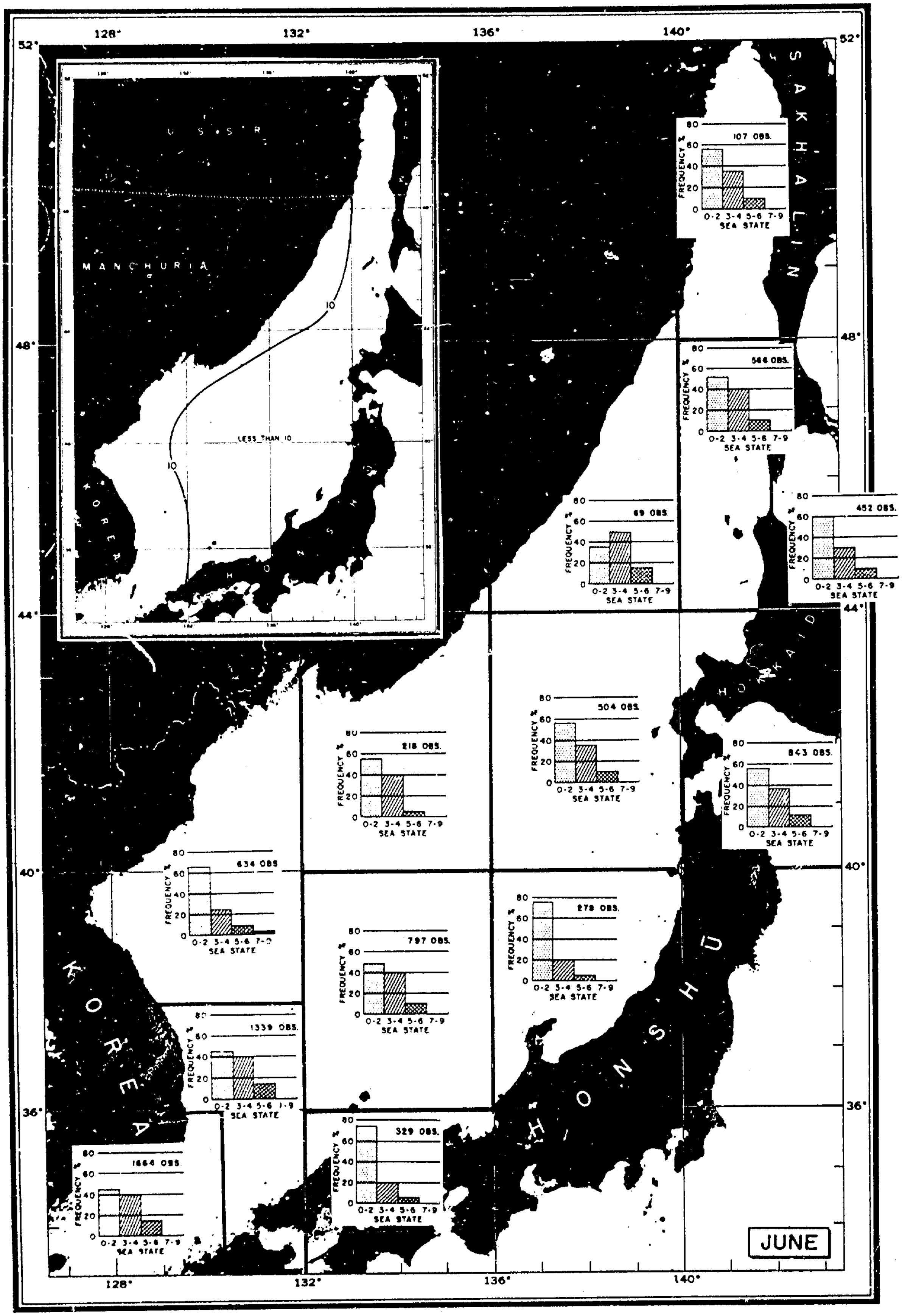
ific Ocean Areas, "Climatology and Oceanography I and II, (CINCPAC-CINCPOA Bulletin No. 4-45),

# STATE OF SEA


STATE OF SEA
CODE HEIGHT
0-2 LESS THAN 2 FEET
3-4 2 TO 5 FEET
5-6 5 TO 12 FEET
7-9 GREATER THAN 12 FEET
CODE USED IS THE PARIS CODE AND NOT THE U.S. HYDROGRAPHIC OFFICE CODE
INSETS SHOW PERCENT OF WAVE HEIGHTS OVER 5 FEET
U.S.S.R
MANCHURIA
KOREA
HONSHU
SAKHALIN
HOKKAIDO
NO DATA
53 OBS
114 OBS
159 OBS
167 OBS
96 OBS
399 OBS
823 OBS
492 OBS
198 OBS
1163 OBS
348 OBS
1425 OBS
FREQUENCY %
SEA STATE
128°
132°
136°
140°
52°
48°
44°
40°
36°
FEBRUARY


MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
INSUFFICIENT DATA
30 OBS
158 OBS
67 OBS.
313 OBS
214 OBS.
461 OBS.
554 OBS
299 OBS.
637 OBS.
1350 OBS
364 OBS
1780 OBS
FREQUENCY %
SEA STATE
0-2 3-4 5-6 7-9
APRIL
128°
132°
136°
140°
52°
48°
44°
40°
36°

2

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## WAVES

The condition of the surface of the ocean is described by the terms sea and swell. Sea refers to waves caused by local winds, whereas swell refers to waves which have progressed beyond the influence of the generating winds. The direction of sea is determined by the local wind, whereas the direction of swell is independent of the local wind. Frequently sea and swell are present at the same time. Wave characteristics can be changed considerably by the depth of the water (shoaling), bottom topography (refraction), and currents. It is beyond the scope of this study to provide details on these factors. The data presented here are not broken down into sea and swell, but rather are combined as waves.

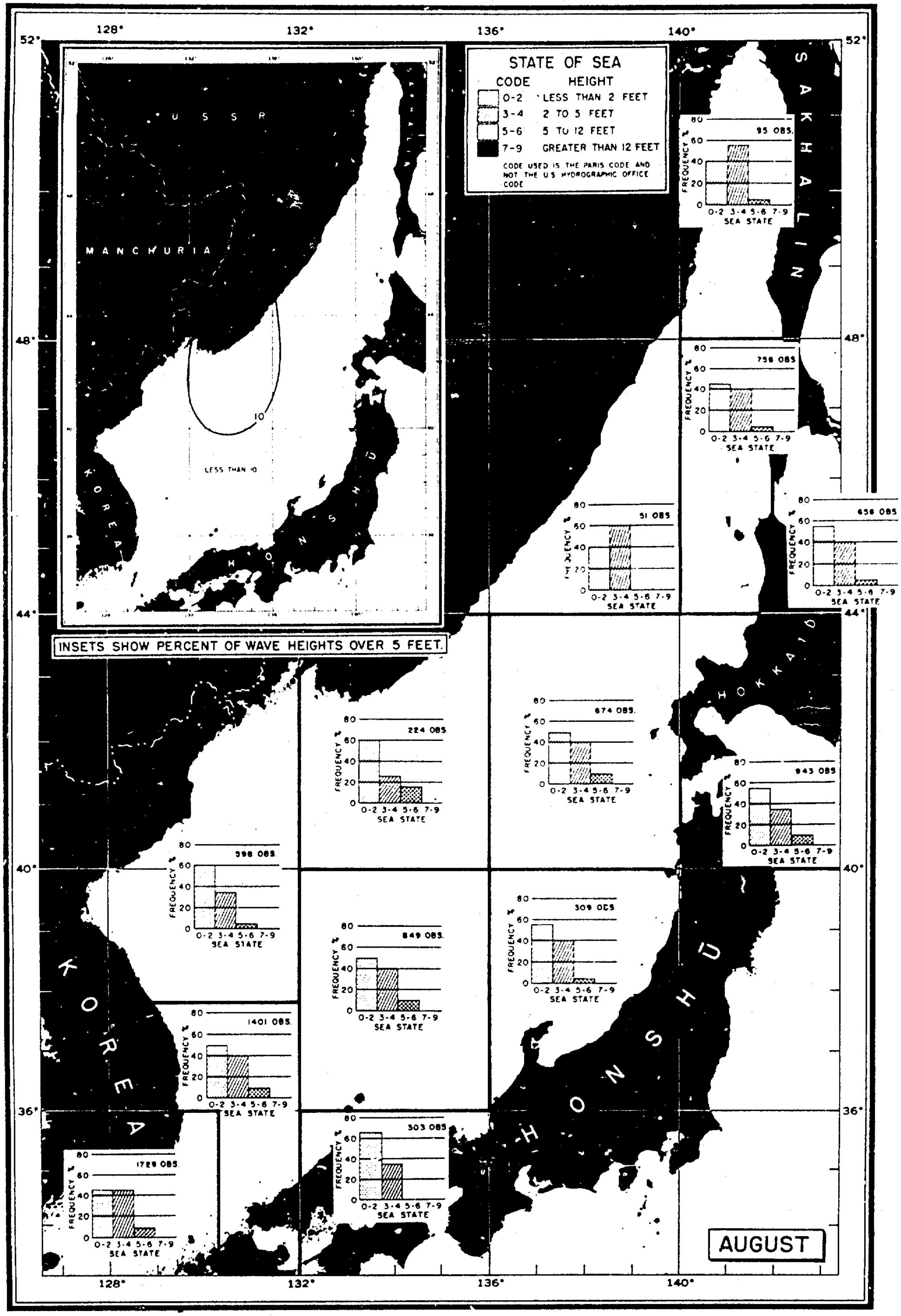
During the winter, the Sea of Japan is under the influence of the cold continental high pressure area. As this high pressure cell builds up in December, the prevailing wind direction is north to northwest. The effect of this circulation is evident in the tongue of high frequency of waves over 5 feet in height (greater than 40 percent) which extends from 44°N. southwestward to 37°N. Since the longest fetch is from the northeast, the coastal areas immediately south of Vladivostok, protected by the projection of the coast line, have low wave conditions, 80 percent of the observations being under 5 feet in height. To the east of this area, open to the northeast, waves above 8 feet in height occur in 10 to 15 percent of the observations.

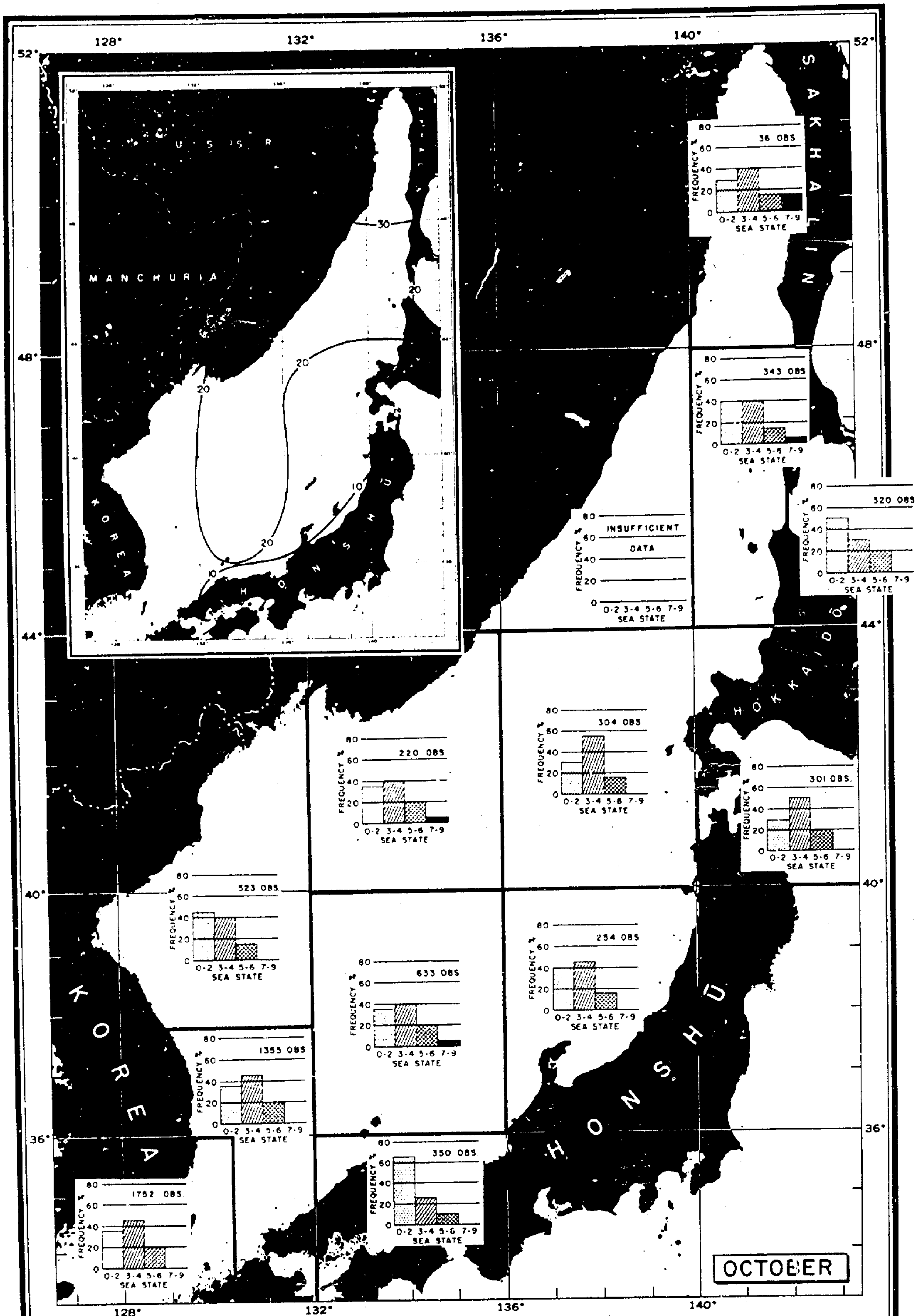
By February, the prevailing wind direction has shifted more toward the northeast, its influence being indicated by a tongue of high wave frequencies extending from 47°N. southward to 39°N. South of Vladivostok, waves under 5 feet appear in 85 percent of the observations, while to the east along the coast of Honshu a similar condition prevails.

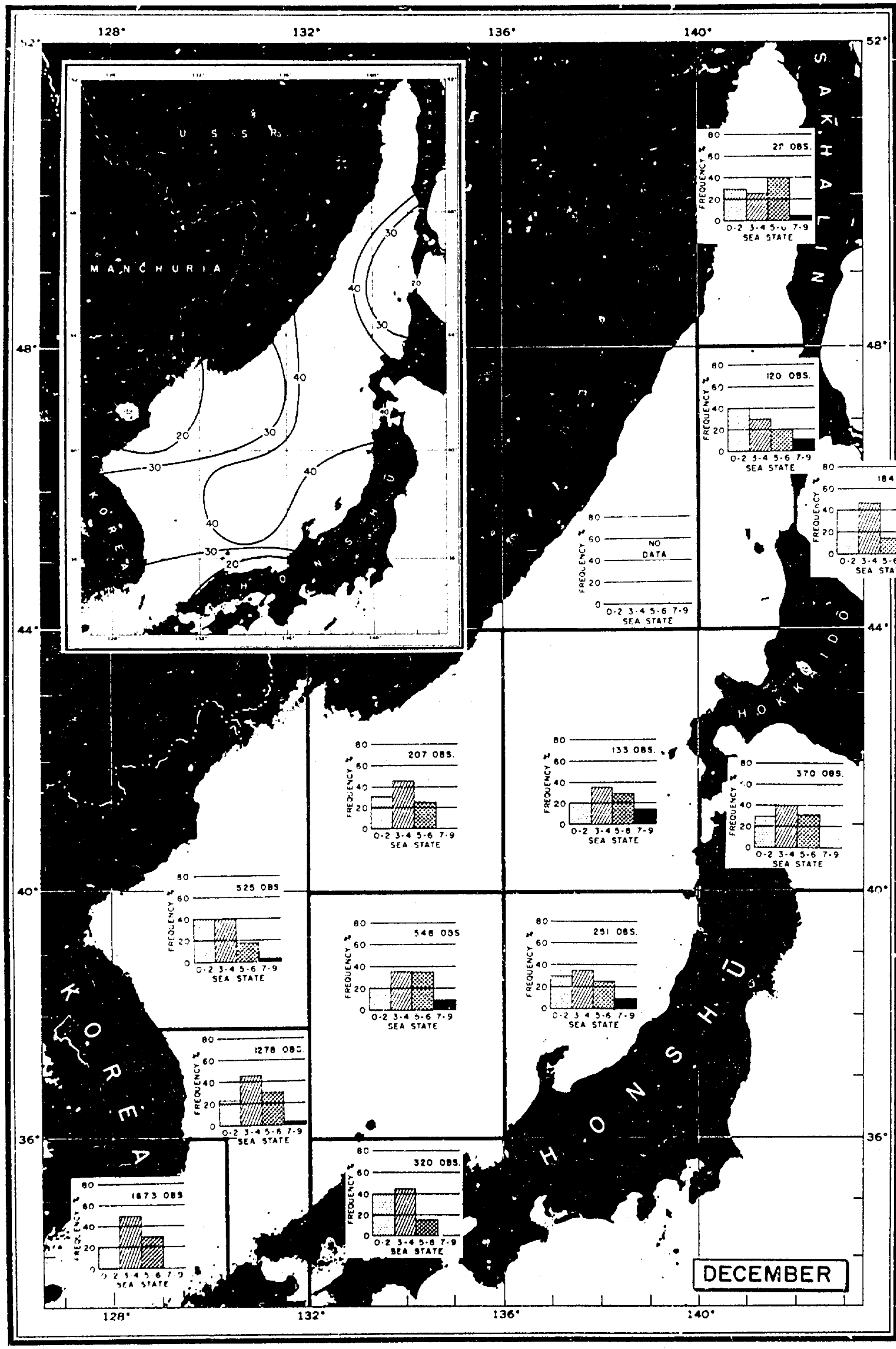
The frequency distribution of waves north of 40°N. is rather doubtful as ice conditions prevent observation of wave conditions except in warm years. The effect of ice, drift or landfast, on waves has not been investigated thus far; hence, a discussion of waves for this area would be inadequate.

April is considered the transition period between the winter and summer monsoonal circulation. During this time the wind is usually from the southwest, its effect being evident in the frequency pattern of waves over 5 feet. A band of frequencies over 10 percent extends from the east coast of Korea northeastward to Hokkaido, reaching a maximum of over 20 percent at both extremities. Throughout this month, waves over 12 feet in height occur only in the vicinity of the Korean coast (5 percent of the observations).

By June the high pressure area over the continent has disappeared, to be replaced by a thermal low pressure center which causes the prevailing winds to blow from the south. Weak winds are the rule, producing low wave conditions. Similar conditions exist through the summer to September. Waves over 5 feet high occur with a frequency of less than 10 percent over most of the central part of the Sea of Japan. There is one exception, however. Along the Russian coast, the prevailing wind reinforces a sea breeze effect, producing waves greater than 5 feet in over 10 percent of the observations in June.


STATE OF SEA
CODE HEIGHT
0-2 LESS THAN 2 FEET
3-4 2 TO 5 FEET
5-6 5 TO 12 FEET
7-9 GREATER THAN 12 FEET
CODE USED IS THE PARIS CODE AND NOT THE U.S. HYDROGRAPHIC OFFICE CODE
INSETS SHOW PERCENT OF WAVE HEIGHTS OVER 5 FEET.
U S S R
MANCHURIA
KOREA
HONSHU
SAKHALIN
HOKKAIDO
LESS THAN 10
10
95 OBS.
758 OBS.
51 OBS.
658 OBS.
224 OBS.
674 OBS.
943 OBS.
598 OBS.
849 OBS.
309 OBS.
1401 OBS.
1729 OBS.
303 OBS.
FREQUENCY %
SEA STATE
0-2 3-4 5-6 7-9
128° 132° 136° 140°
52° 48° 44° 40° 36°
AUGUST


U. S. S. R
MANCHURIA
KOREA
HONSHU
SAKHALIN
HOKKAIDO
INSUFFICIENT DATA
36 OBS
343 OBS
320 OBS
304 OBS
220 OBS
301 OBS
523 OBS
633 OBS
254 OBS
1355 OBS
350 OBS
1752 OBS
FREQUENCY %
SEA STATE
0-2 3-4 5-6 7-9
OCTOBER



128°
132°
136°
140°
52°
48°
44°
40°
36°
U S S R
MANCHURIA
KOREA
HONSHU
SAKHALIN
HOKKAIDO
DECEMBER
FREQUENCY %
SEA STATE
0-2 3-4 5-6 7-9
NO DATA
120 OBS.
184 OBS.
207 OBS.
133 OBS.
370 OBS.
525 OBS
546 OBS
251 OBS.
320 OBS.
1673 OBS


3

By August, due to the increase of the frequency of calms, only the coast north and east of Vladivostok experiences class 5 waves and higher with a frequency greater than 10 percent. In the area west of Honshu, waves 5 feet in height or under occur with a frequency of 95 percent. No area in the Japan Sea has waves over 12 feet high.

October exhibits characteristics of a transitional month with no well defined pattern of wind direction. However, southwest winds are slightly more frequent than those from any other direction. Since this is also the direction of the major axis of the Sea of Japan, southwest winds can generate waves over the longest possible fetch within this sea. Hence, the highest waves are at the northern end of the fetch. North of 48°N., waves over 5 feet in height occur with a frequency of 30 percent, decreasing to less than 20 percent of the observations south of 44°N., except for a tongue of high frequency which extends to 36°N. On both sides of this tongue, the frequency of class 5 waves or greater decreases. Along the west coast of Honshu waves 2 feet or less in height occur in 85 to 90 percent of the observations.

Summary:

The Sea of Japan is relatively calm in summer and rough in winter. In the summer the frequency of waves 2 feet or less in height exceeds 50 percent and there are no waves over 12 feet. In the winter, waves over 5 feet high are frequent (20 to 40 percent) and waves exceed 12 feet on occasion. The west coast of Honshu usually experiences lower wave conditions than the coast of the continent. Also, waves are relatively higher north of 44°N.

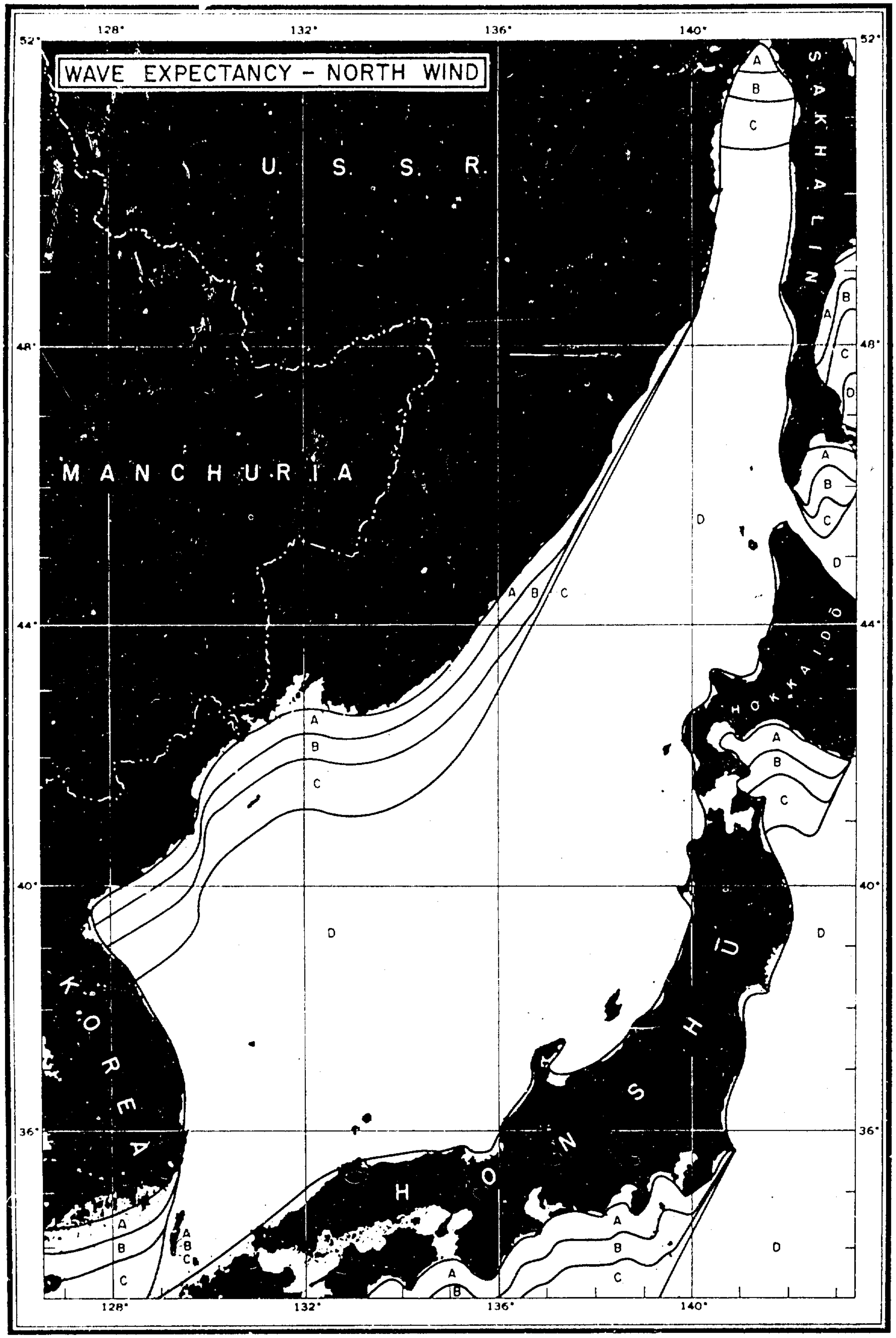
References:

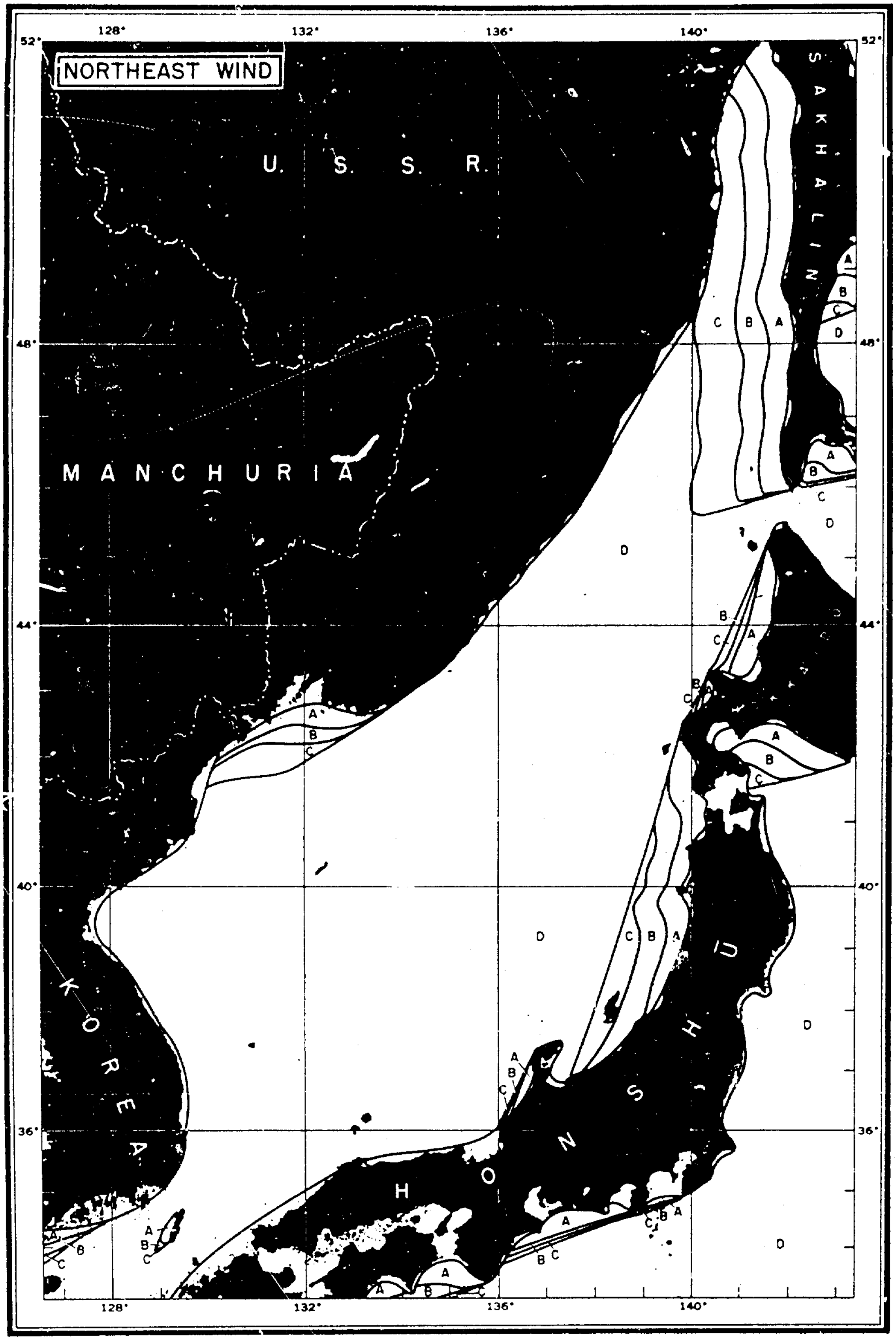
Japan, Hydrographic Department, "Hydrographic Data on Northern Sea Areas," Vol. 1, No. 8105, November 1941.

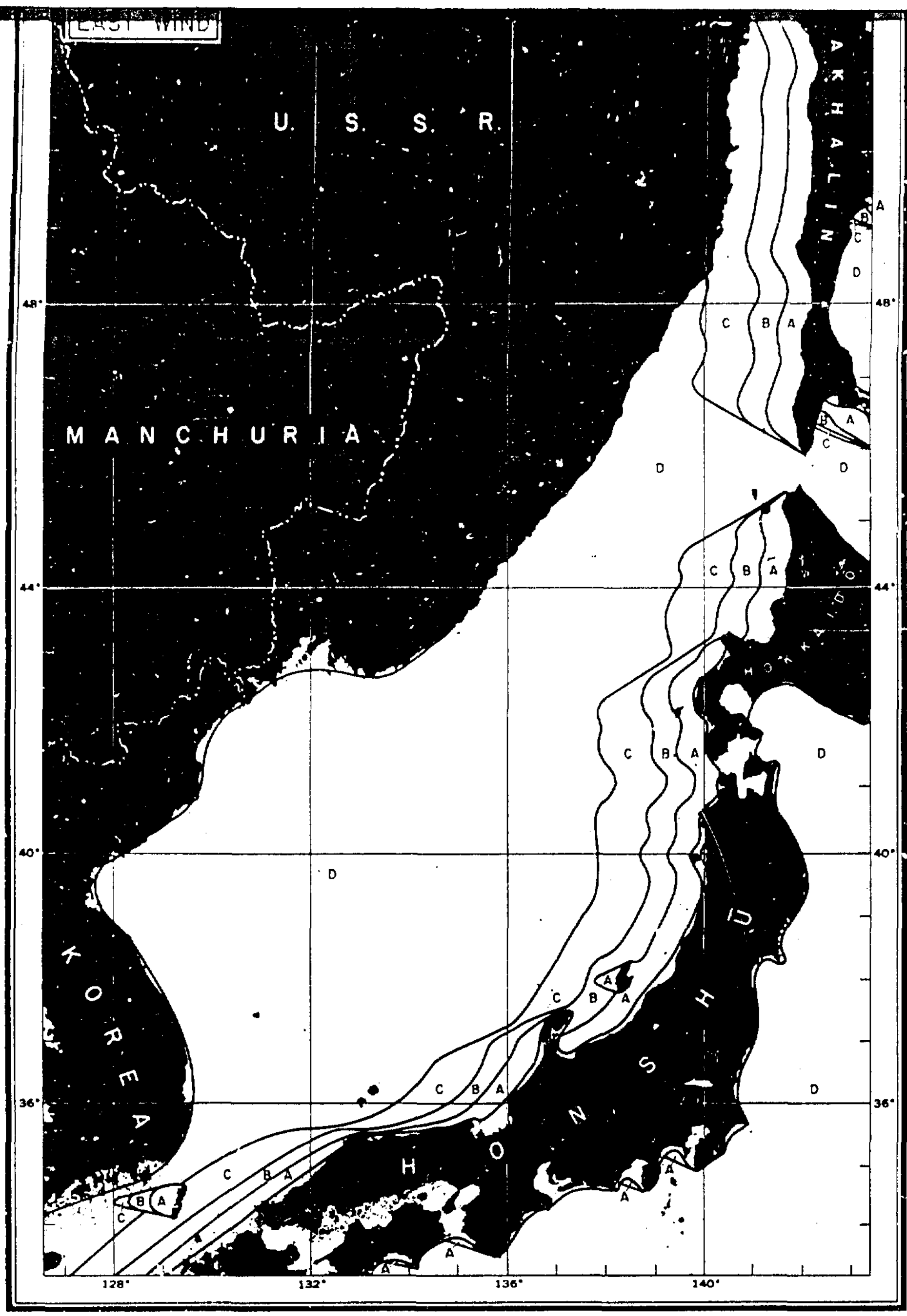
————, "Hydrographic Data on Southern Sea Areas," Vol. 1, No. 8100, October 1941.

————, "The Japan Sea," Oceanographic Memoirs (Kaizo Iho), Vol. 24, Tokyo, October 1944, (in Japanese).

# WAVE EXPECTANCY—WIND N, NE, E, SE

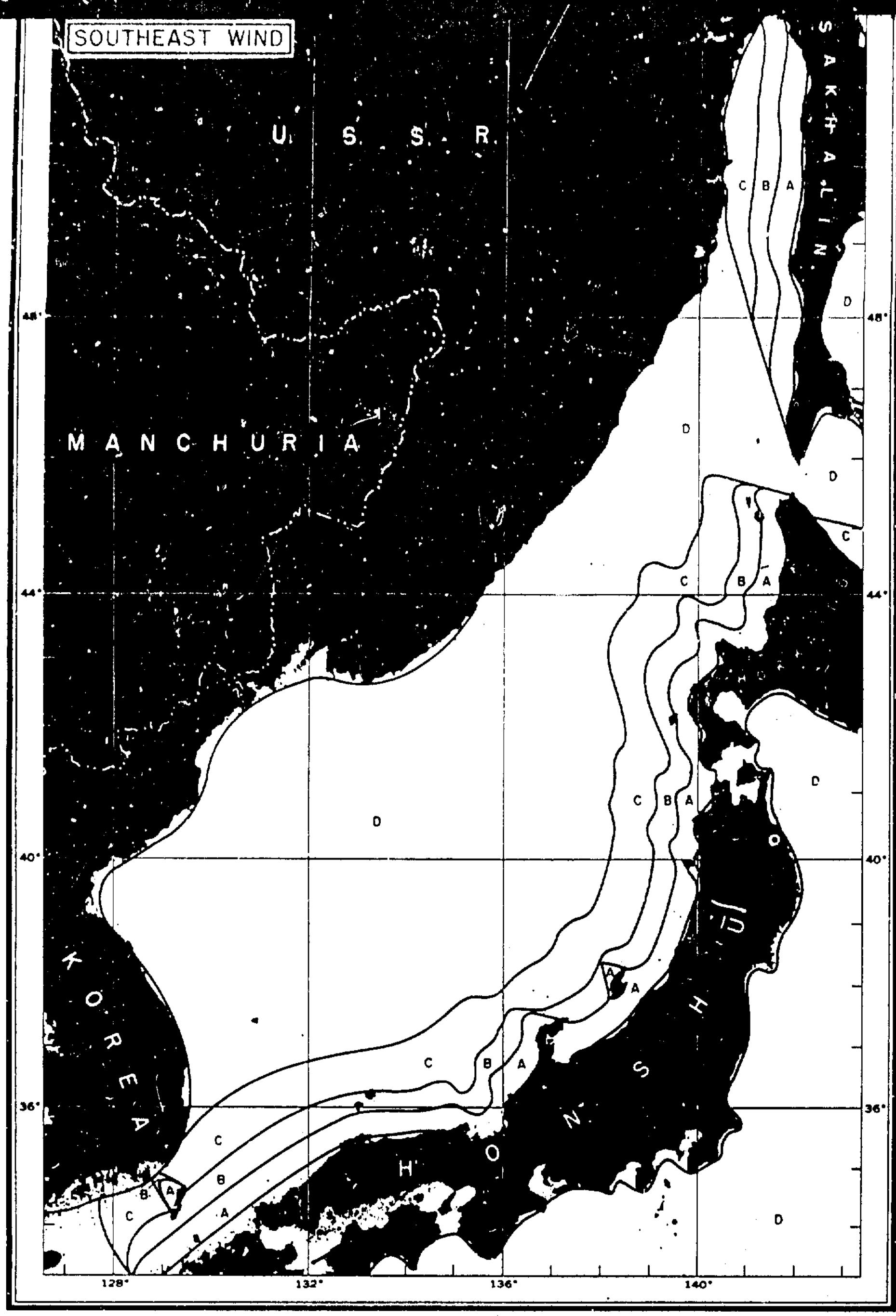



NORTHEAST WIND
U. S. S. R.
MANCHURIA
SAKHALIN
KOREA
HONSHU
128°
132°
136°
140°
52°
48°
44°
40°
36°
A
B
C
D




Wave height expectancy charts are useful for estimating the height of waves in open bodies of water where little sounding data are available and when the time available for the preparation of a forecast is limited. From the latter part of September to the end of January the Sea of Japan is under the influence of the winter monsoon. The winds blow for several days at a time generally from the north to northwest with speeds up to 30 knots. From February through April the winter monsoon tapers off gradually, wind speeds decrease, and wind directions become variable as low pressure areas pass through the region. From April through September the winds are generally light and variable, southerly winds predominating during the summer monsoon from the middle of June to the end of August. During the summer the worst sea conditions are associated with tropical disturbances.

Wave heights determined from these charts are in proportion to the fetch and the speed




of the effective wind blowing for at least six hours. The effects of small islands, intricate coastal formations, refraction, and shoaling have been neglected.

In a generating area, waves are present which are moving at various angles to the wind direction because when the waves are formed there is a tendency for some of them to fan out instead of moving in the same direction as the wind. Therefore, off the leeward side of small islands, it is possible to have waves generated from a longer fetch distance than in the case of waves generated downwind from long, straight coast lines. Waves that are moving at an angle to the wind may be less than half the height of waves moving directly before the wind. However, on the basis that waves moving in a direction as much as 30 degrees from the wind direction is a common condition, expected wave heights behind islands and in the vicinity of headlands will tend to be 80 to 90 percent of the value calculated from the chart.

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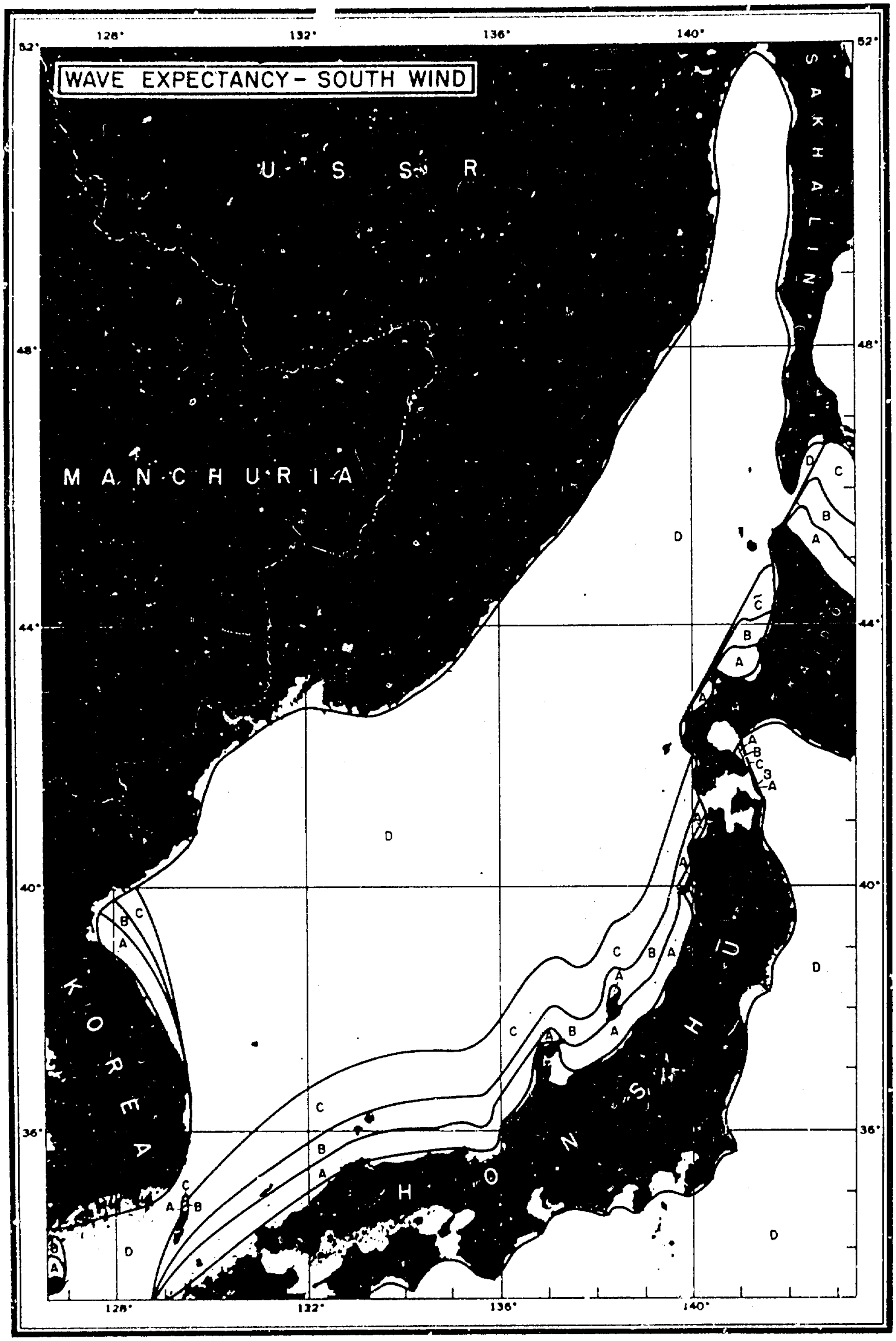
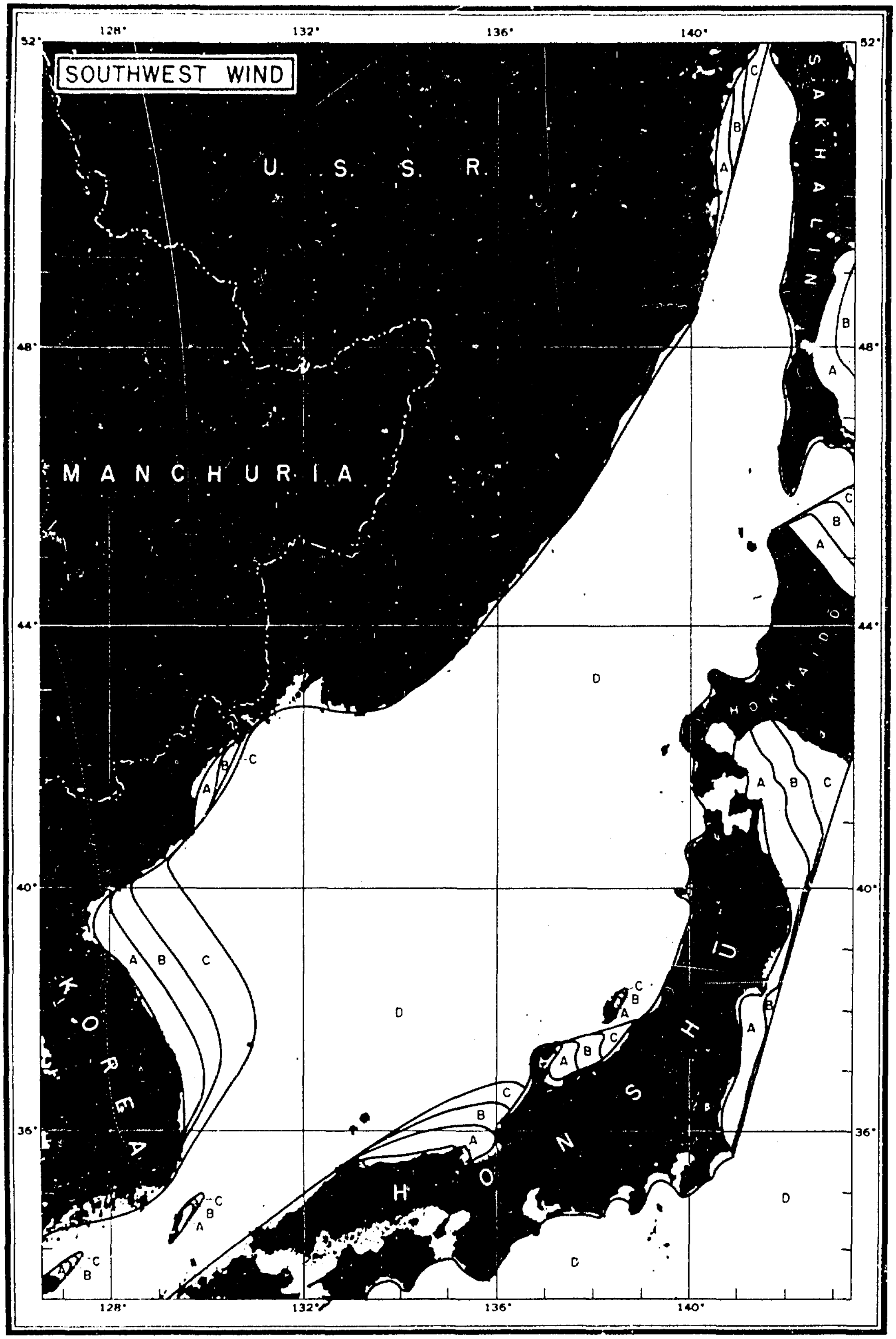
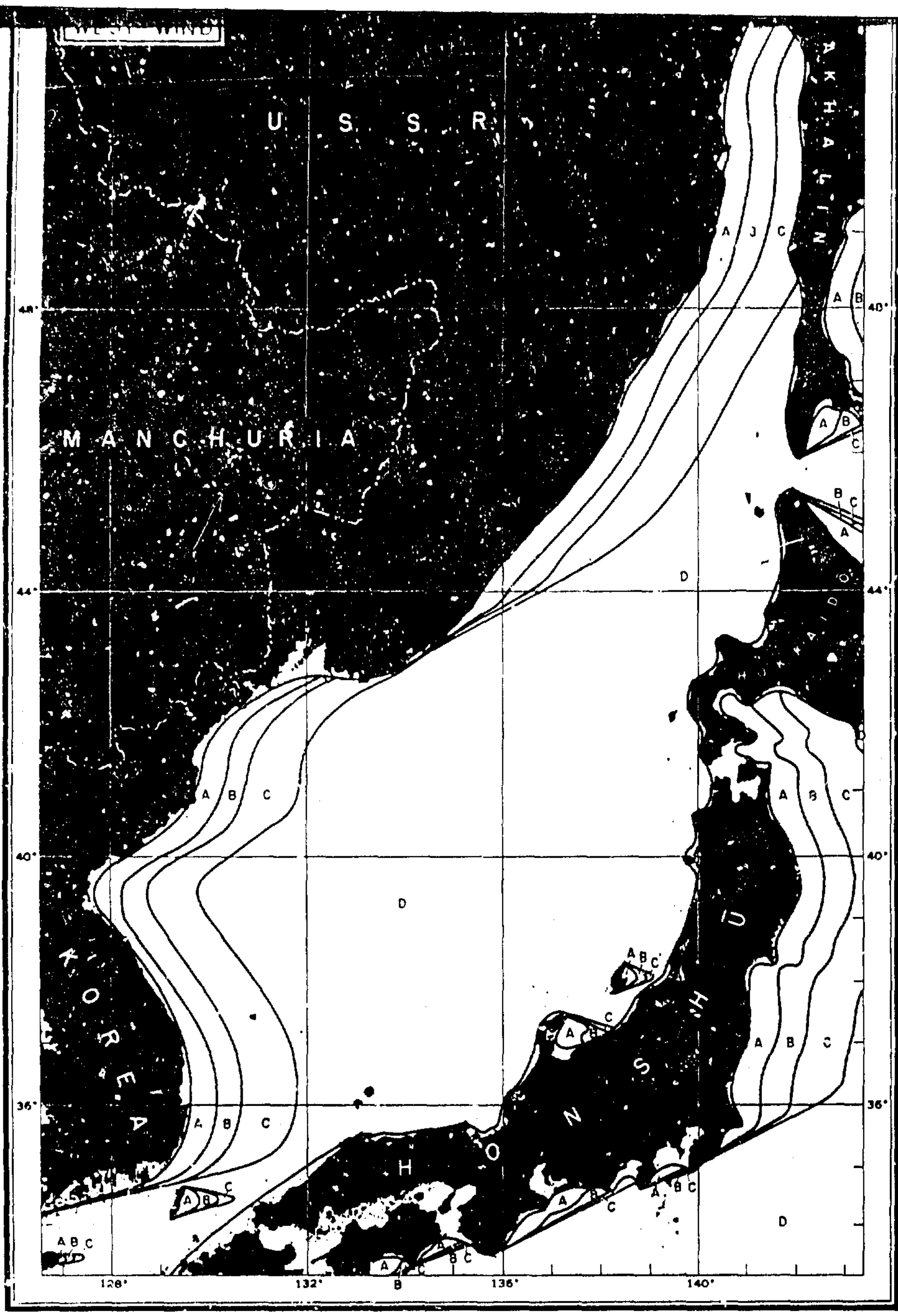
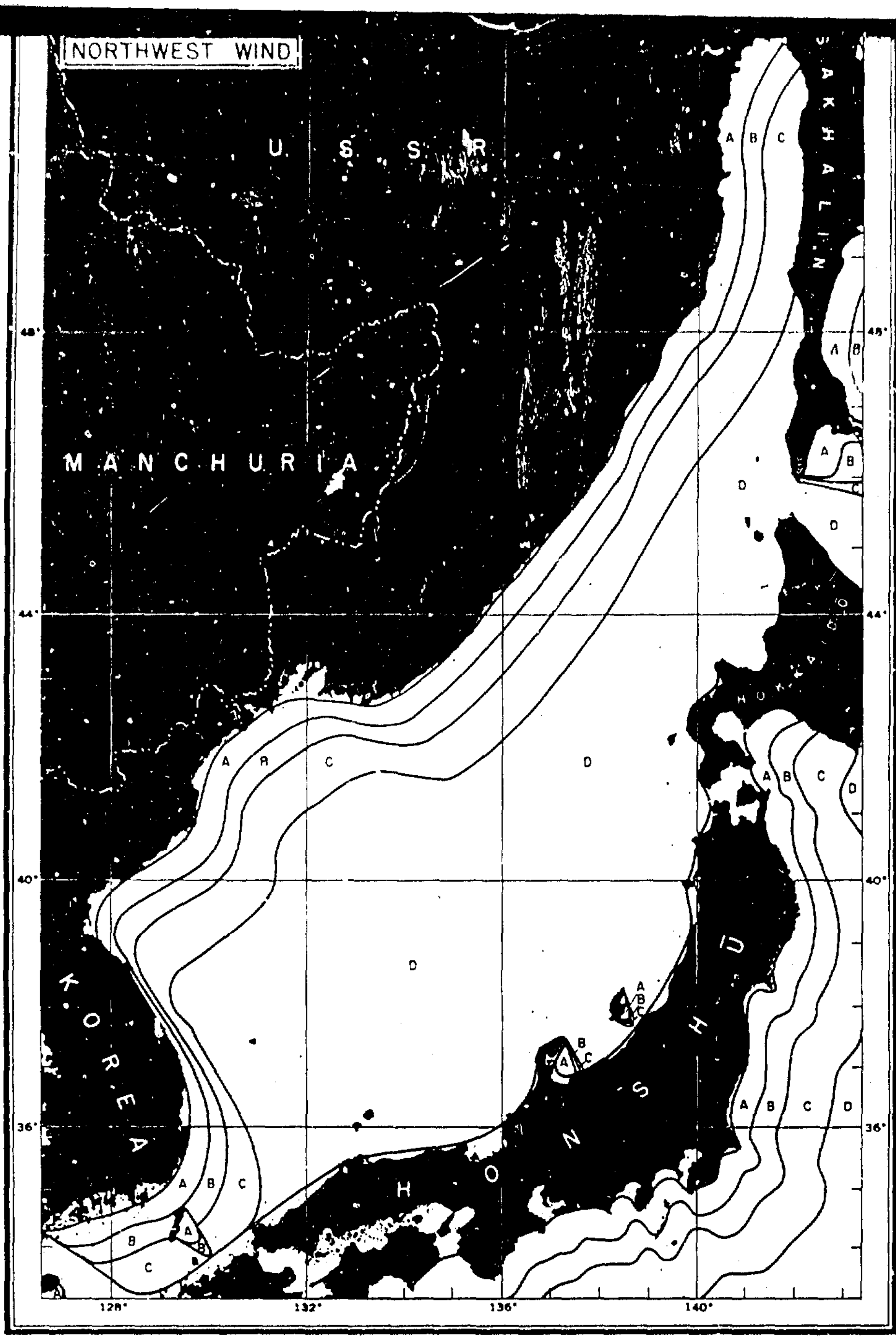

WAVE EXPECTANCY - SOUTH WIND
U. S. S. R.
MANCHURIA
SAKHALIN
KOREA
HONSHU
128°
132°
136°
140°
52°
48°
44°
40°
36°
A
B
C
D


SOUTHWEST WIND
U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
128°
132°
136°
140°
52°
48°
44°
40°
36°
A
B
C
D




To use the charts: (1) select chart representing direction of effective wind; (2) select zone (A, B, C, or D) for locality where estimate is desired; and (3) with the Beaufort wind force and zone enter table below to determine wave height.

| WAVE HEIGHTS (Feet) | | | | |
|---|---|---|---|---|
| Beaufort Force | Zone A | Zone B | Zone C | Zone D |
| 4 | 2–4 | 2–5 | 2–5 | 2–6 |
| 5 | 4–7 | 5–8 | 5–9 | 6–9 |
| 6 | 7–9 | 8–11 | 9–14 | 9–15 |
| 7 | 9–11 | 11–15 | 14–18 | 15–20 |
| 8 | 11–13 | 13–18 | 18–24 | 20–28 |
| 9 | 13–15 | 15–21 | 21–29 | 28–37 |




References:

Arthur, Robert S., "Variability in Direction of Wave Travel," Annals of the New York Academy of Sciences, Vol. 51, pp. 511–521, Article 3, 1949.

U. S., Hydrographic Office, "Marine Geography of Korean Waters," (H. O. Pub. No. 752), Washington, D. C., 1950.

————, "Wind Waves at Sea, Breakers and Surf," by Henry B. Bigelow and W. T. Edmondson, (H. O. Pub. No. 602), Washington, D. C., 1947.



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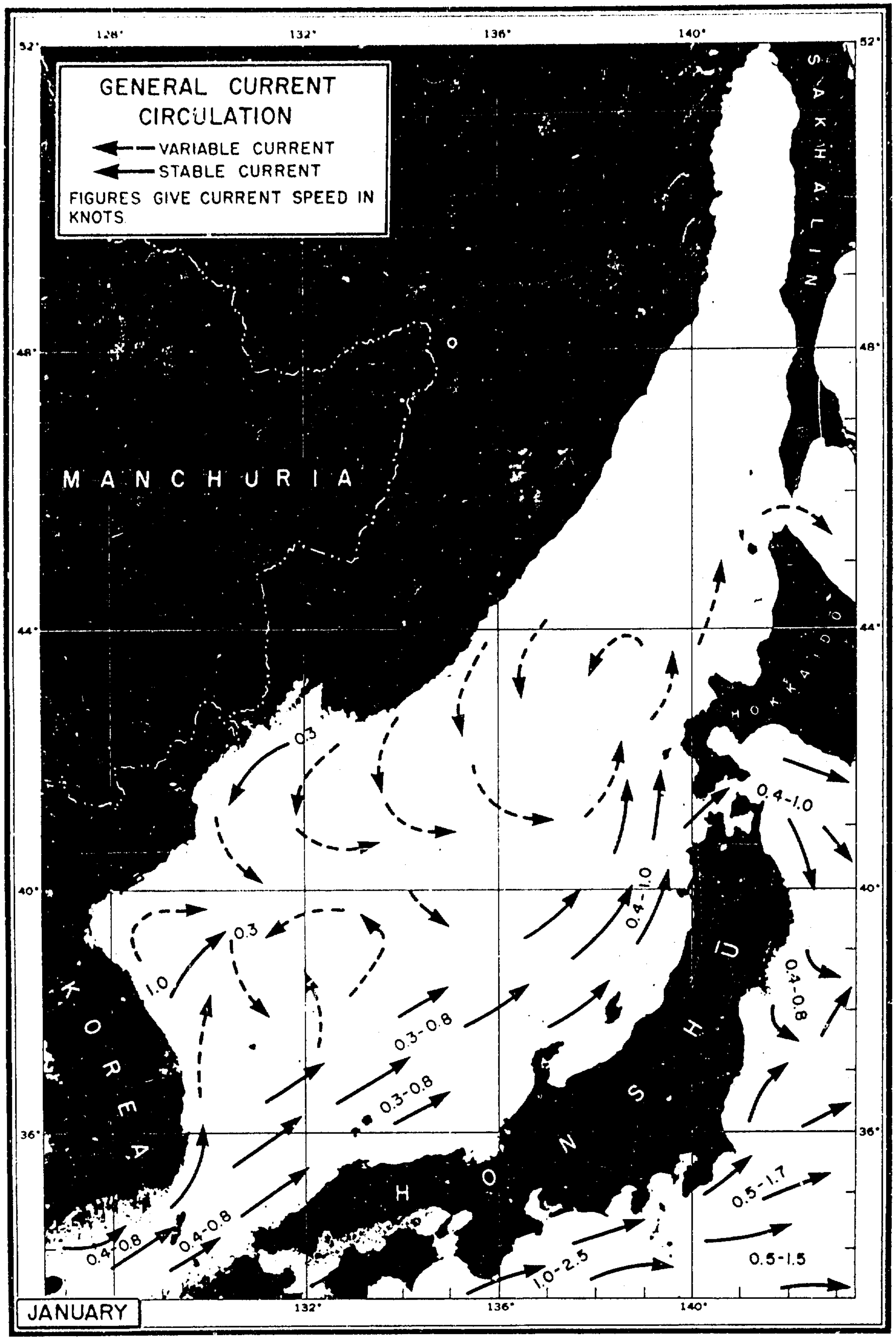
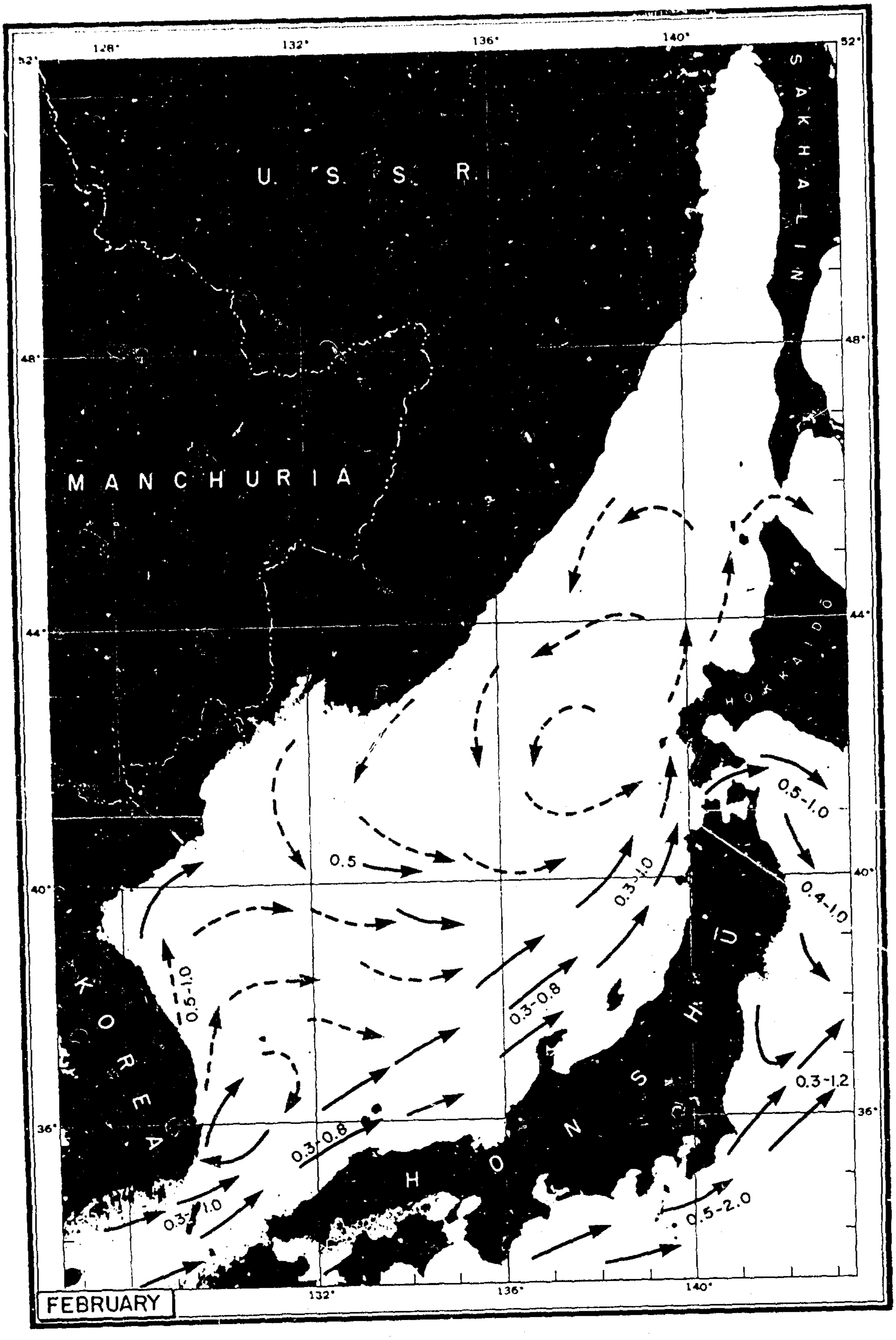
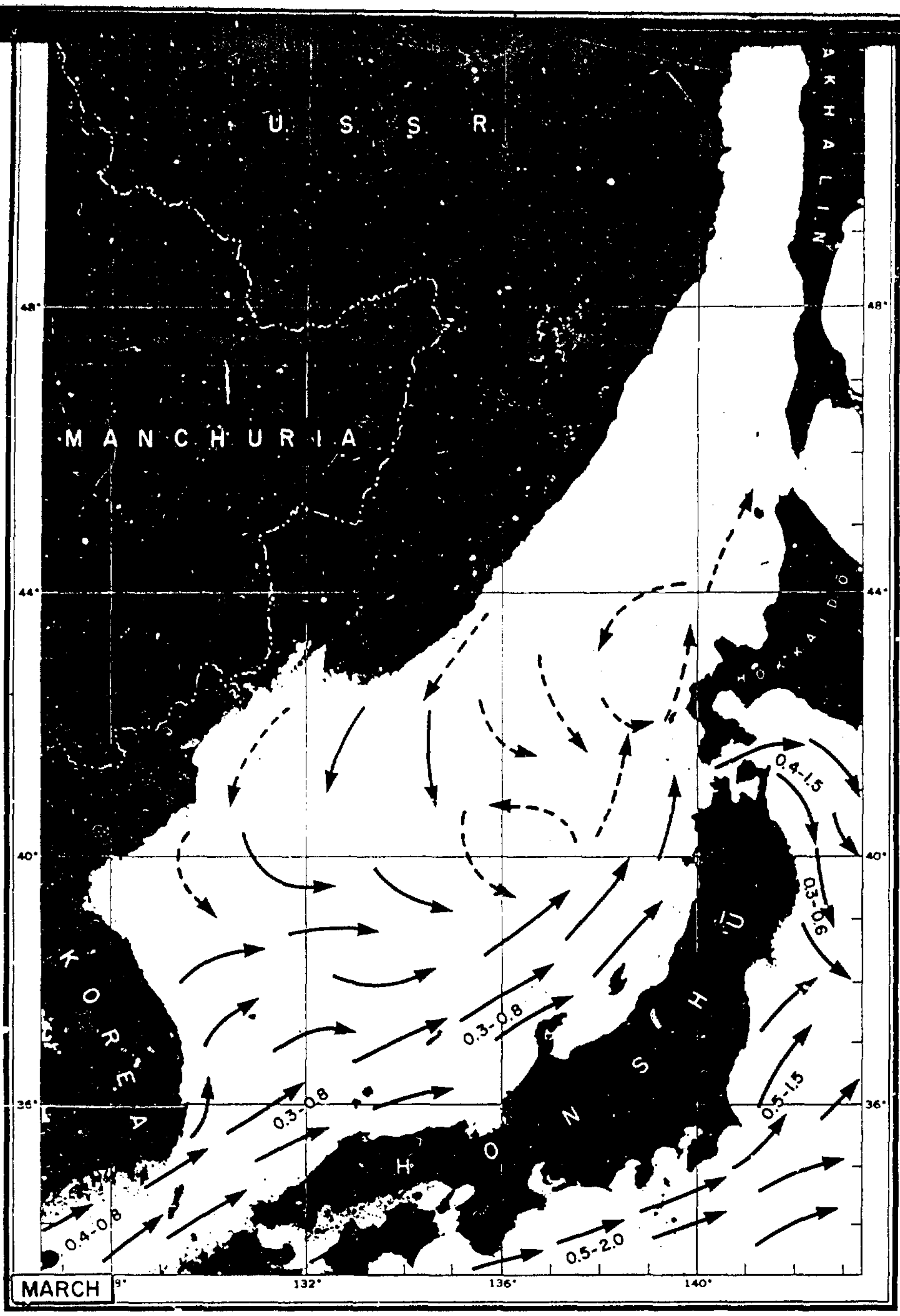
# GENERAL CURRENT CIRCULATION

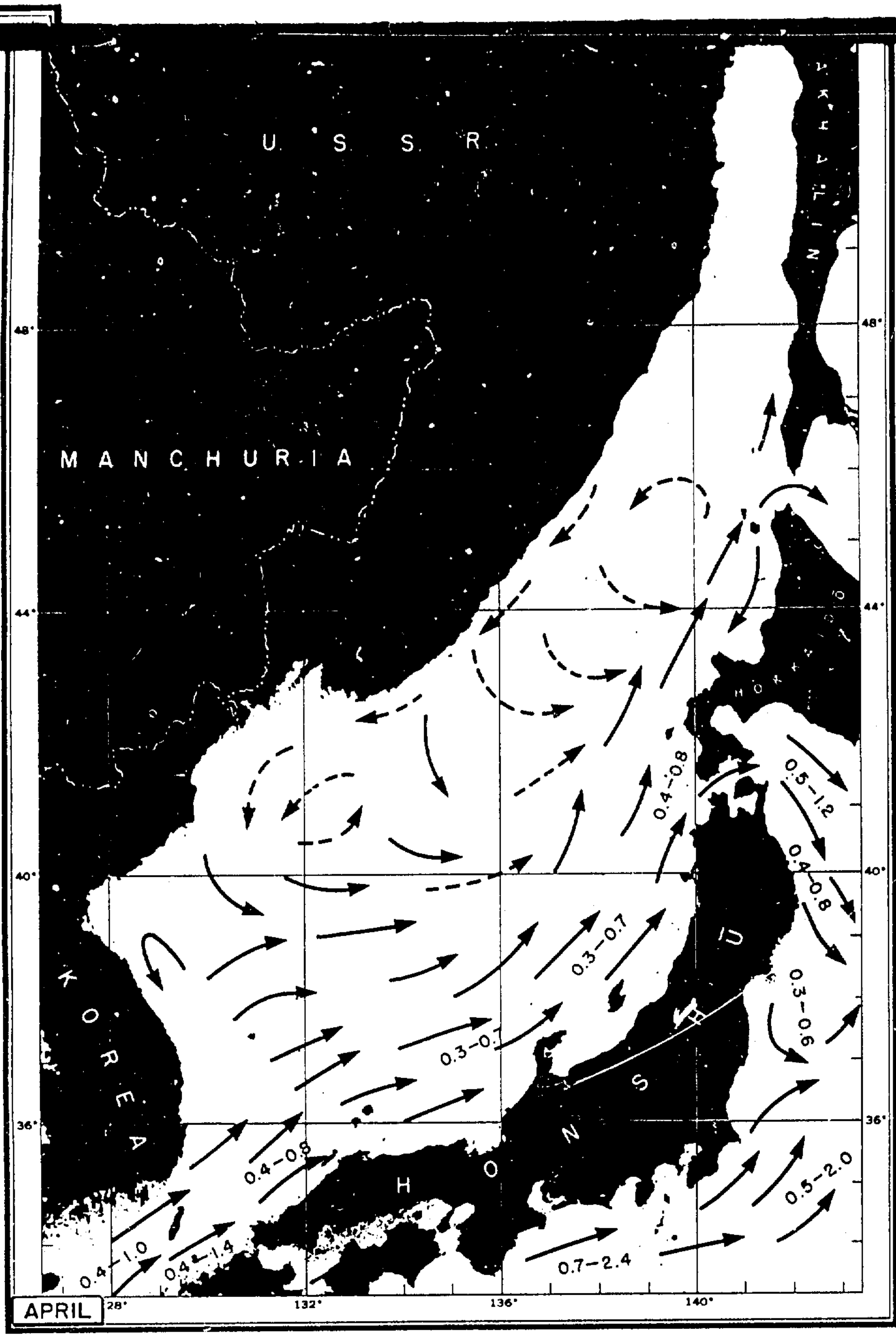



U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
128°
132°
136°
140°
52°
48°
44°
40°
36°
0.5
0.5-1.0
0.4-1.0
0.3-1.0
0.3-0.8
0.5-1.0
0.3-0.8
0.3-1.0
0.3-1.2
0.5-2.0
FEBRUARY



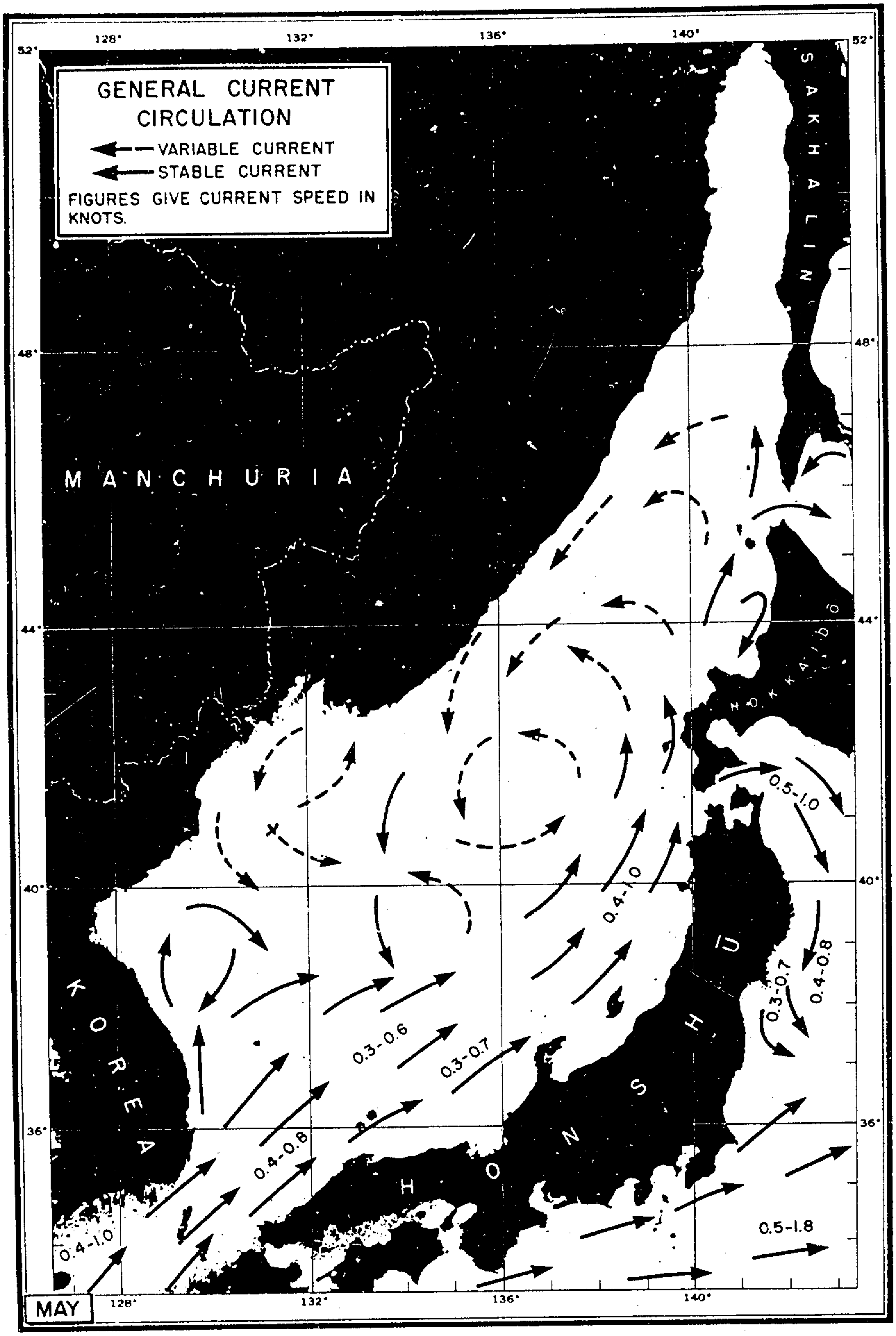

The main ocean currents that affect the areas included in these charts are th Kuroshio, the Tsushima which is stated to be a branch of the Kuroshio, and the co The Kuroshio bifurcates at the southern extremity of Japan proper, the main strea northward along the Pacific coast of Honshu. In latitude 32°N., off the island of the Kuroshio has a width of about 75 miles, which it maintains more or less const the current turns eastward in latitude 35°N., where it merges with the westerly mo of the North Pacific West Wind Drift. On the average, the surface waters of the K move with a speed of 1.5 to 2.0 knots in the portion covered by this study. Acros of 75 miles or more there are encountered bands of water moving with different sp sometimes in opposite directions. Wind and weather influence the width of these bands and the speed of the water. Speeds of as much as 5.0 knots have been enc but these are exceptional.

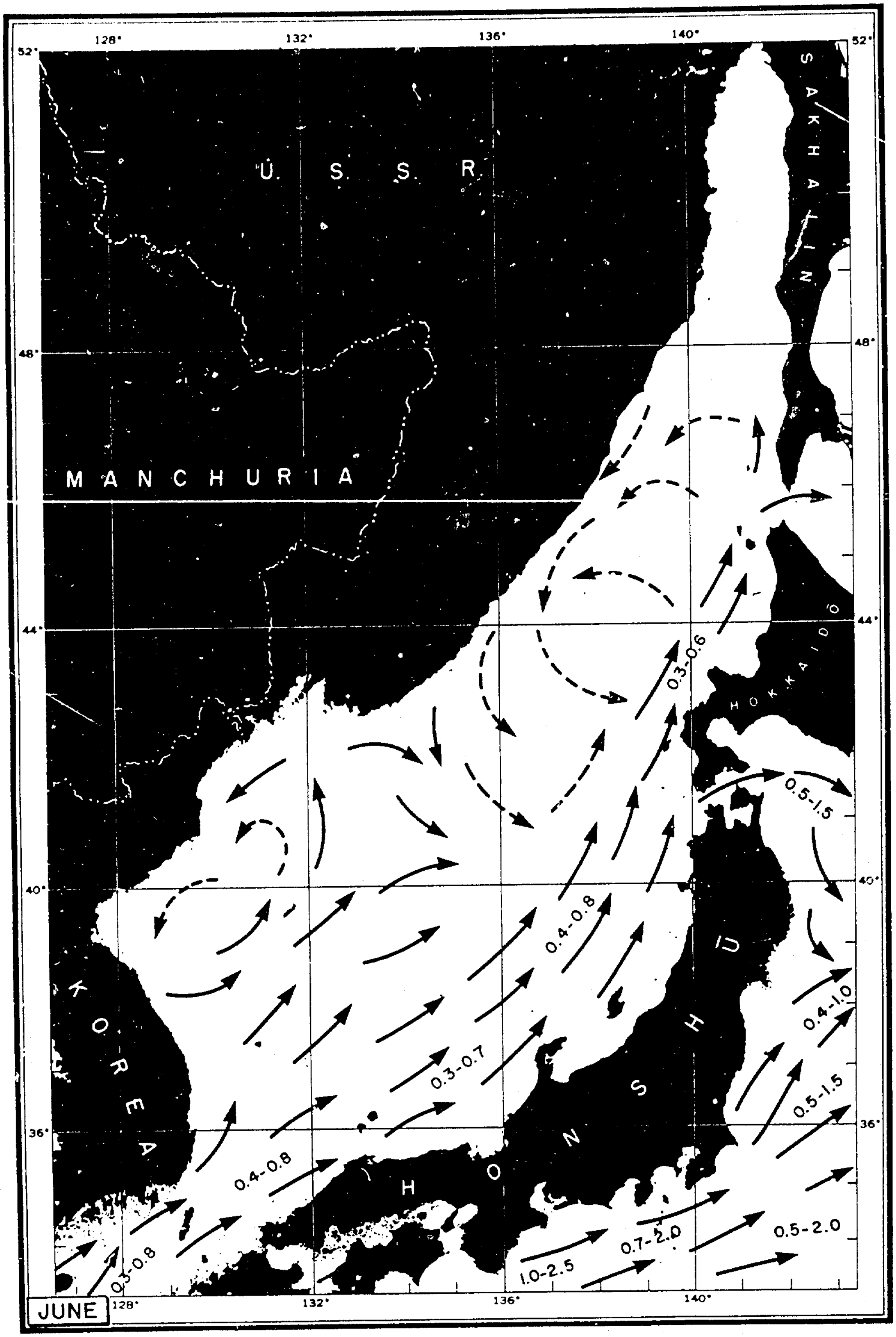
The Tsushima Current, containing a smaller amount of warm water, enters the through the Tsushima (Korea) Strait, flows northward in the eastern part of the Ja and carries warm water to the western shores of Honshu and Hokkaido. In summe entering the Sea of Japan, its general speed is around 0.5 to 1.0 knot. In winter is weaker, though near the islands and headlands it may attain a speed exceedin especially after northwesterly gales.

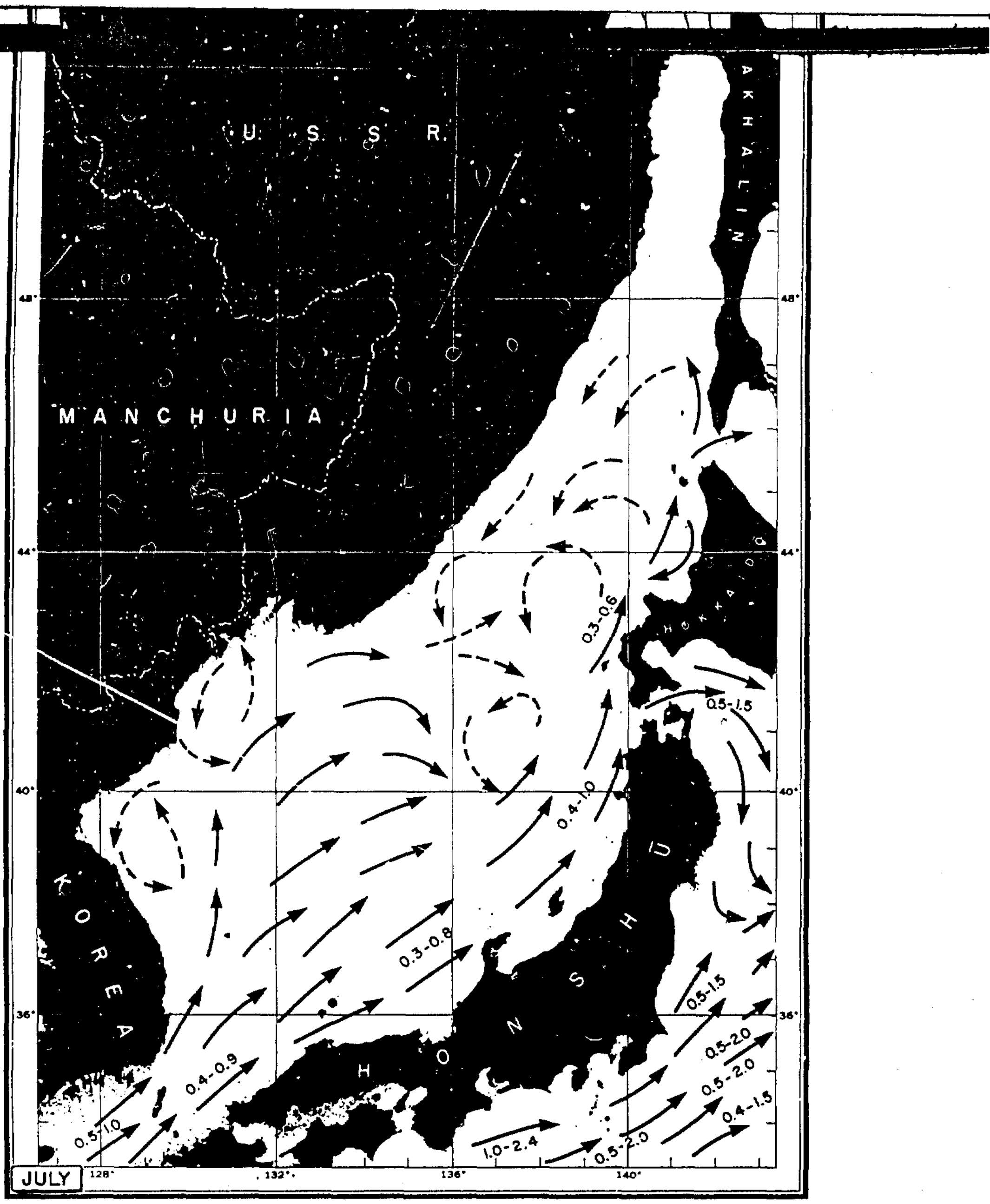



he areas included in these charts are the warm be a branch of the Kuroshio, and the cold Oyashio. xtremity of Japan proper, the main stream flowing hu. In latitude 32°N., off the island of Kyushu, , which it maintains more or less constantly until ., where it merges with the westerly moving waters he average, the surface waters of the Kuroshio e portion covered by this study. Across the width bands of water moving with different speeds and d weather influence the width of these different of as much as 5.0 knots have been encountered

aller amount of warm water, enters the Japan Sea northward in the eastern part of the Japan Sea, es of Honshu and Hokkaido. In summer, after d is around 0.5 to 1.0 knot. In winter the current dlands it may attain a speed exceeding 1.0 knot,


GENERAL CURRENT CIRCULATION
VARIABLE CURRENT
STABLE CURRENT
FIGURES GIVE CURRENT SPEED IN KNOTS.
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
HONSHU
0.5-1.0
0.4-1.0
0.3-0.7
0.4-0.8
0.3-0.6
0.3-0.7
0.4-0.8
0.4-1.0
0.5-1.8
MAY
128°
132°
136°
140°
52°
48°
44°
40°
36°

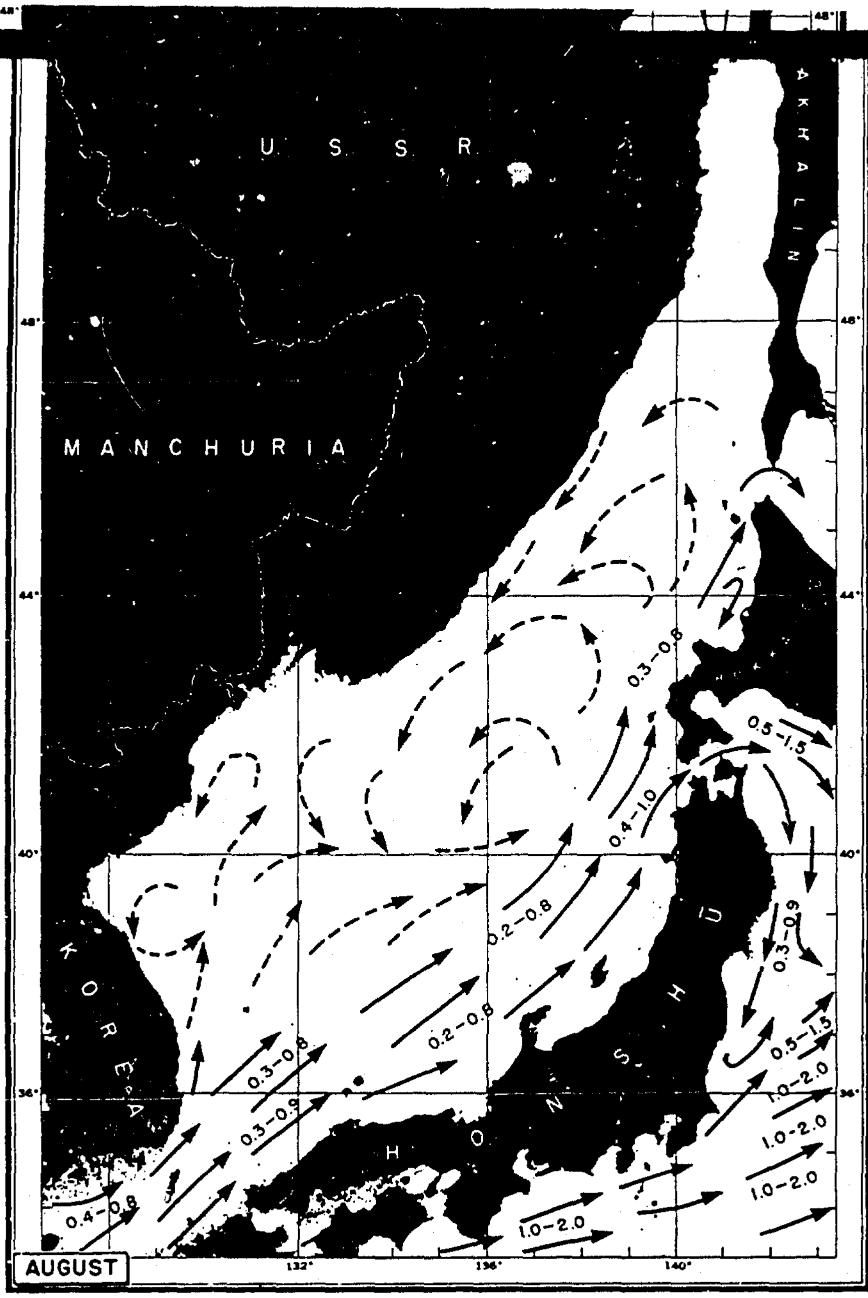

128°
132°
136°
140°
52°
48°
44°
40°
36°
U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDŌ
KOREA
HONSHŪ
0.3-0.6
0.5-1.5
0.4-0.8
0.3-0.7
0.4-1.0
0.5-1.5
0.4-0.8
0.3-0.8
1.0-2.5
0.7-2.0
0.5-2.0
JUNE




The cold Oyashio flowing southward from the Okhotsk Sea, hugs the Pacific co Japan down to about latitude 36°N., where it sinks below the waters of the Kurosh rate of the Oyashio, as it turns southward off Tsugaru Kaikyo is usually less than in summer, except at some places near the coast, where it may attain speeds up tc In winter it covers a wide area and appears to flow at a rate of about 2.0 knots.

In the western part of the Sea of Japan, out of the direct influence of the Tsusl Current, the currents are weak and variable and depend on the wind for their direct speed. They are generated by north winds in autumn and winter and south winds i and summer, seldom exceeding a rate of 0.5 knot. These currents assume a count wise circulation throughout the year but seem to be steadiest during the period fro through July.

The cold Liman Current which flows southward in the western part of the Gulf can be divided into the Coastal Cold Current which washes the shores of the mari inces, and the North Korean Cold Current which develops in the northern part of th Japan and flows southward along the coast of Korea. The speed of these currents than 1.0 knot.

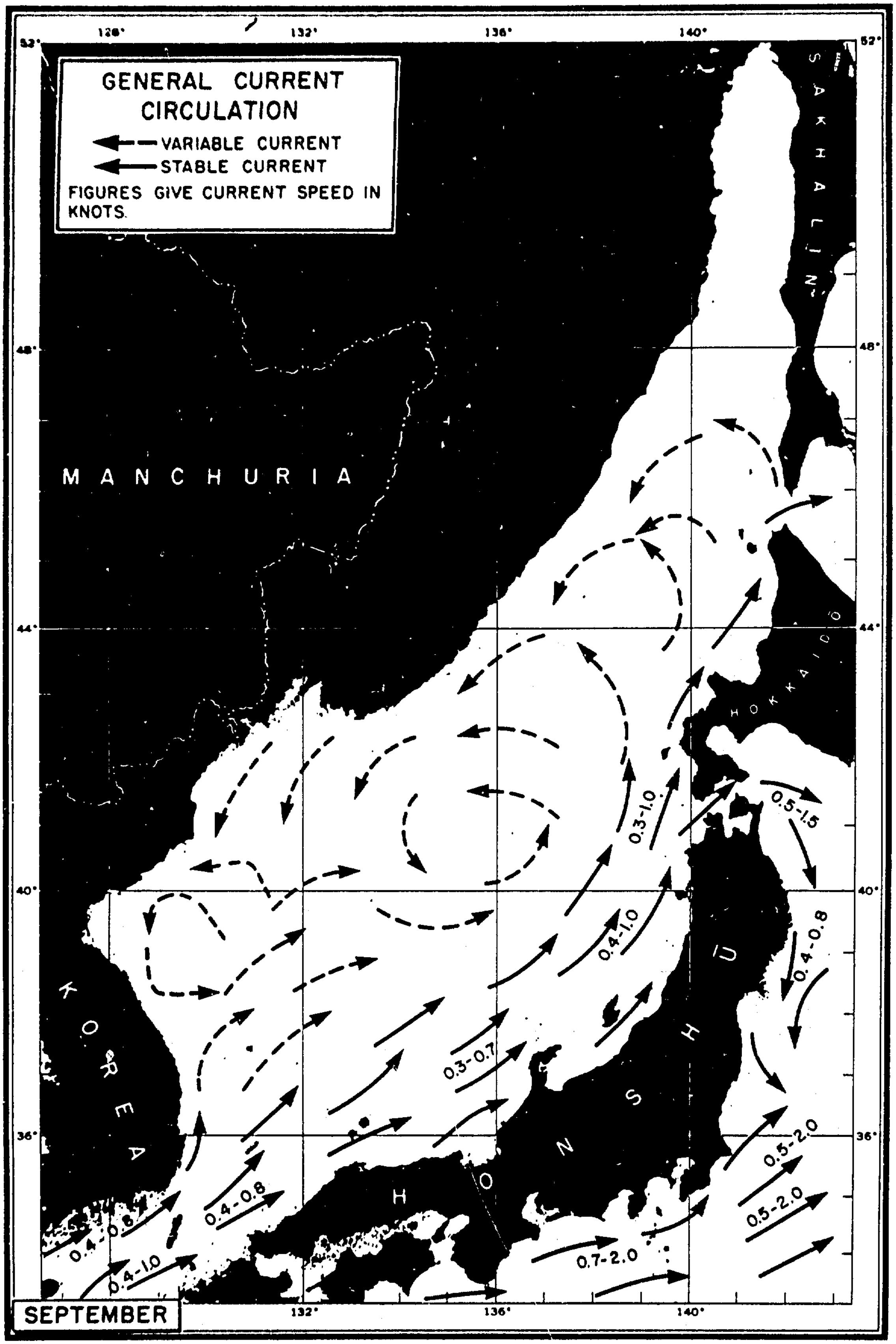


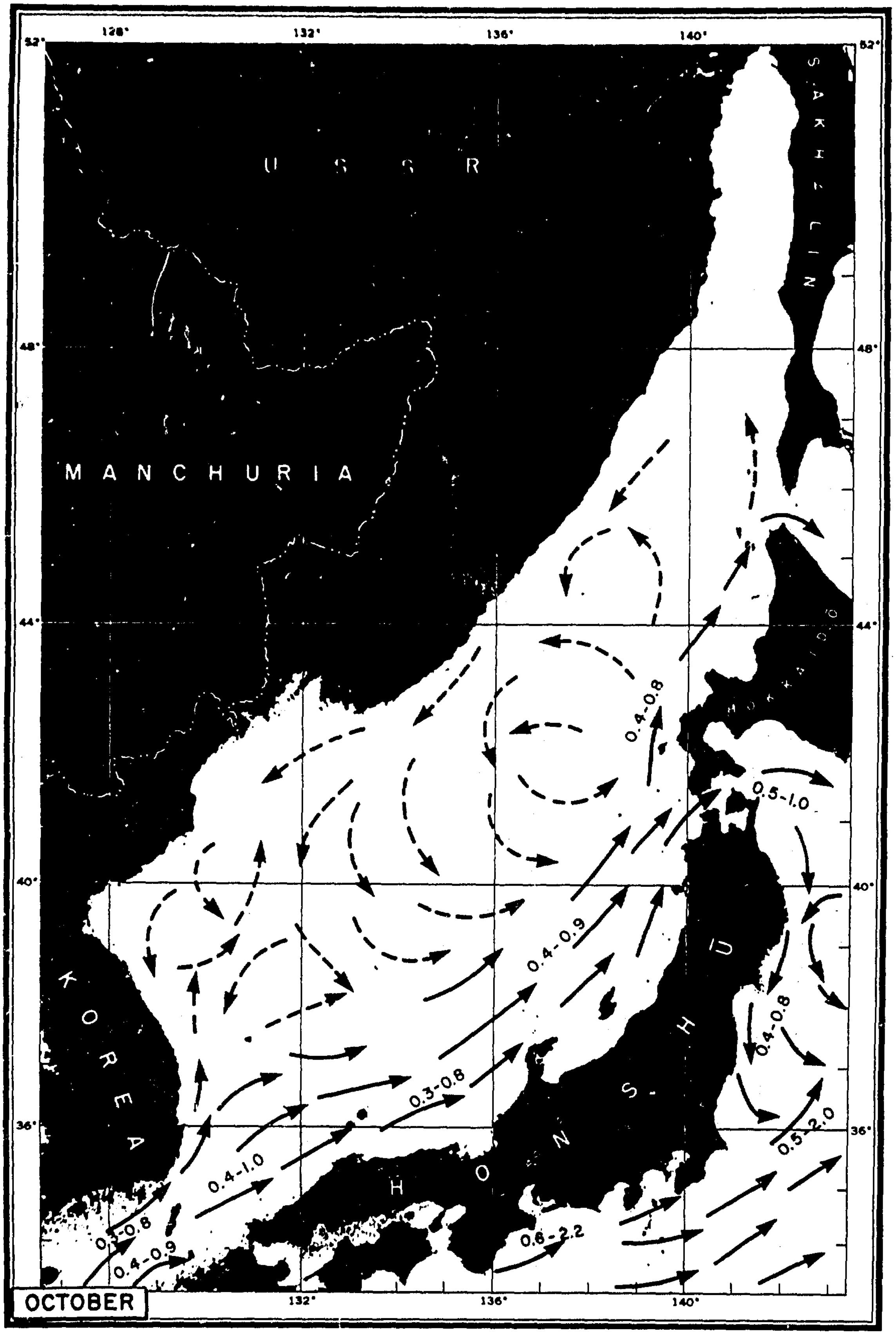

hward from the Okhotsk Sea, hugs the Pacific coast of
., where it sinks below the waters of the Kuroshio. The
uthward off Tsugaru Kaikyo is usually less than 1.0 knot
near the coast, where it may attain speeds up to 3.0 knots.
appears to flow at a rate of about 2.0 knots.

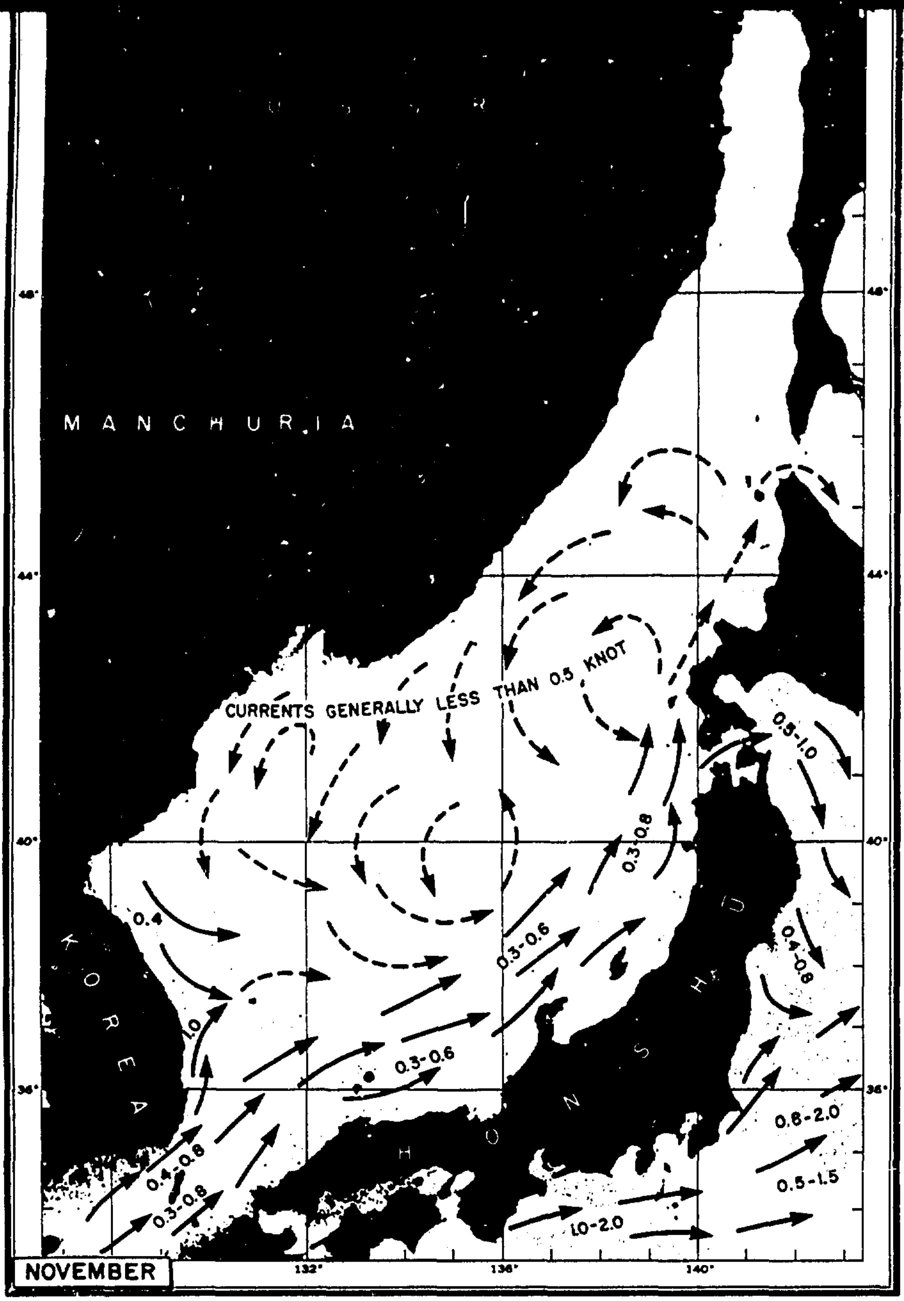
of Japan, out of the direct influence of the Tsushima
variable and depend on the wind for their direction and
th winds in autumn and winter and south winds in spring
ate of 0.5 knot. These currents assume a counterclock-
ar but seem to be steadiest during the period from March

flows southward in the western part of the Gulf of Tatary
old Current which washes the shores of the maritime prov-
Current which develops in the northern part of the Sea of
the coast of Korea. The speed of these currents is less

# GENERAL CURRENT CIRCULATION—Continued




128°
132°
136°
140°
52°
48°
44°
40°
36°
U S S R
MANCHURIA
SAKHALIN
HOKKAIDO
KOREA
HONSHU
0.4-0.8
0.5-1.0
0.4-0.9
0.4-0.8
0.3-0.8
0.5-2.0
0.4-1.0
0.3-0.8
0.4-0.9
0.6-2.2
OCTOBER

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Japan, Hydrographic Department, "The Japan Sea," Oceanographic Memoirs (Kai
Vol. 24, October 1944, Tokyo, (in Japanese).

U. S., Hydrographic Office, "Marine Geography of Korean Waters," (H. O. Pub. N
Washington, D. C., 1951.

———, "Ocean Currents in the Vicinity of the Japanese Islands and China
(H. O. Pub. No. 237), Washington, D. C.

U. S. Naval Institute Proceedings, Vol. 63, p. 1426, October 1937.

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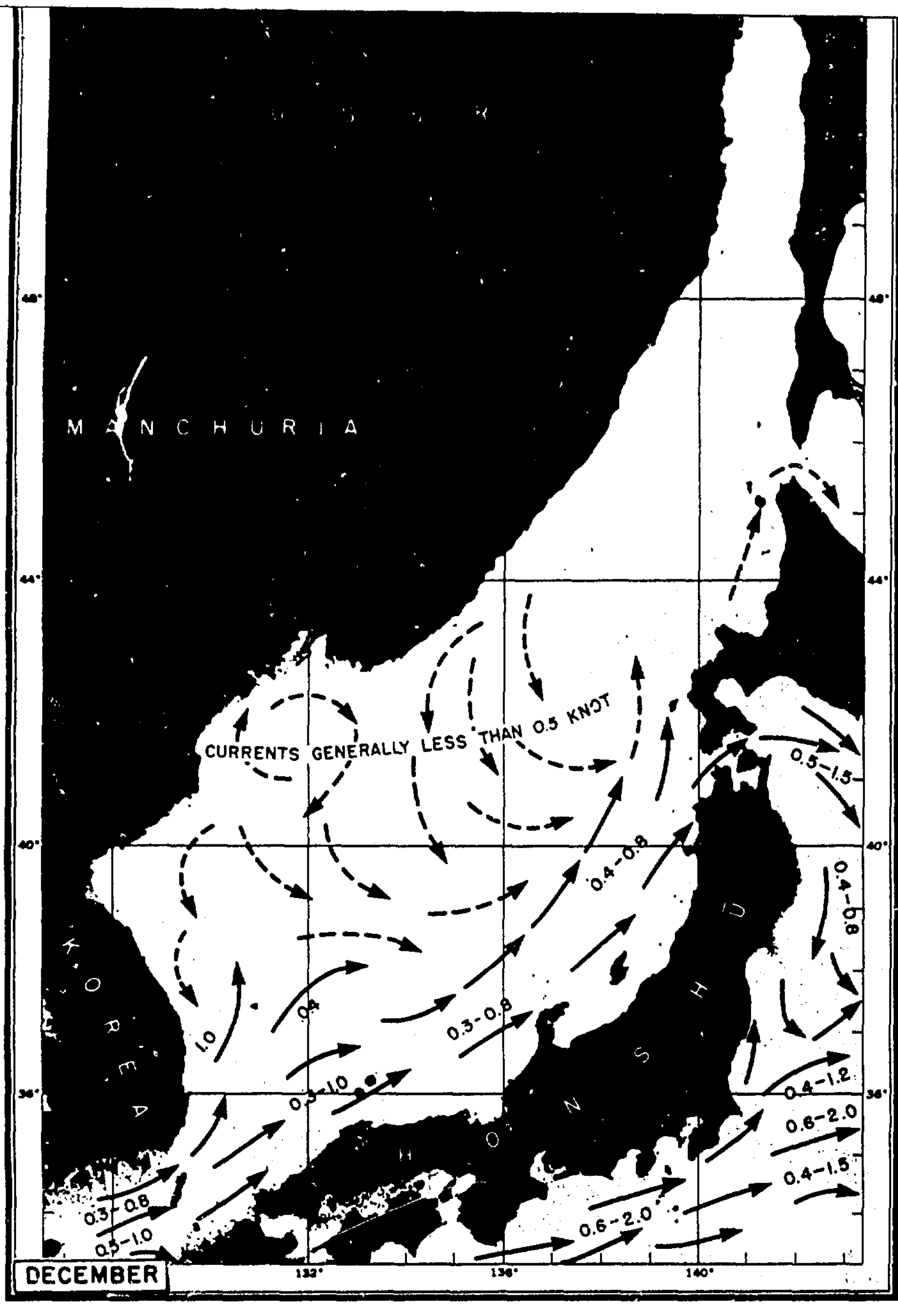



"The Japan Sea," Oceanographic Memoirs (Kaizo Iho), kyo, (in Japanese).

he Geography of Korean Waters," (H. O. Pub. No. 752),

he Vicinity of the Japanese Islands and China Coast," hington, D. C.

s, Vol. 63, p. 1426, October 1937.

## TIDAL AND LOCAL CURRENTS

1. Tatar Strait. In a position 1½ miles SW of Mys Tyk the flood and the ebb currents, which attain a speed of 1 knot, set respectively in a northerly and a southerly direction. The tidal currents in the fairway attain speeds of 3 to 4 knots.

2. Zaliv DeKastri. The flood and ebb currents set respectively in a northerly and a southerly direction; both currents are weak.

3. Tumdzha. The current of the river attains a speed of 2 knots immediately after the time of high water.

4. Bukhta Yugozapadnaya. At the anchorage the flood current sets in a SW direction and the ebb current in a NE direction.

5. Zaliv Petra Velikogo. Tidal currents in the gulf are imperceptible and influenced mostly by the winds.

6. Tumen River. Currents off the mouth very irregular, the rate being about ¼ knot.

7. Chosan Man. Currents weak and irregular; 5 miles south of Nan Do the surface current in May sets SW and in June WNW with a speed of ¼ knot.

8. Musu Dan. Along the coast from Orang Dan to Musu Dan, in the area between 2 and 10 miles offshore, the ocean current sets southward with a speed of about 1 knot. Speeds of 2 knots occur with strong northerly winds.

9. Kyongsong Man. About 5 miles from the coast of Ch'ongjin Hang the current is southerly; 6 miles eastward of Komalsan Dan the current sets SSW; 15 miles northeastward of Orang Dan the current sets southerly; 50 miles eastward of Komalsan Dan the current sets northerly; all have speeds from ½ to ¾ knot.

10. Tongjoson Man. Tidal currents weak and irregular; warm and cold ocean currents meet in this area, flowing counterclockwise; in summer, the cold current sets in a southerly direction and the warm current in a northerly direction, attaining a speed of 1 knot. Currents near Mayang Do set in an easterly direction with a speed of 1 knot.

11. Tongjoson Man to Yongch'u Gap. Along this coast the set of the ocean current is mostly northerly with a speed of about 1 knot. This current is influenced by winds, its direction and speed becoming irregular, occasionally with a reverse set.

12. Ullung Do. The mean current usually sets eastward with a speed up to ¾ knot and becomes irregular when influenced by winds.

13. Yongch'u Gap to Pusan Hang. Along the coast from Yongch'u Gap to Ulsan Man, the ocean current generally flows in a northerly direction with a speed of ½ to 1 knot. It is stronger in summer than in winter. Between Ulsan Man and Pusang Hang, the ocean current flows from Korea Strait in a NE direction parallel to the coast, attaining a speed of ½ to 1 knot.

14. Ulsan Man. From 1 to 2 miles outside the inlet, the ebb current sets NE with a speed of about 2 knots and the flood current sets SW with a speed of about 1¼ knots.

15. Kwanggye Mal to Sungdu Mal. The flood current sets SW with a speed of 1 knot; the ebb current sets NE with a speed of 2 knots.

16. Shiomaki. Tidal currents in the vicinity of Shiomaki are radically altered by the Tsushima Current, the flood setting SSW for about 1 hour at a maximum rate of ¾ knot, and the ebb setting NNE for 11 hours at a maximum rate of 2¼ knots.

17. Kawajiri Zaki. The Tsushima Current flows close off Kawajiri Zaki causing tide rips which are heaviest in the summer. About 2 miles northward of the headland the flood sets SW from about the time of low water until 4 hours later, attaining a rate of 1 knot. The ebb, which may attain a rate of 2 knots, sets NE from 2 hours before high water and runs for the remainder of the cycle.

18. Mi Shima. The current sets eastward, with a speed sometimes as high as 2½ knots. It is particularly strong off the northern side of the island.

19. Hamada Ko to Hinami Saki. Off this coast the resultant current sets NE at some distance offshore. About 1 mile westward of Hinami Saki the south-going flood current sometimes attains a speed of 0.8 knot.

55. Ushiro Wan. In a position about 1¾ miles NW of Horokishi Misaki the flood current sets in a NNE direction and attains a speed of ½ knot. The ebb current sets in a SSW direction and attains a speed of ¾ knot, but in a position about 1¾ miles NW of Inawa Saki the ebb current sets in a SW direction and attains a speed of 1 knot.

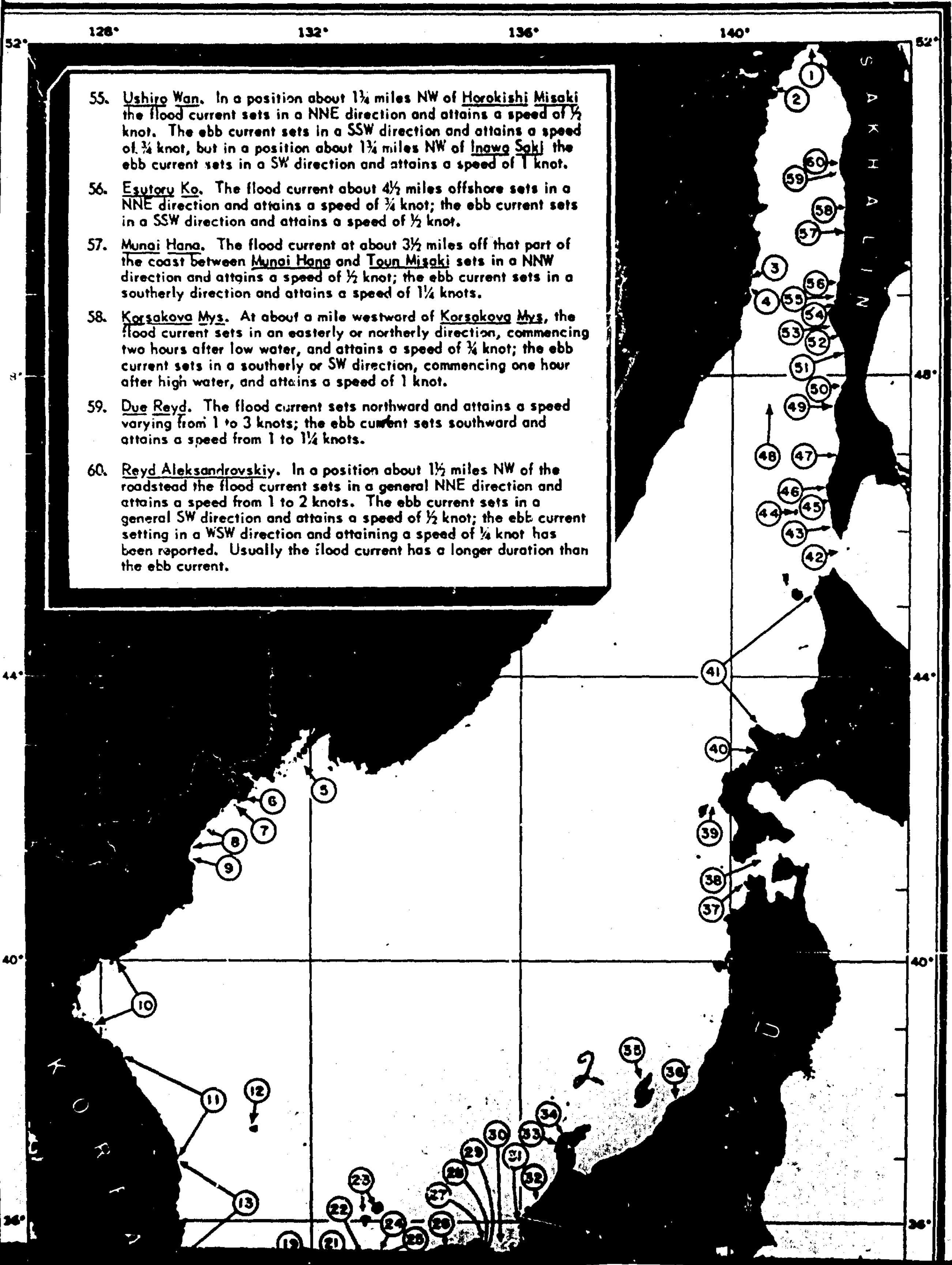
56. Esutoru Ko. The flood current about 4½ miles offshore sets in a NNE direction and attains a speed of ¾ knot; the ebb current sets in a SSW direction and attains a speed of ½ knot.

57. Munai Hana. The flood current at about 3½ miles off that part of the coast between Munai Hana and Toun Misaki sets in a NNW direction and attains a speed of ½ knot; the ebb current sets in a southerly direction and attains a speed of 1¼ knots.

58. Korsakova Mys. At about a mile westward of Korsakova Mys, the flood current sets in an easterly or northerly direction, commencing two hours after low water, and attains a speed of ¾ knot; the ebb current sets in a southerly or SW direction, commencing one hour after high water, and attains a speed of 1 knot.

59. Due Reyd. The flood current sets northward and attains a speed varying from 1 to 3 knots; the ebb current sets southward and attains a speed from 1 to 1¼ knots.

60. Reyd Aleksandrovskiy. In a position about 1½ miles NW of the roadstead the flood current sets in a general NNE direction and attains a speed from 1 to 2 knots. The ebb current sets in a general SW direction and attains a speed of ½ knot; the ebb current setting in a WSW direction and attaining a speed of ¼ knot has been reported. Usually the flood current has a longer duration than the ebb current.



Zaki causing tide rips which are heaviest in the summer. About 2 miles northward of the headland the flood sets SW from about the time of low water until 4 hours later, attaining a rate of 1 knot. The ebb, which may attain a rate of 2 knots, sets NE from 2 hours before high water and runs for the remainder of the cycle.

18. Mi Shima. The current sets eastward, with a speed sometimes as high as 2½ knots. It is particularly strong off the northern side of the island.

19. Hamada Ko to Hinami Saki. Off this coast the resultant current sets NE at some distance offshore. About 1 mile westward of Hinami Saki the south-going flood current sometimes attains a speed of 0.8 knot.

20. Yunotsu Ko. Tidal currents off the entrance of Yunotsu Ko do not exceed ½ knot; the ebb sets NE and the flood SW.

21. Benten Shima. Tidal currents about 1½ miles WSW of Benten Shima do not exceed ½ knot, the flood setting southward and the ebb northward.

22. Etomo Ko. In the entrance of Etomo Ko the flood sets SE and the ebb NW at about ¼ knot. The tide turns from 2 to 3 hours after high and low water. About 4 miles NW of the entrance the resultant current sets ENE at about ½ knot. In the Sado Gawa the currents attain a speed of 2 knots at springs.

23. Oki Gunto. The tidal streams in the vicinity of the Oki Gunto are weak and irregular, the flood setting NE and the ebb SW, with the turn coming at about the times of high and low water. During the summer the tidal streams may have a continual SE set in the channel between Dozen and Dogo Shima.

24. Jizo Zaki. East of Jizo Zaki the resultant set is easterly during both ebb and flood with a maximum speed of about ½ knot. Between Jizo Zaki and Okino-gozen Shima a NW set of about ½ knot may be experienced during the flood.

25. Nakaeno Seto. The flood sets inward from three hours after low water until three hours after high water, and the ebb sets outward for the remainder of the cycle. The flood following lower low water and the ebb following higher high water may attain speeds of 2 knots, but at other times the rate seldom exceeds 1 knot.

26. Amarube Zaki. Eastward of Amarube Zaki an east-going current sets along the coast at ¼ to 2 knots.

27. Washi Saki. The currents are generally weak, but during northerly winds a SE set with maximum speed of 1 knot has been experienced 3 miles ENE of the point. Off Ine Ko the current is irregular, but an easterly set predominates. After a period of heavy rains the speed of this easterly set is increased as the rivers discharging into the head of Miyazu Wan raise the level of the water in that narrow inlet above that of Wakasa Wan proper, resulting in a surface outflow.

28. Miyazu Wan. The weak tidal streams set parallel to the shores. After the passing of an area of low pressure, a northerly set with speed of about ¼ knot may be experienced off the western side of Kataahima Bana.

29. Maizuru Wan. From the entrance to Maizuru Wan to the point where it bifurcates the tidal currents are irregular and weak, running at a rate of not more than 0.1 knot.

30. Wakasa Wan. Tidal currents are weak, their maximum speed being attained near the shores at the times of high and low water. Slack water occurs about midway between the times of high and low waters. Although the directions of the tidal currents are considerably influenced by the wind, in general the flood is east-going and the ebb west-going.

31. Echizen Misaki. The ebb, augmented by the river current, attains a rate of 1 to 2¼ knots.

32. Hashidate Ko. In a position about 5½ miles NNE of Hashidate Ko a resultant easterly current with a maximum speed of 1 knot may be experienced with the rising tide.

33. Saruyama Zaki. In a position about 6 miles NNW of Saruyama Zaki a SW set with speed of 1¾ knots has been observed during the flood.

34. Noto Hanto. Tidal currents on the eastern side set southward on the rising tide and northward on the falling tide. Their speeds are less than 1 knot within 5 miles of the shore.

35. Sado Shima. The Tsushima Current sets NNE along both sides o Sado Shima at about ½ knot, and may increase to 1 knot with SE Occasionally, with a protracted period of strong NE winds, its di tion may be reversed.

36. Niigata Ko. The current at the mouth of the river sets out at abo 2 knots, though it is reported to reach 8 or 9 knots during freshet

37. Kadomari Misaki. The current sets northward at about 2 knots, c though greater speeds have been reported.

38. Tsugaru Kaikyo. A stream of the northerly Tsushima Current flov an easterly direction through Tsugaru Kaikyo, causing the set wi the strait to be nearly always toward the Pacific Ocean. At the eastern entrance to the strait, between Esan Misaki and Shiriya S the charted speeds near mid-channel are ½ to 5½ knots, and near middle of the narrows at the same end of the strait, between Shio Misaki and Oma Saki, they are 1½ to 5 knots. The resultant east current in Tsugaru Kaikyo sets up eddies or countercurrents in ai on both the northern and southern sides of the strait. The tidal c in Tsugaru Kaikyo, being affected by the flow and a diurnal inequ ity, have the typical characteristics of unequal durations of the f and ebb, together with irregularities in speed.

39. Okushiri Kaikyo. The ocean current is very irregular in direction During summer, northerly sets of ½ to 1½ knots and southerly set about ¼ to ½ knot have been experienced.

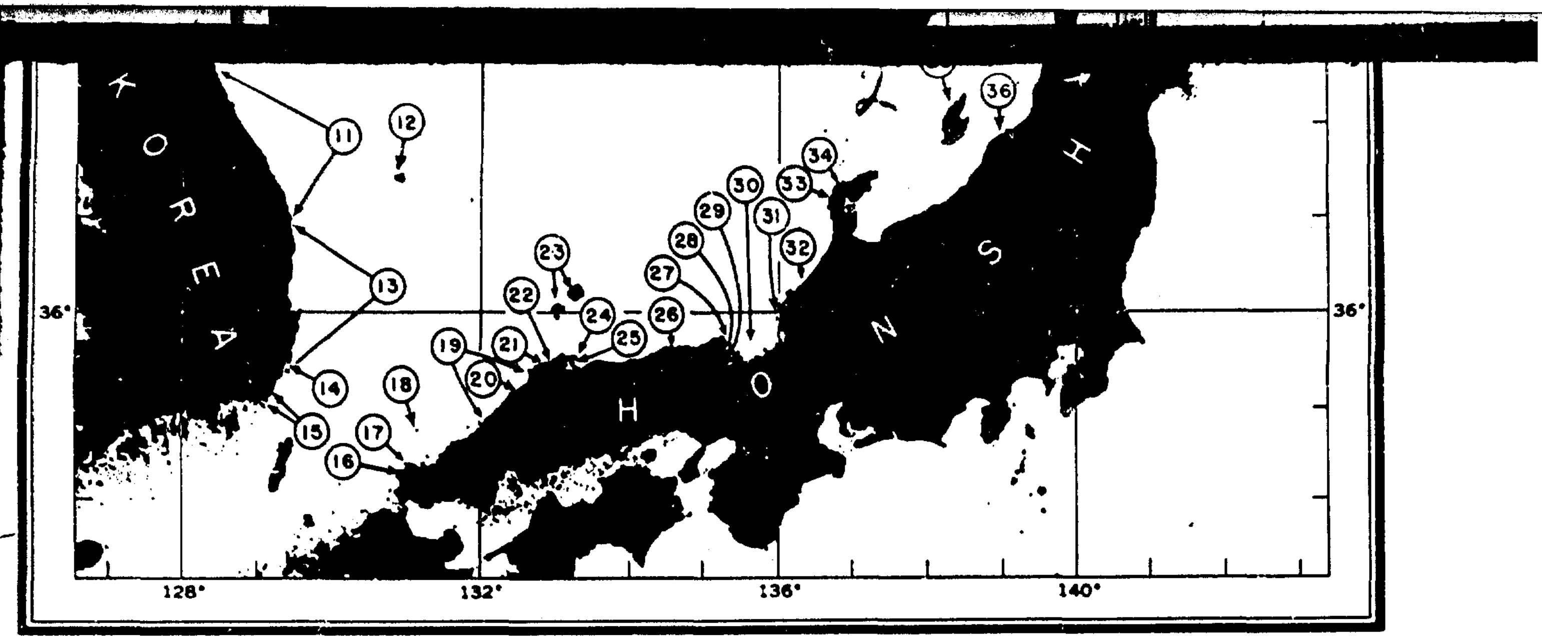
40. Iwanai Byochi. There is a reported SW tidal current and a NE eb current.

41. West Coast of Hokkaido. In general the tidal currents are very w and irregular. They are influenced to a large extent by the north-going ocean current.

42. Soya Kaikyo. Tidal currents of 3 to 3½ knots are charted close s ward of Nishi-notoro Misaki and an east-going ocean current, wit speed of 1¼ knots, is charted about 6 miles SSW of that cape. In summer the east-going ocean current has a charted speed of ¾ to knots about 2 miles northward of Soya Misaki. About 2½ miles nc ward of Noshappu Saki an east-going ocean current of 1¼ to 2 knc has been observed in June.

43. Enchishi Saki. A constant current flowing in a general southerly direction parallels this coast and at a distance of about 2½ miles offshore attains a speed of 1¼ knots.

44. Kaiba To. On the eastern side the flood current sets in a norther direction and attains a speed of 1½ knots; the ebb current sets in a SSW direction and attains a speed of 1¾ knots. On the southern side of the island, in a position about a mile southward of Tachii (Tatiiwa) Hana, the flood current sets in a WNW direction and attains a speed of 1¼ knots; the ebb current, attaining a speed of




Shima. The Tsushima Current sets NNE along both sides of Shima at about ½ knot, and may increase to 1 knot with SE winds. asionally, with a protracted period of strong NE winds, its direc- may be reversed.

ata Ko. The current at the mouth of the river sets out at about ots, though it is reported to reach 8 or 9 knots during freshets.

omari Misaki. The current sets northward at about 2 knots, al- gh greater speeds have been reported.

aru Kaikyo. A stream of the northerly Tsushima Current flows in asterly direction through Tsugaru Kaikyo, causing the set within strait to be nearly always toward the Pacific Ocean. At the ern entrance to the strait, between Esan Misaki and Shiriya Saki, charted speeds near mid-channel are ½ to 5½ knots, and near the ile of the narrows at the same end of the strait, between Shiokubi aki and Oma Saki, they are 1½ to 5 knots. The resultant easterly ent in Tsugaru Kaikyo sets up eddies or countercurrents in areas oth the northern and southern sides of the strait. The tidal currents sugaru Kaikyo, being affected by the flow and a diurnal inequal- have the typical characteristics of unequal durations of the flood ebb, together with irregularities in speed.

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hishi Saki. A constant current flowing in a general southerly ction parallels this coast and at a distance of about 2½ miles hore attains a speed of 1¼ knots.

ba To. On the eastern side the flood current sets in a northerly ction and attains a speed of 1½ knots; the ebb current sets in SW direction and attains a speed of 1¾ knots. On the southern of the island, in a position about a mile southward of Tachiiwa iiwa) Hana, the flood current sets in a WNW direction and ins a speed of 1¼ knots; the ebb current, attaining a speed of 1 knot, sets in a reverse direction. On the northern side of the island, in a position about a mile seaward of Hakozaki Iwa, the flood current sets in a NE direction and attains a speed of 1½ knots, and the ebb current sets in an ESE direction and attains a speed of 1¼ knots. Tide rips occasionally are observed between Kita-Se and Kuroiwa Hana.

45. Kenushi Misaki. Tidal currents are combined with the constant current, which at a distance of about 2½ miles offshore sets in a southerly direction and attains a speed of 1 knot; the resulting flood current sets in a northerly direction and attains a speed of ½ knot, and the ebb current setting in a southerly direction attains a speed of 1½ knots.

46. Oko Hakuchi. A constant current setting in a general SW direction and attaining a speed of ¼ knot has been observed in the month of August at a distance of about 4 miles off this coast.

47. Muoka (Kholmsk). A constant current setting in a southerly direction and attaining a speed of ¾ knot has been observed at a distance of 2 miles off this coast.

48. Gulf of Tatary. There is no appreciable current in the central part of the gulf southward of the 50th parallel. Observations from mid-July to the beginning of October tend to show that the weak south-going current flowing along the western shore of the gulf and the branch of Tsushima Current setting in a northerly direction along the coast of Sakhalin hardly need to be taken into account for that part of the gulf northward of the 50th parallel. The tidal currents, which attain speeds of 1½ to 2 knots, are very regular.

49. Usu Misaki. At a distance of about 3 miles offshore a constant current sets in a northerly direction and attains a speed of ¾ knot.

50. Tomarioru Hakuchi. A constant current attaining a speed of 1½ knots sets in a NNE direction about 2 miles off this coast.

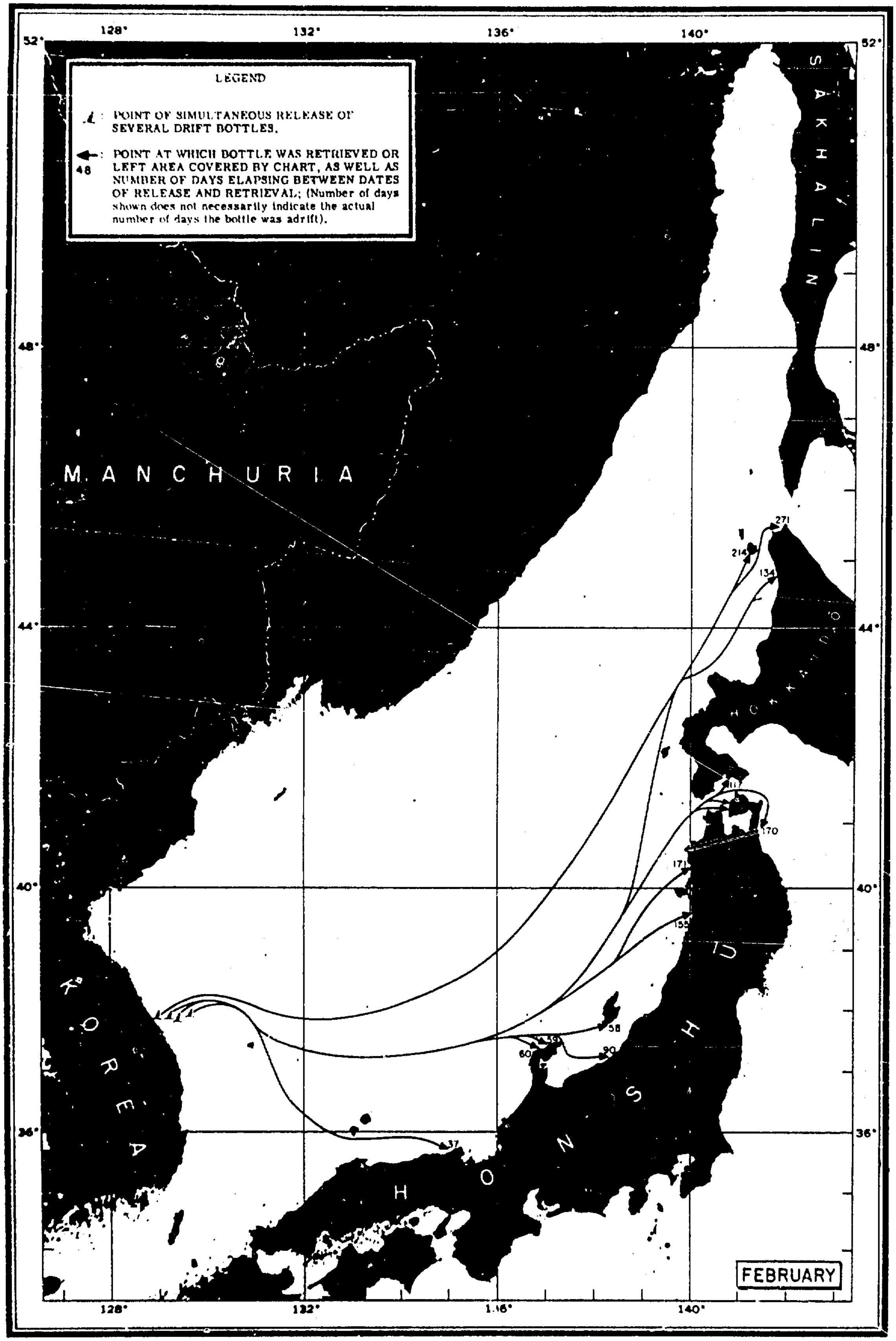
51. Chinnai (Krasnogorsk). In a position about 3½ miles offshore the flood current sets in a SSE direction and attains a speed of ¾ knot; the ebb current sets in a SSW direction and attains a speed of 1 knot.

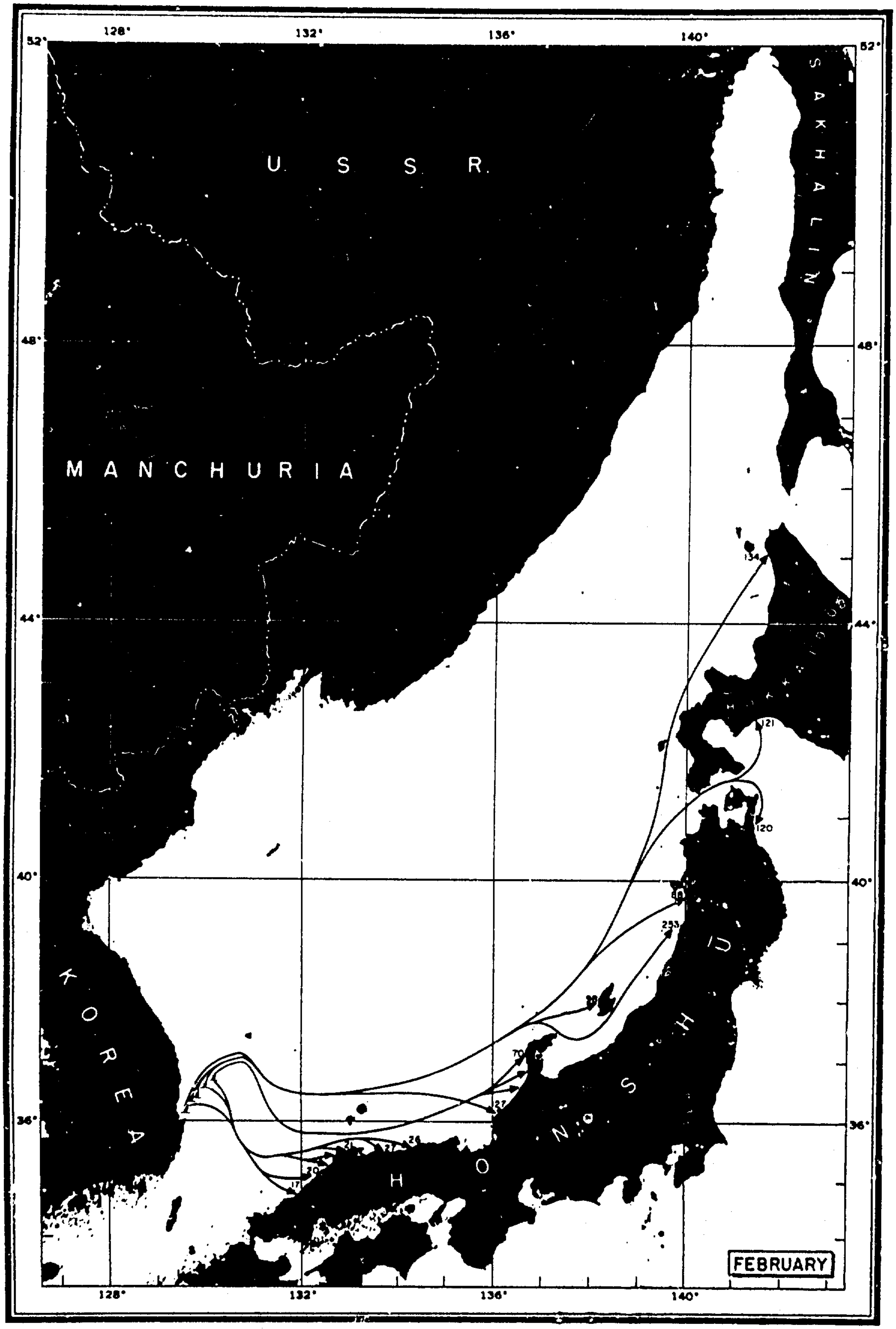
52. Chishini. In a position about 3 miles offshore, the flood current sets in a SE direction and attains a speed of ½ knot; the ebb current sets in a SSE direction and attains a speed of ¾ knot.

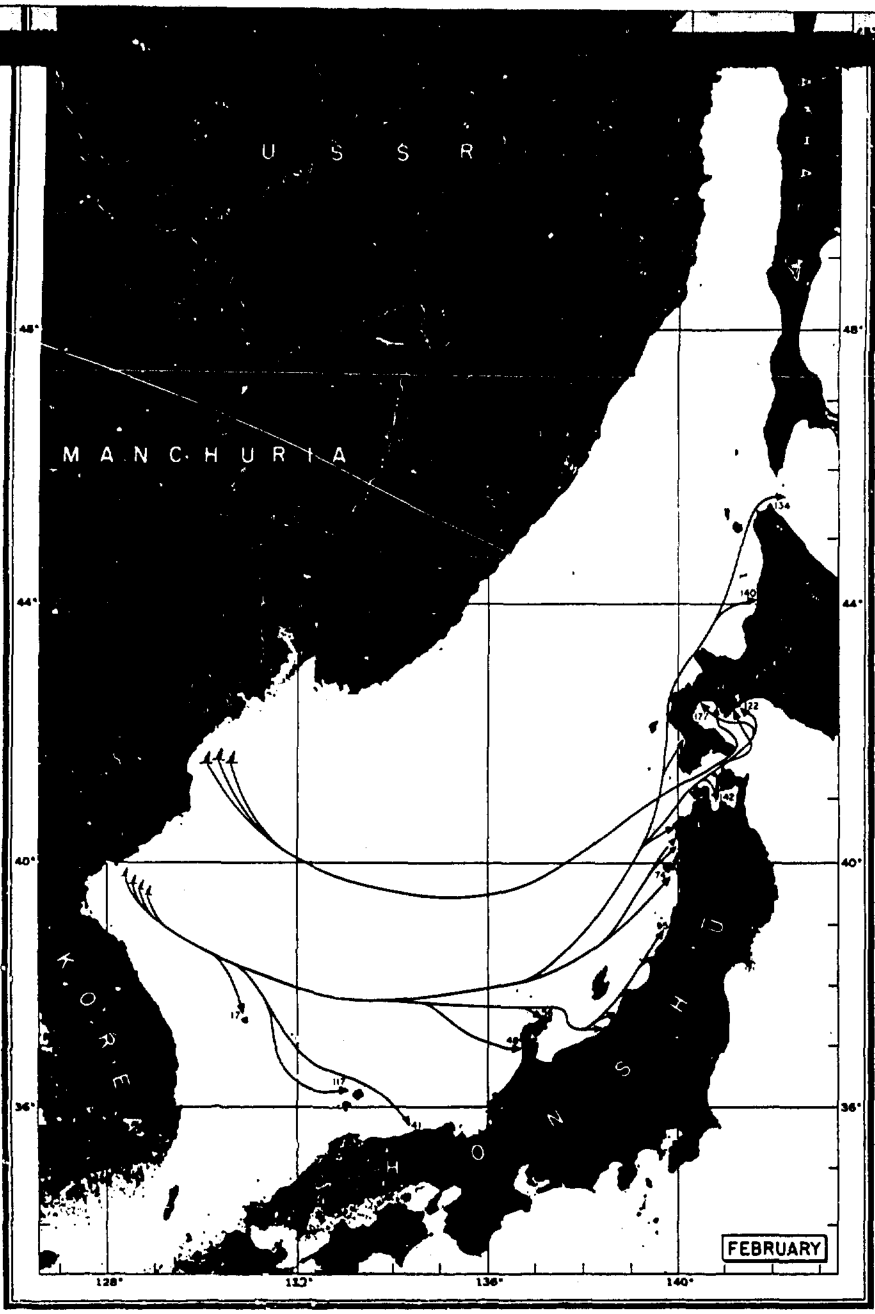
53. Tsurugi Saki. About 2½ miles off the section of the coast between Tsurugi Saki and Chirai Misaki the flood current sets in a northerly direction and attains a speed of 1½ knots; the ebb current sets in a SSW direction and attains a speed of 1 knot.

54. Inawa Saki. The flood current in the vicinity sets in a northerly direction and attains a speed of 1½ knots; the ebb current sets in a SSW direction and attains a speed of 1 knot.

# PROBABLE PATHS OF DRIFT BOTTLES




U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
FEBRUARY
128°
132°
136°
140°
52°
48°
44°
40°
36°



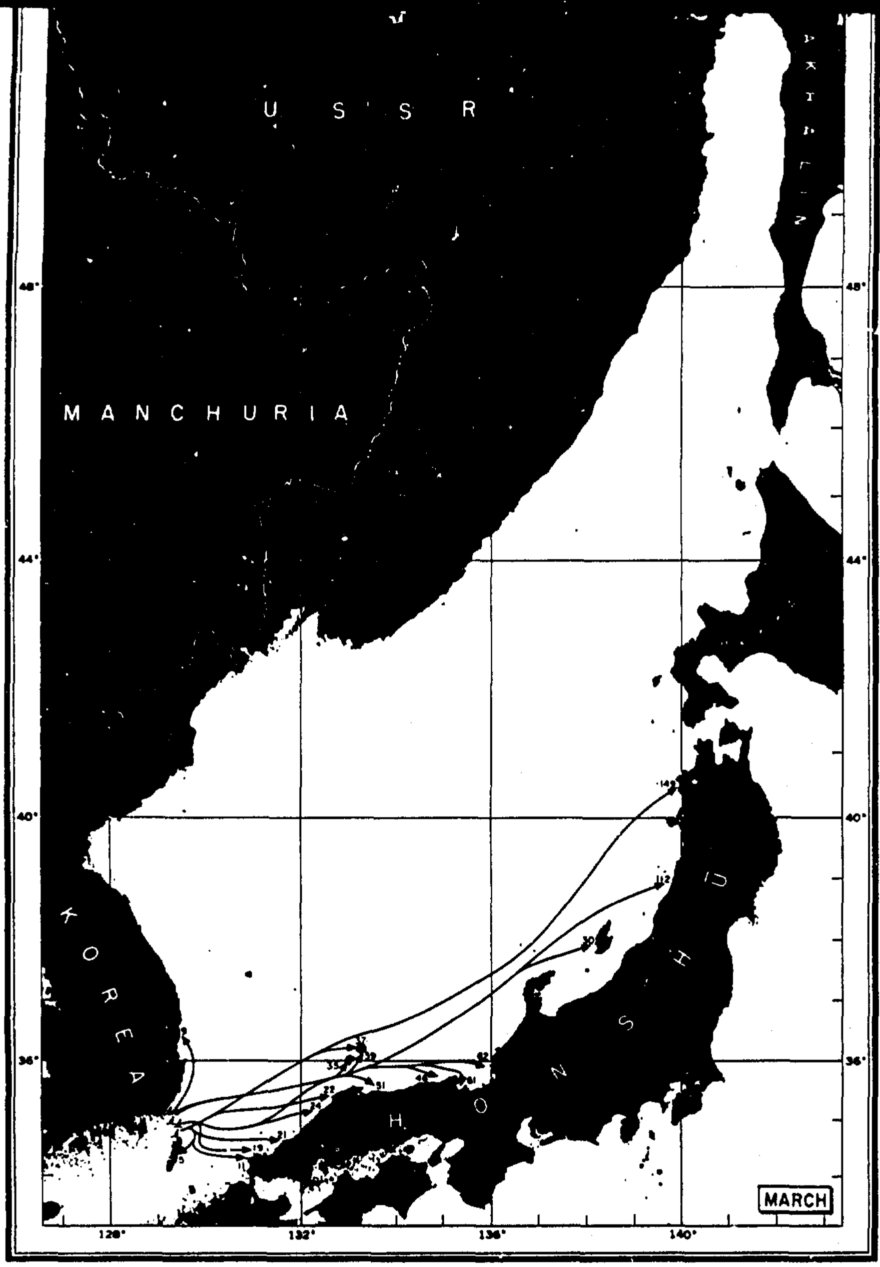

A series of experiments was conducted by the Japanese Hydrographic Office 6,800 drift bottles were thrown overboard at various locations in the Sea of Japa was fitted with a small drag made of tin plate suspended at the end of a wire ab long attached to the bottle.

Bottles were retrieved in greatest quantity in regions where the current strea crowded; in regions where the currents upon approaching the coast sink before i forming a convergence of streamlines; in regions where the bottles were capture currents; or in regions of complicated coast lines. Recovery of bottles was 34 p cessful, but seems to be inversely proportional to the distance from land.

3

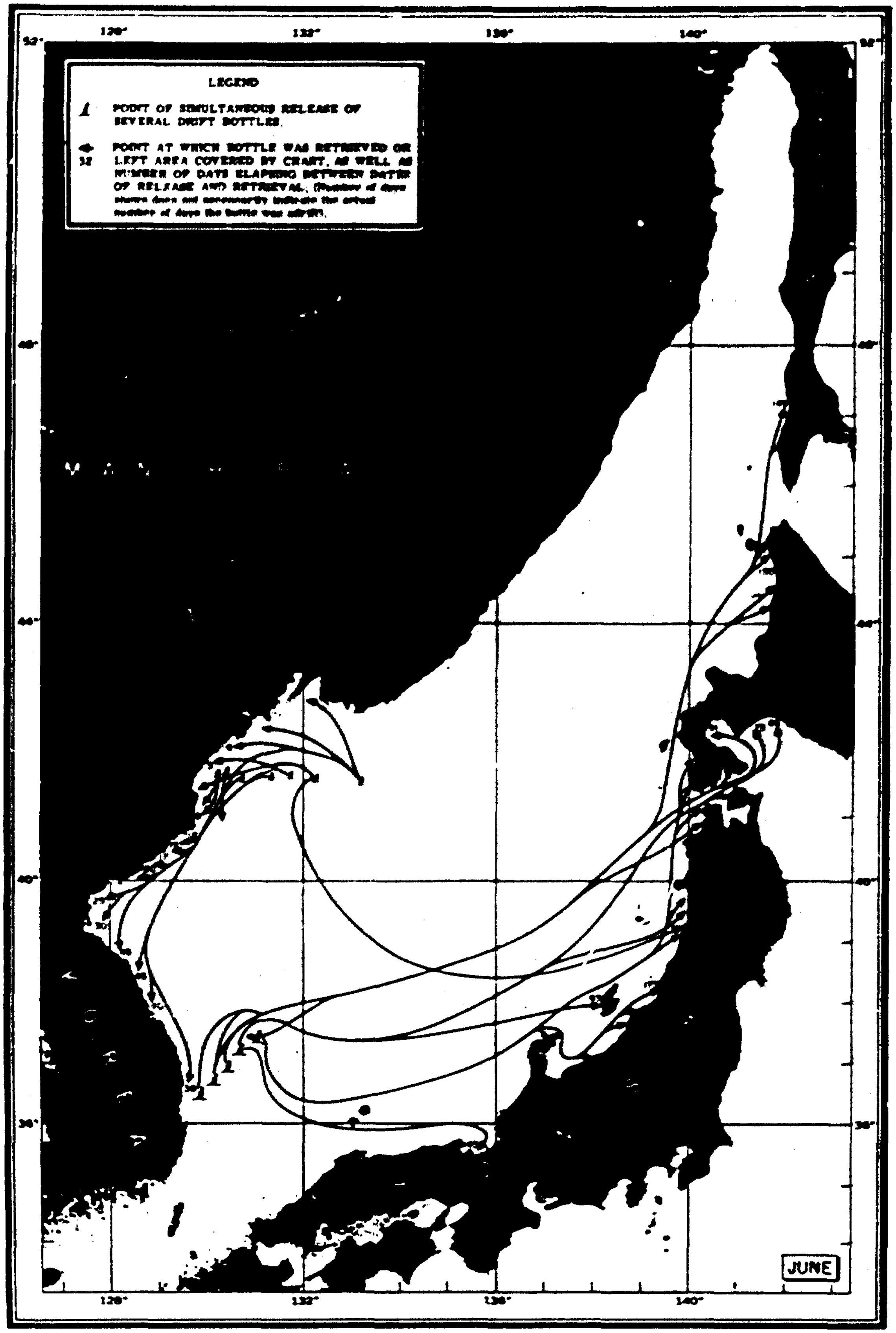
RESTRICTED

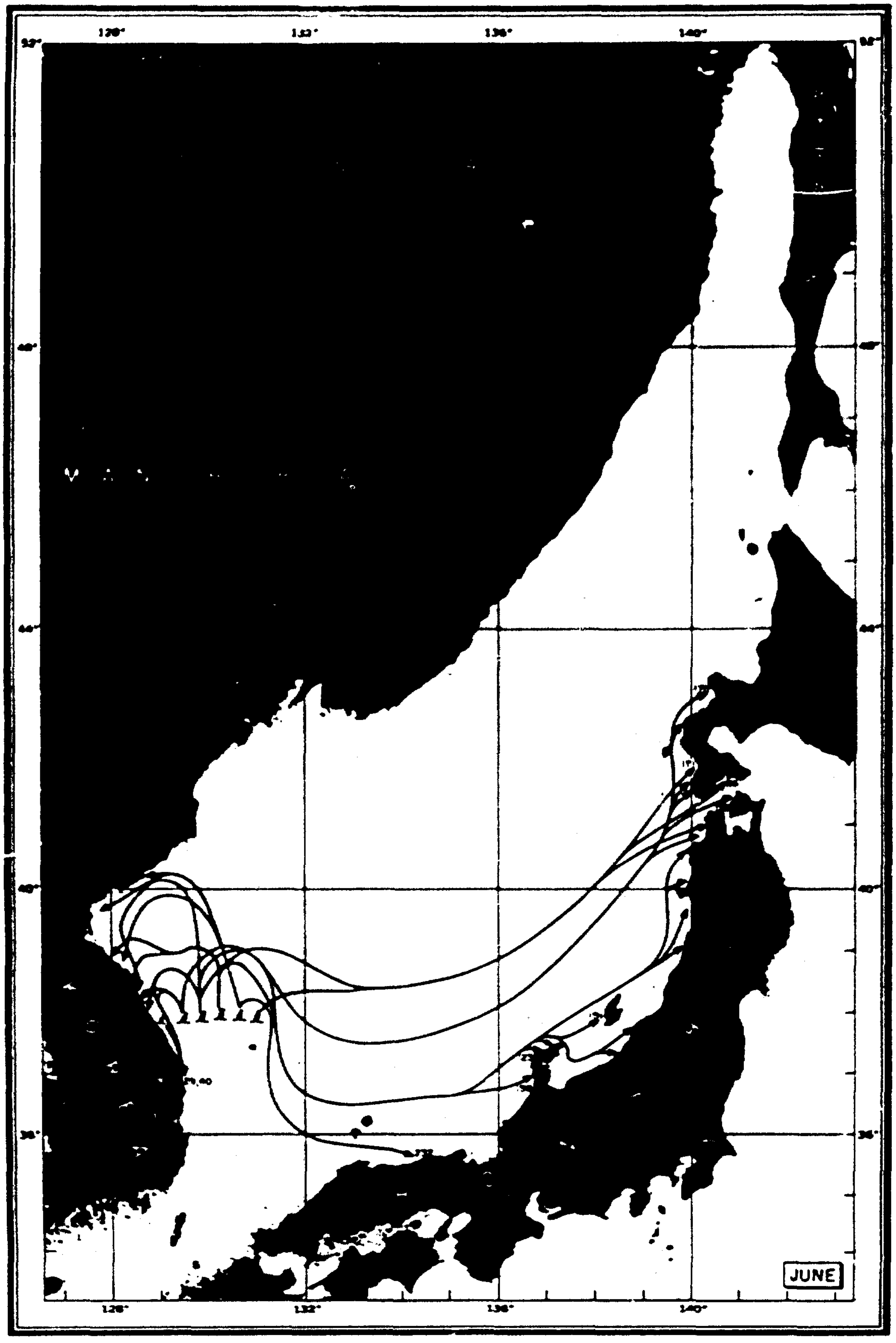
2

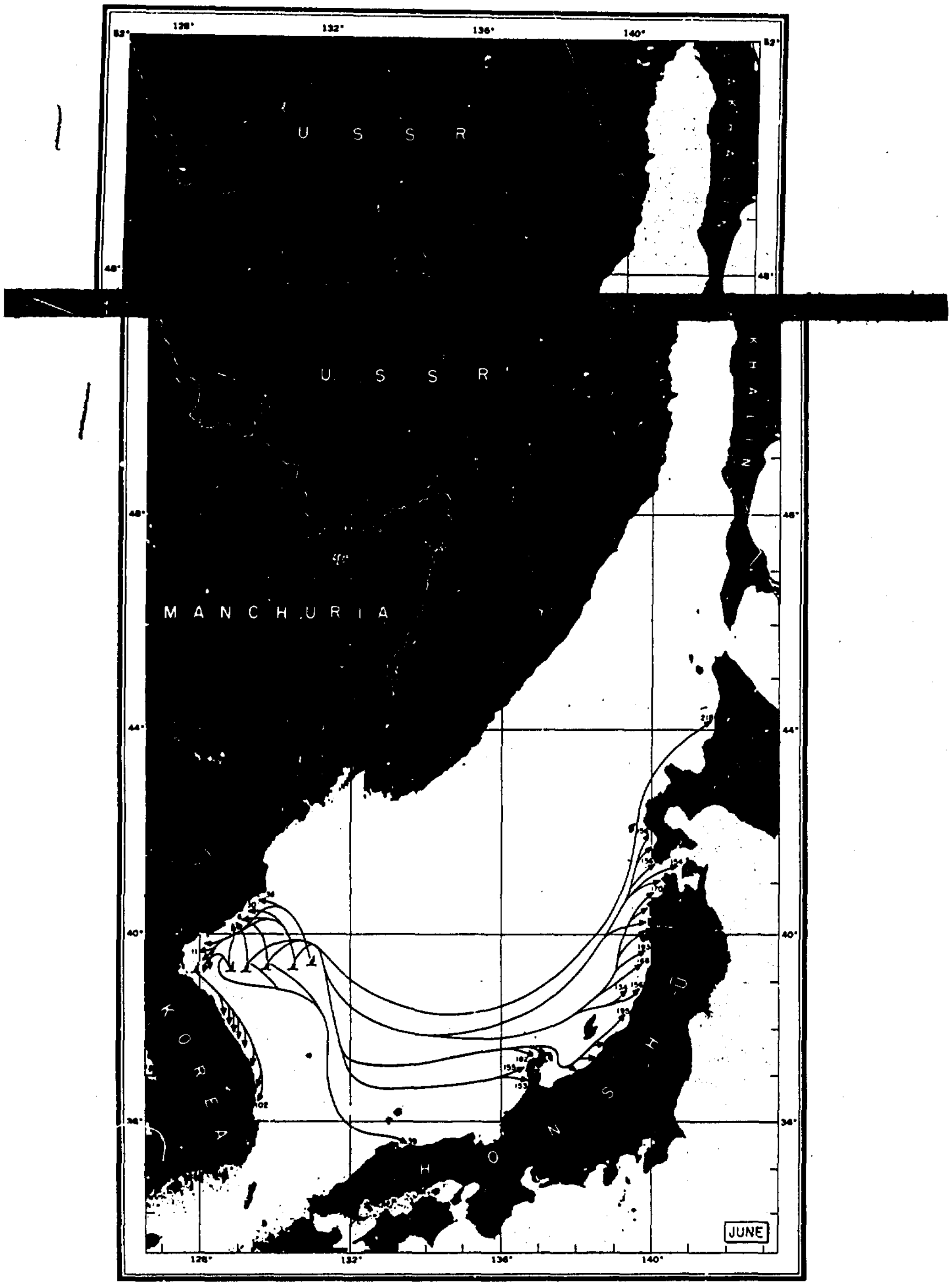



s conducted by the Japanese Hydrographic Office in which
overboard at various locations in the Sea of Japan. Each
ade of tin plate suspended at the end of a wire about 1 meter

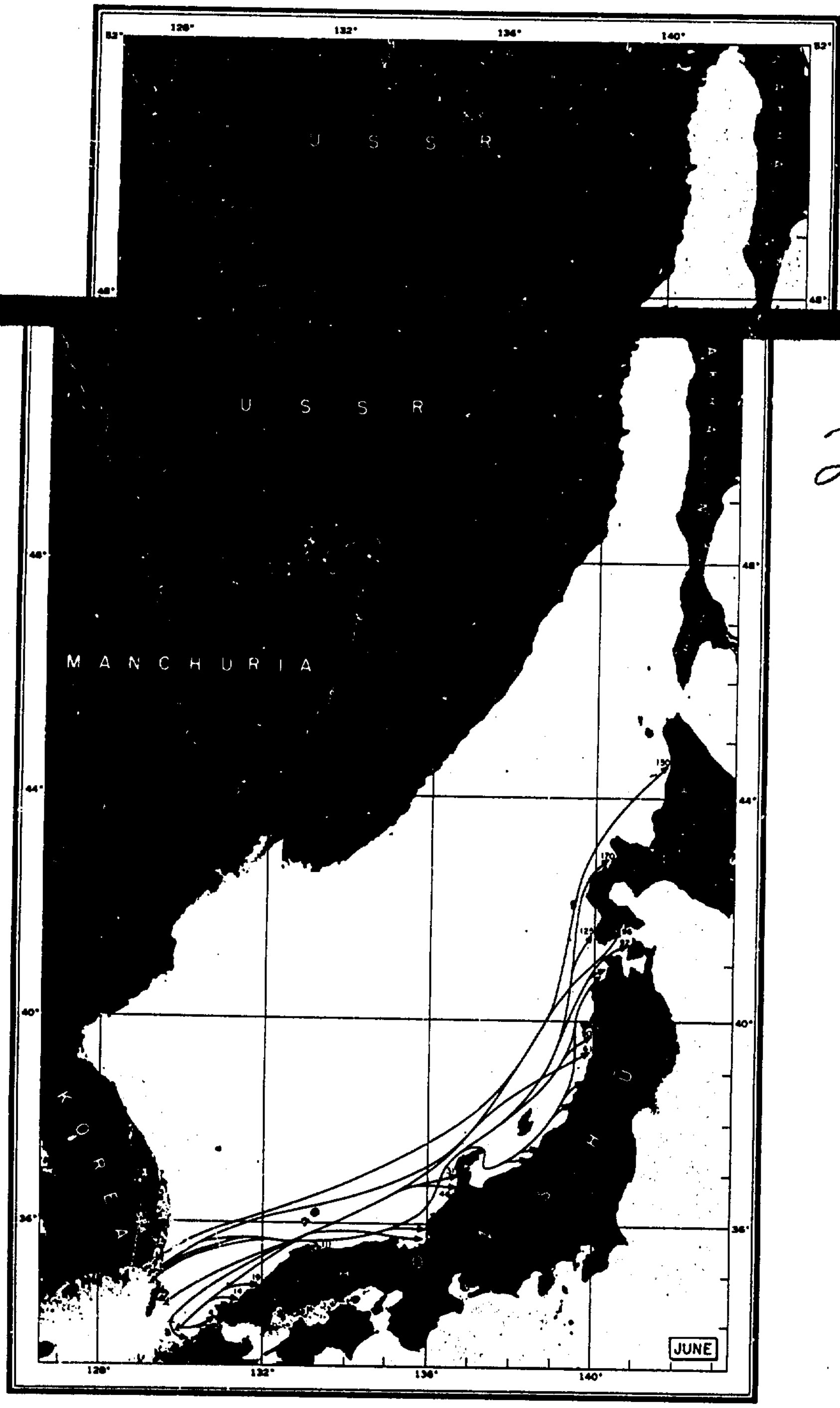
reatest quantity in regions where the current streamlines are
currents upon approaching the coast sink before it, thus
mlines; in regions where the bottles were captured by vertical
licated coast lines. Recovery of bottles was 34 percent suc-
sely proportional to the distance from land.


LEGEND
POINT OF SIMULTANEOUS RELEASE OF SEVERAL DRIFT BOTTLES.
POINT AT WHICH BOTTLE WAS RETRIEVED OR LEFT AREA COVERED BY CHART, AS WELL AS NUMBER OF DAYS ELAPSING BETWEEN DATES OF RELEASE AND RETRIEVAL.
128°
132°
136°
140°
JUNE


JUNE

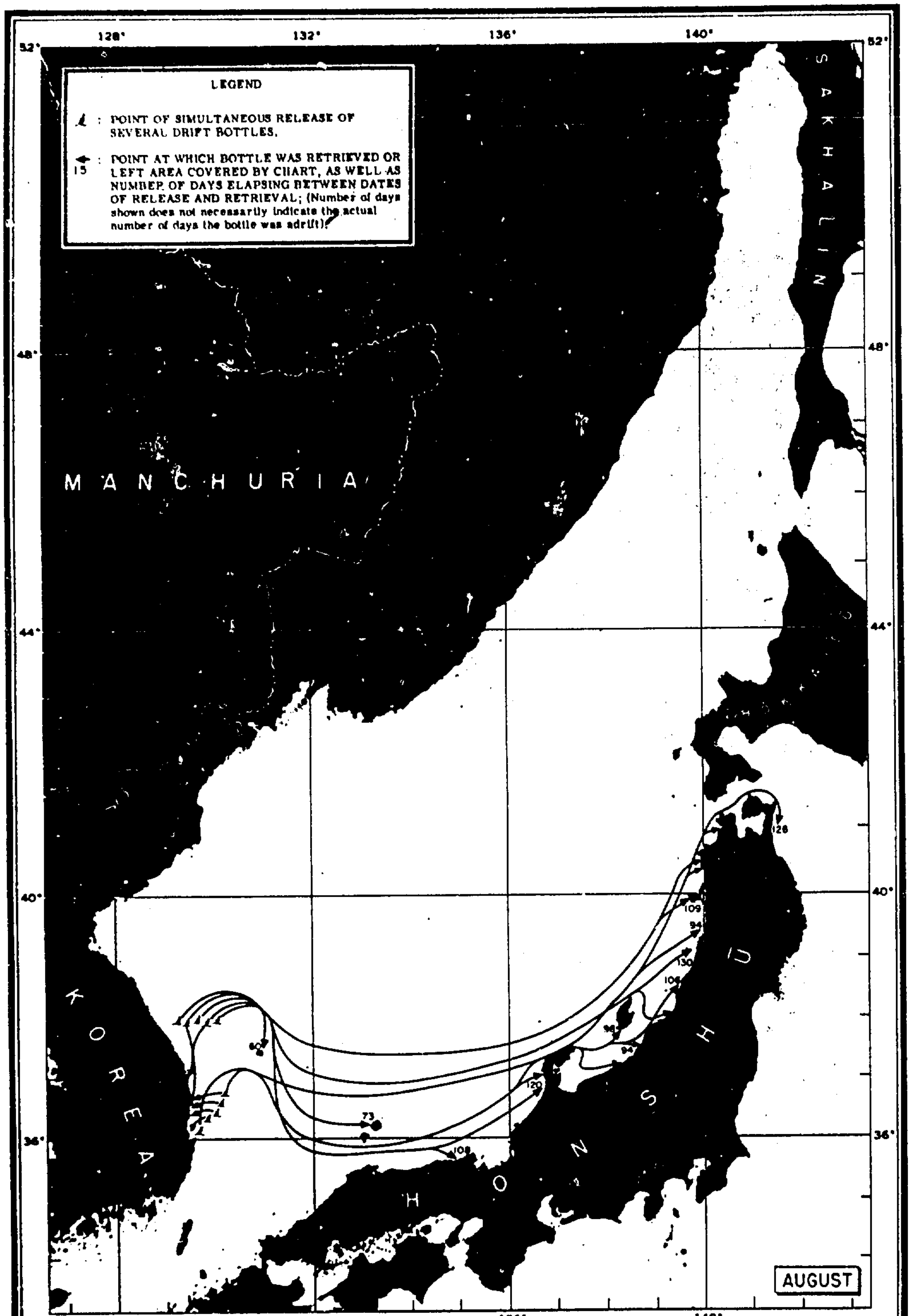


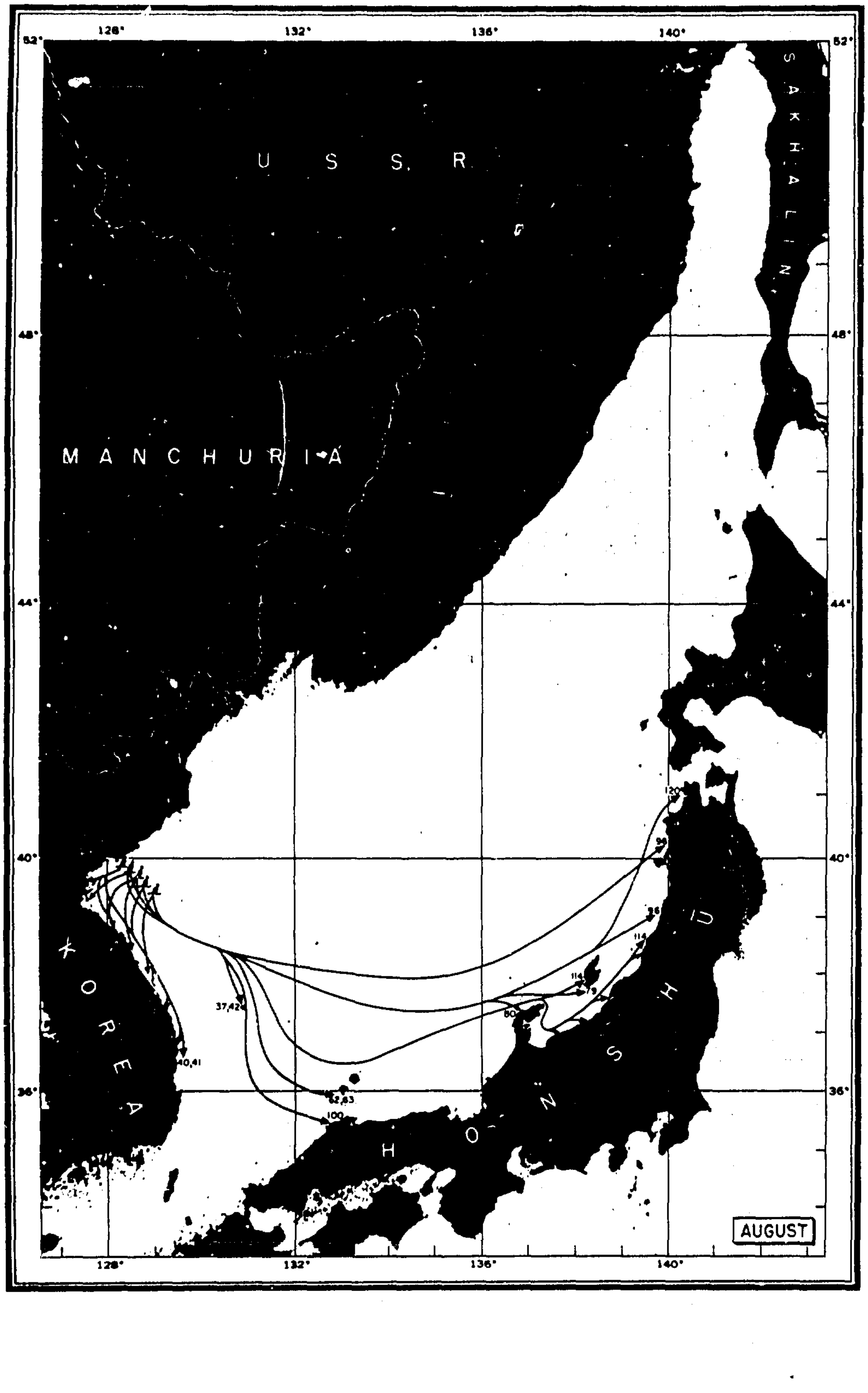

Most of the bottles that were thrown into the cold current system were picke
north and east coasts of Korea and on the south Siberian coast, while those th
warm current were recovered on the coasts of Japan proper, Hokkaido, and Kara
majority of the bottles thrown into the warm current in the southern part of the S
after drifting about, were found concentrated in the west entrance of Tsugaru K
remainder, after continuing on their northerly journey, divided at Soya Kaikyo i
branches, one entering Soya Kaikyo and flowing along the north coast of Hokka
drifting along the west coast of Karafuto. Since the drift currents in the Sea of
more or less, from west to east, any floating object, such as a mine, will follow
currents until they are caught in the northeasterly moving, warm Tsushima Curre
be borne in mind, however, that these drift currents are variable, their rate and
being influenced considerably by local circumstances. The rate, in particular,
creased considerably for short periods by a gale or typhoon.

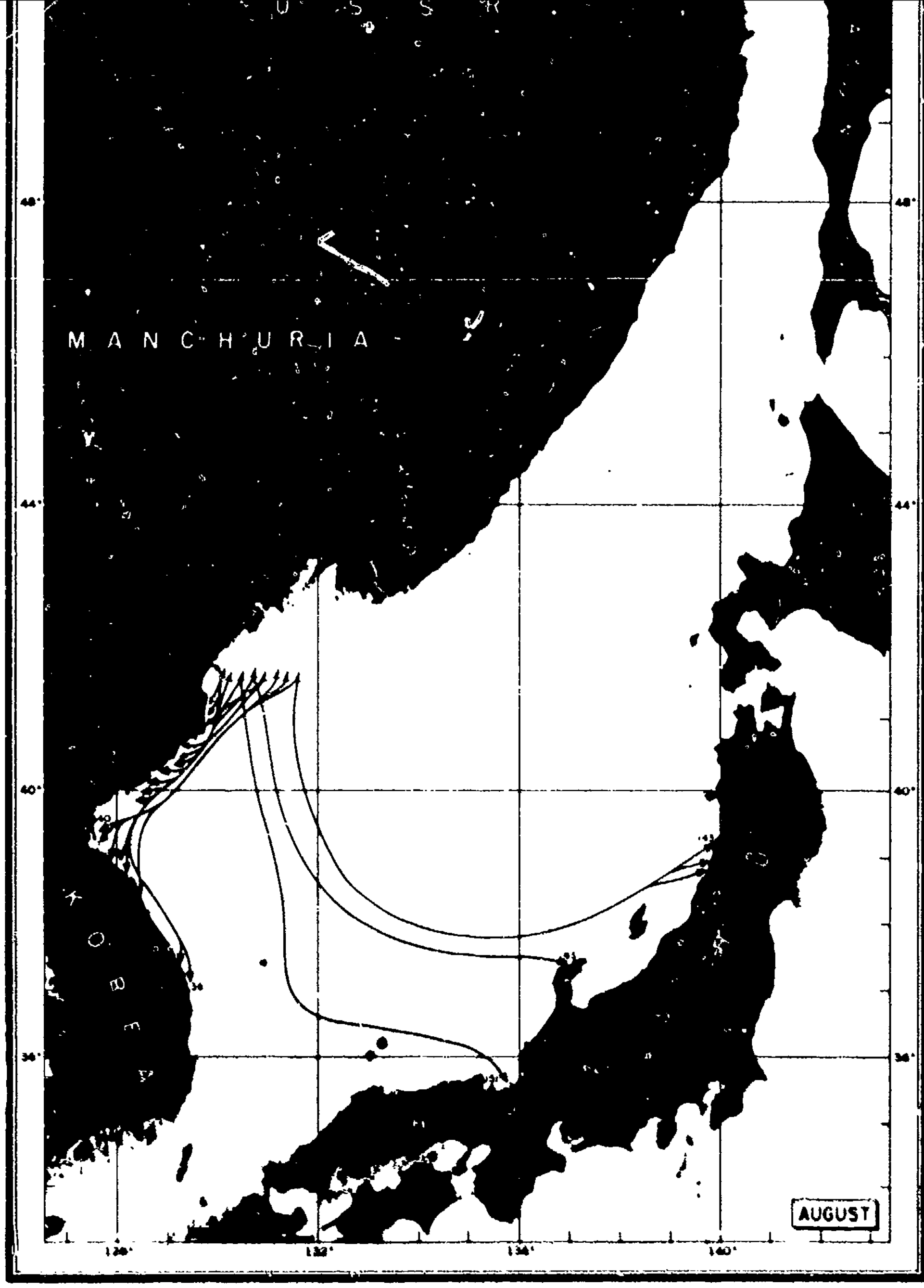



ıt were thrown into the cold current system were picked up on the Korea and on the south Siberian coast, while those thrown into the red on the coasts of Japan proper, Hokkaido, and Karafuto. The own into the warm current in the southern part of the Sea of Japan, found concentrated in the west entrance of Tsugaru Kaikyo. The g on their northerly journey, divided at Soya Kaikyo into two ya Kaikyo and flowing along the north coast of Hokkaido, the other ast of Karafuto. Since the drift currents in the Sea of Japan move, o east, any floating object, such as a mine, will follow these drift ught in the northeasterly moving, warm Tsushima Current. It should r, that these drift currents are variable, their rate and direction ably by local circumstances. The rate, in particular, may be inshort periods by a gale or typhoon.

# PROBABLE PATHS OF DRIFT BOTTLES—Continued




U. S. S. R.
MANCHURIA
SAKHALIN
KOREA
HONSHU
AUGUST





References:

Korea, Fishery Experimental Station, "Report on the Drift Bottle Experiment in the Neighboring Seas of Tyosen in 1932," Annual Report of Hydro Observations, No. 7, for the Year 1932, pp. 160-165, Husan, 1936.

Kubo, T., "On the Surface Drift Currents in the Yellow and Chinese Eastern Determined by Drift Bottles," Journal of Oceanography, Vol. 2, pp. 2 Imperial Marine Observatory, Kobe, (in Japanese).

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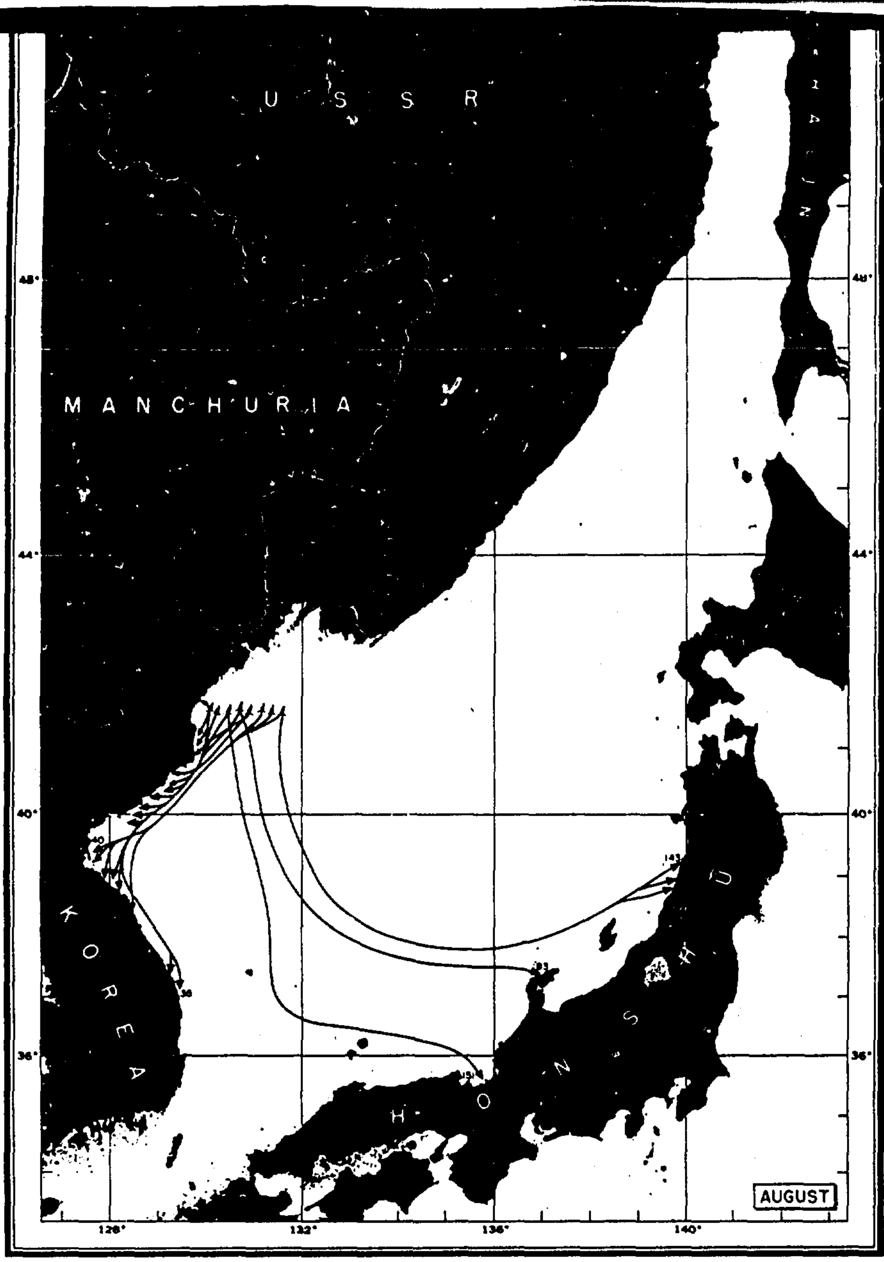


References:

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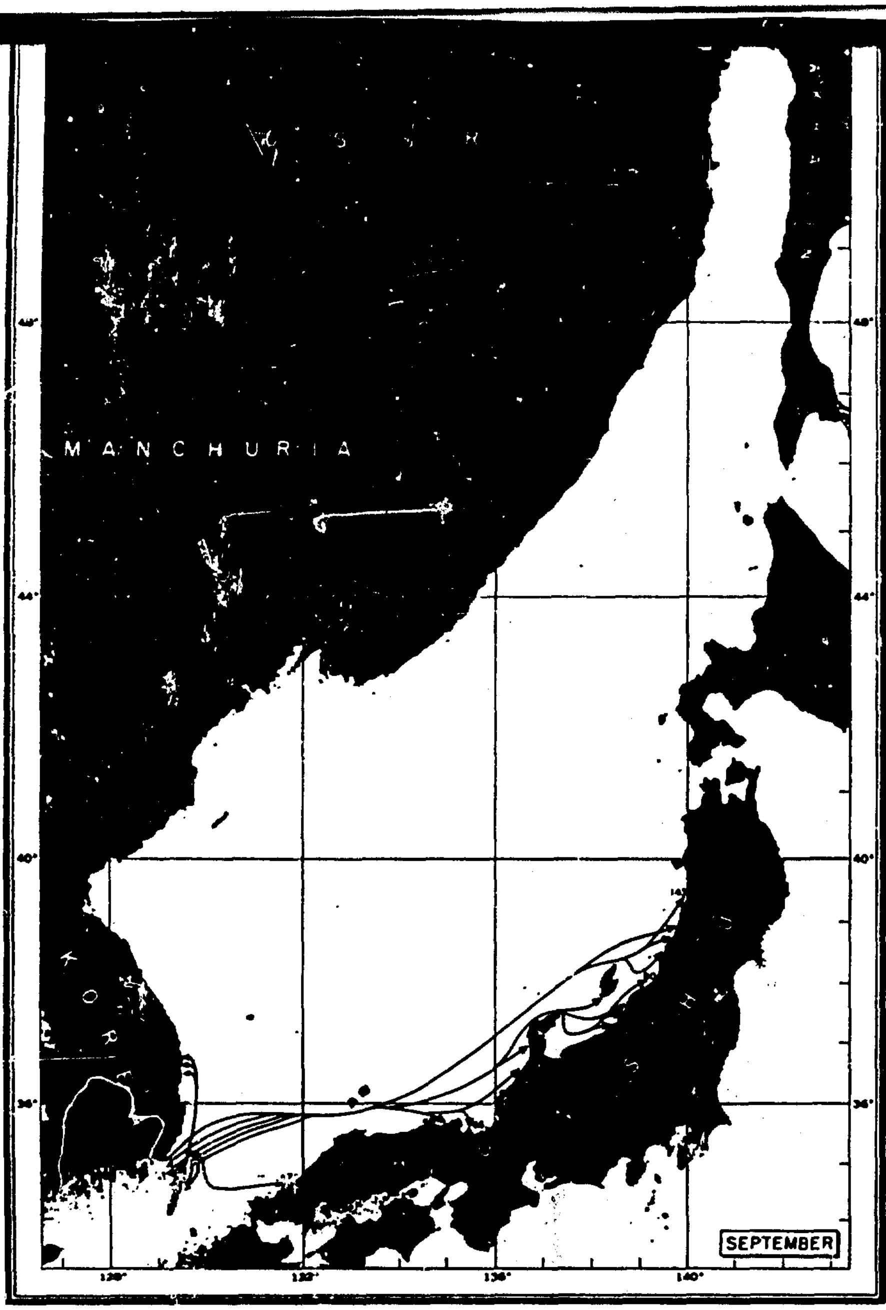
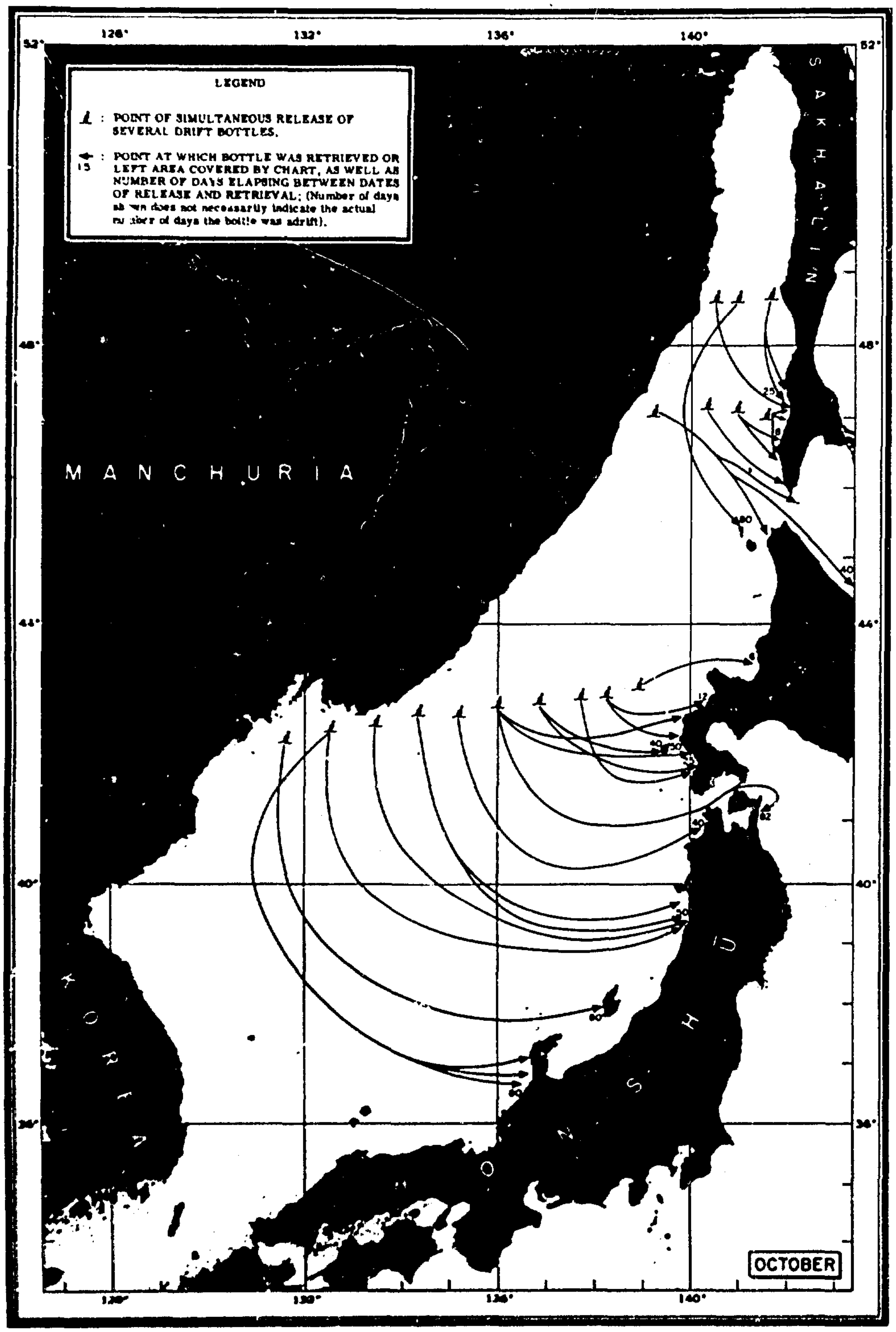
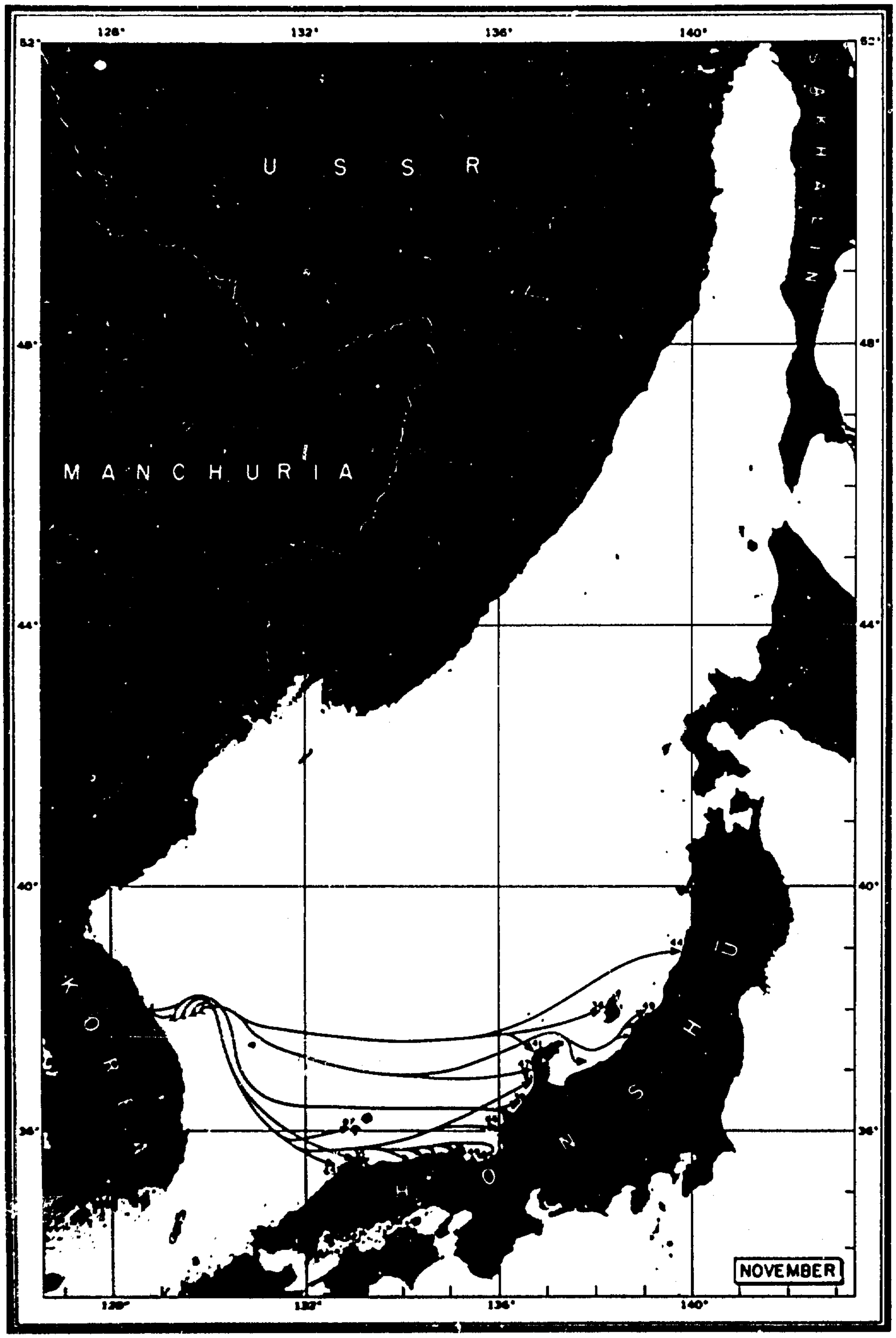



Station, "Report on the Drift Bottle Experiments Carried out
s of Tyosen in 1932," Annual Report of Hydrographical
r the Year 1932, pp. 160-165, Husan, 1936.

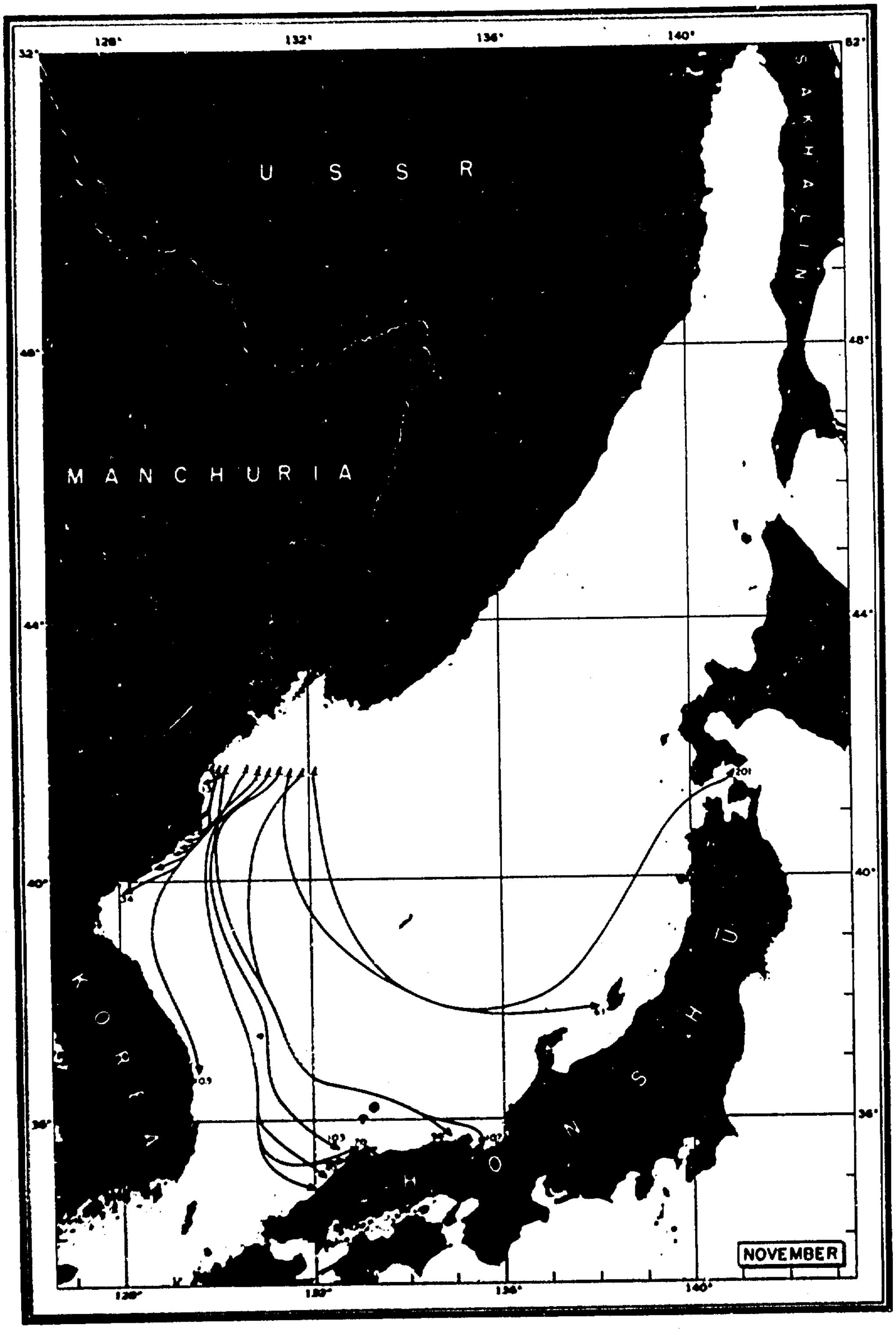
t Currents in the Yellow and Chinese Eastern Seas, as
ttles," Journal of Oceanography, Vol. 2, pp. 289-296, 1930,
atory, Kobe, (in Japanese).


LEGEND
POINT OF SIMULTANEOUS RELEASE OF SEVERAL DRIFT BOTTLES.
POINT AT WHICH BOTTLE WAS RETRIEVED OR LEFT AREA COVERED BY CHART, AS WELL AS NUMBER OF DAYS ELAPSING BETWEEN DATES OF RELEASE AND RETRIEVAL; (Number of days shown does not necessarily indicate the actual number of days the bottle was adrift).
MANCHURIA
SAKHALIN
KOREA
HONSHU
OCTOBER



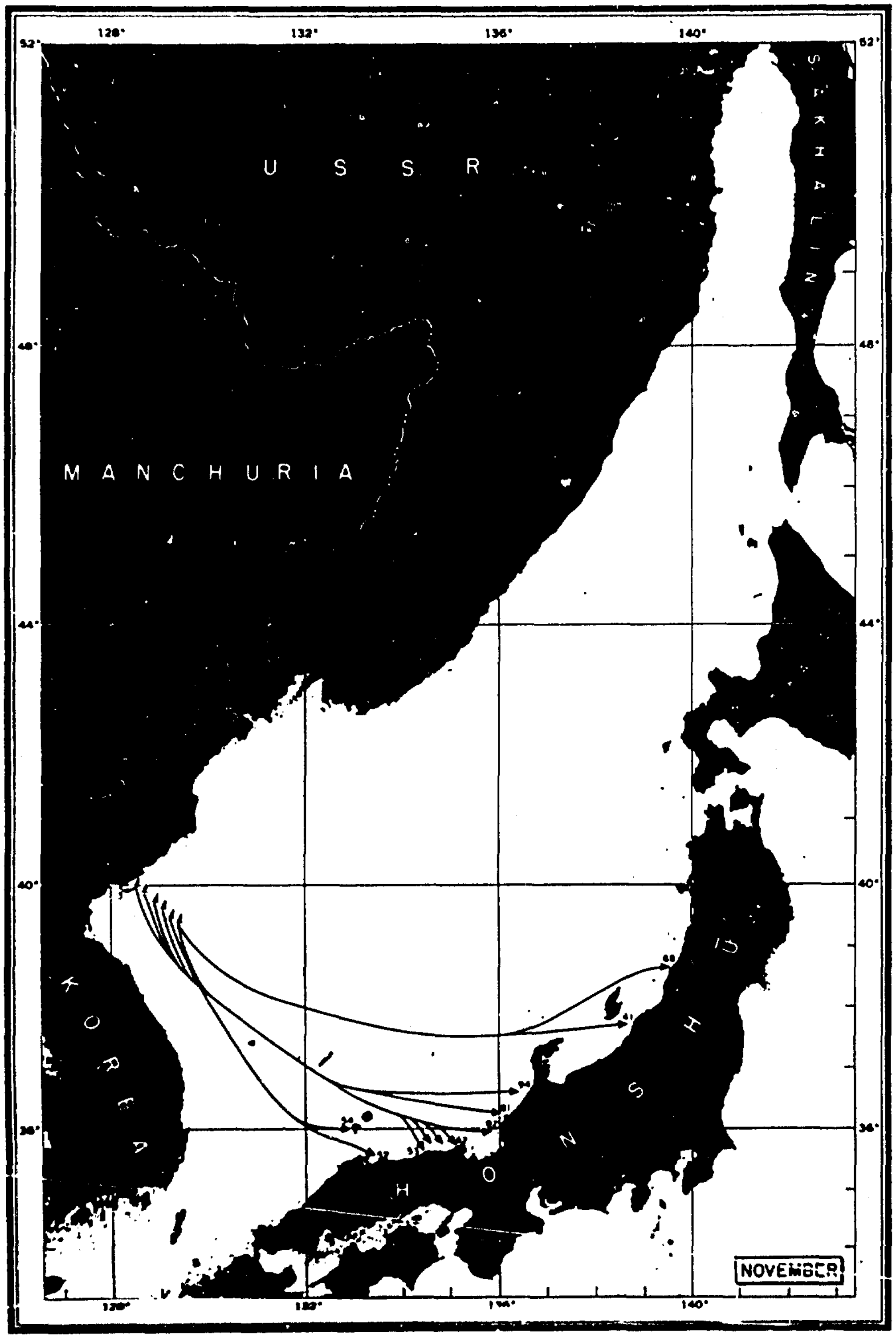
128°
132°
136°
140°
52°
48°
44°
40°
36°
U S S R
MANCHURIA
SAKHALIN
KOREA
HONSHU
NOVEMBER

|


128°
132°
136°
140°
52°
48°
44°
40°
36°
U S S R
SAKHALIN
MANCHURIA
KOREA
HONSHU
NOVEMBER

3

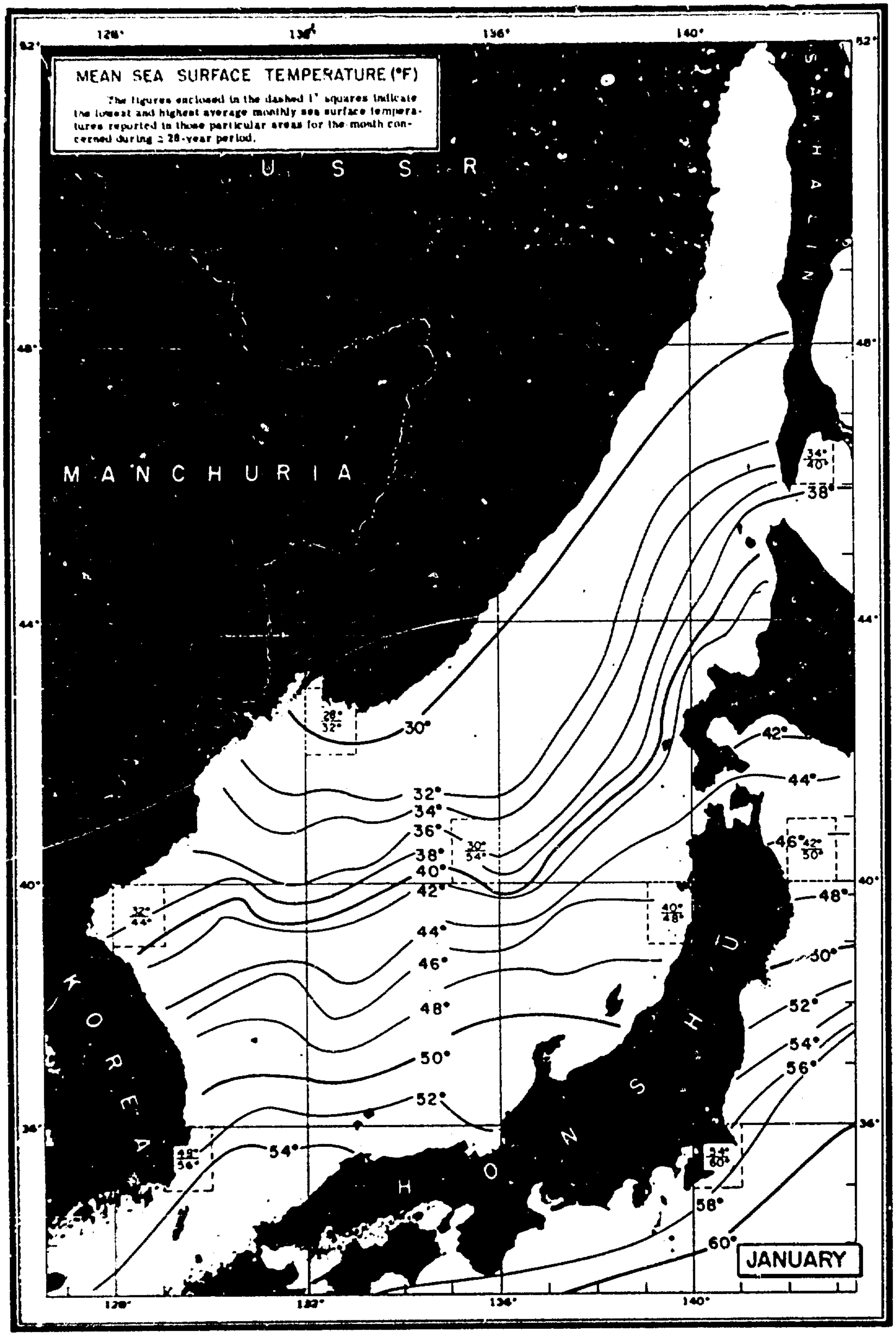
2

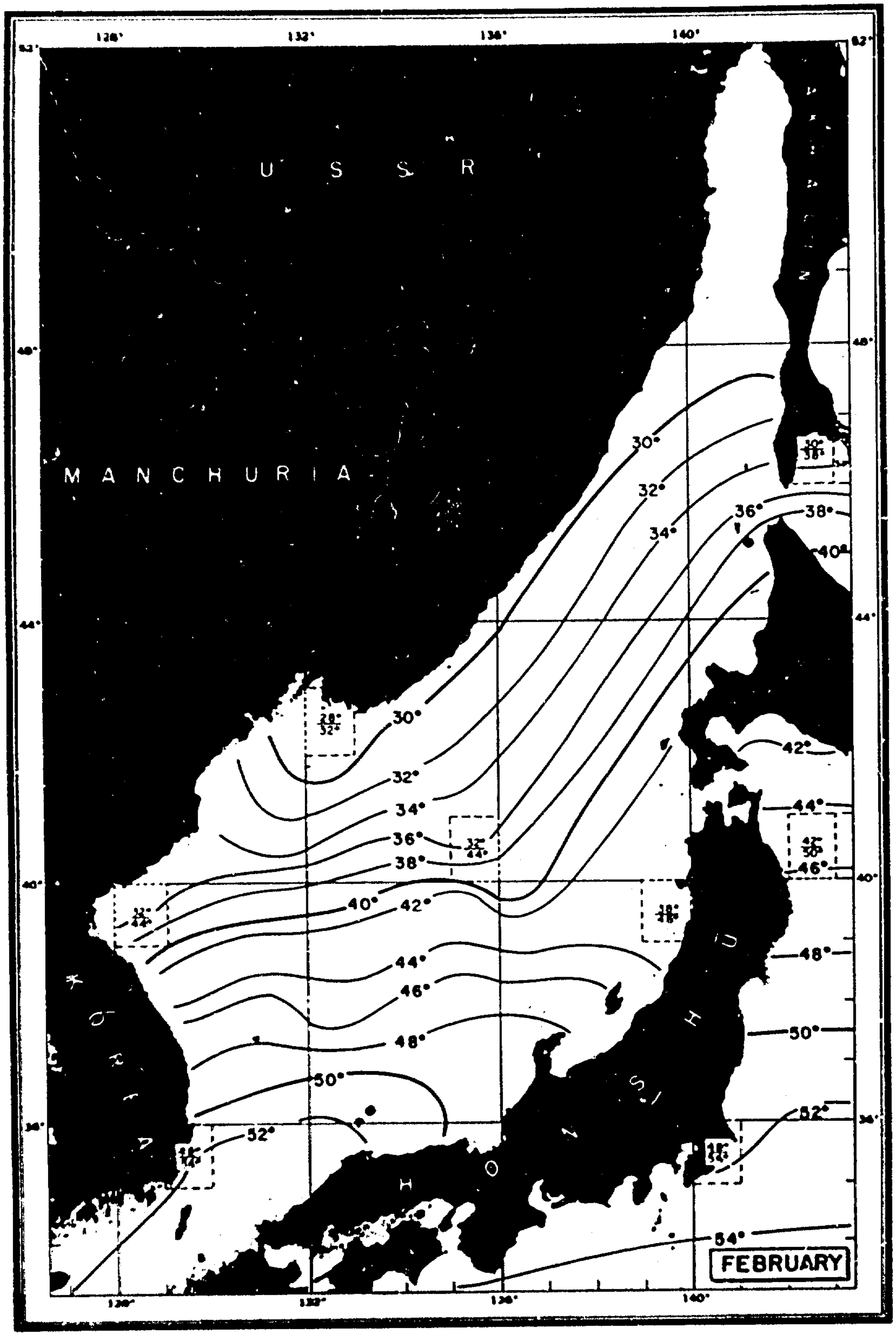




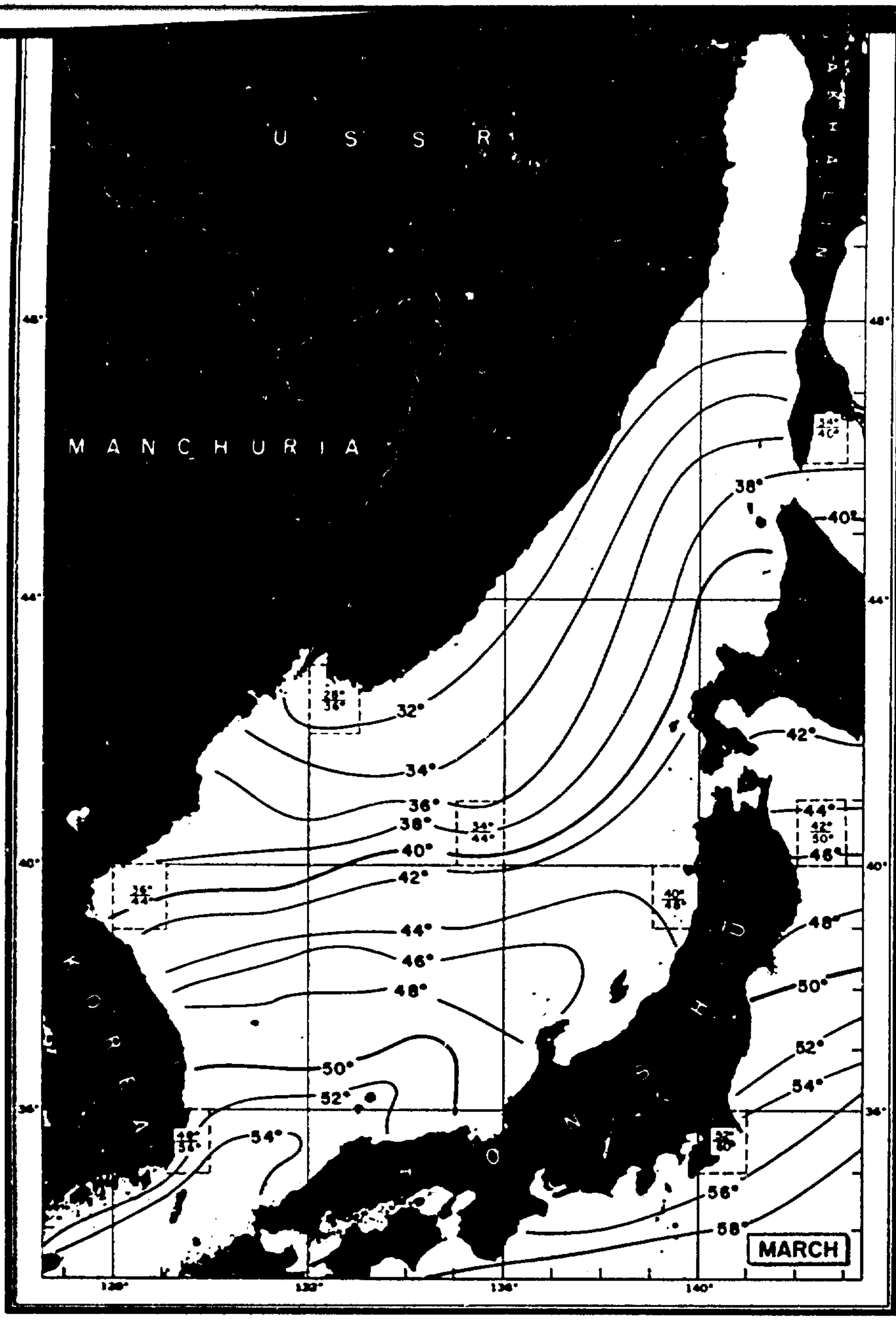

RESTRICTED

# SEA SURFACE TEMPERATURE



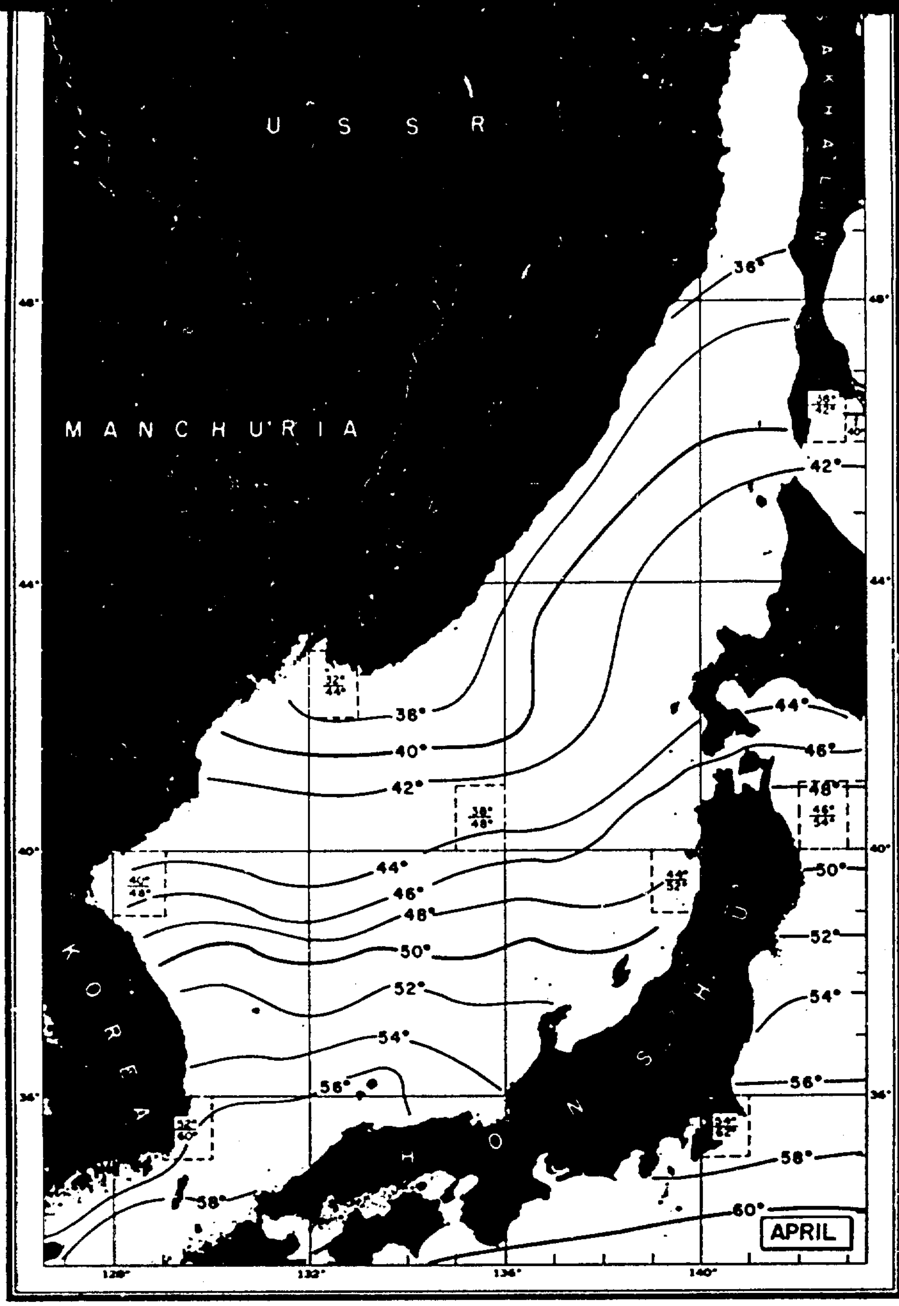


U S S R
MANCHURIA
KOREA
HONSHU
30°
32°
34°
36°
38°
40°
42°
44°
46°
48°
50°
52°
54°
128°
132°
136°
140°
52°
48°
44°
40°
36°
FEBRUARY




From the accompanying charts it can be seen that February has the lowest
the highest temperatures in the Sea of Japan. For the most part, these temper
dependent on the major current systems in the area which transport warm or co
winter, the surface water of the Kuroshio has a temperature of about 75°F. in i
abreast of Formosa which decreases gradually as it moves northward until in i
at about latitude 35°N. the temperature falls to about 53°F.

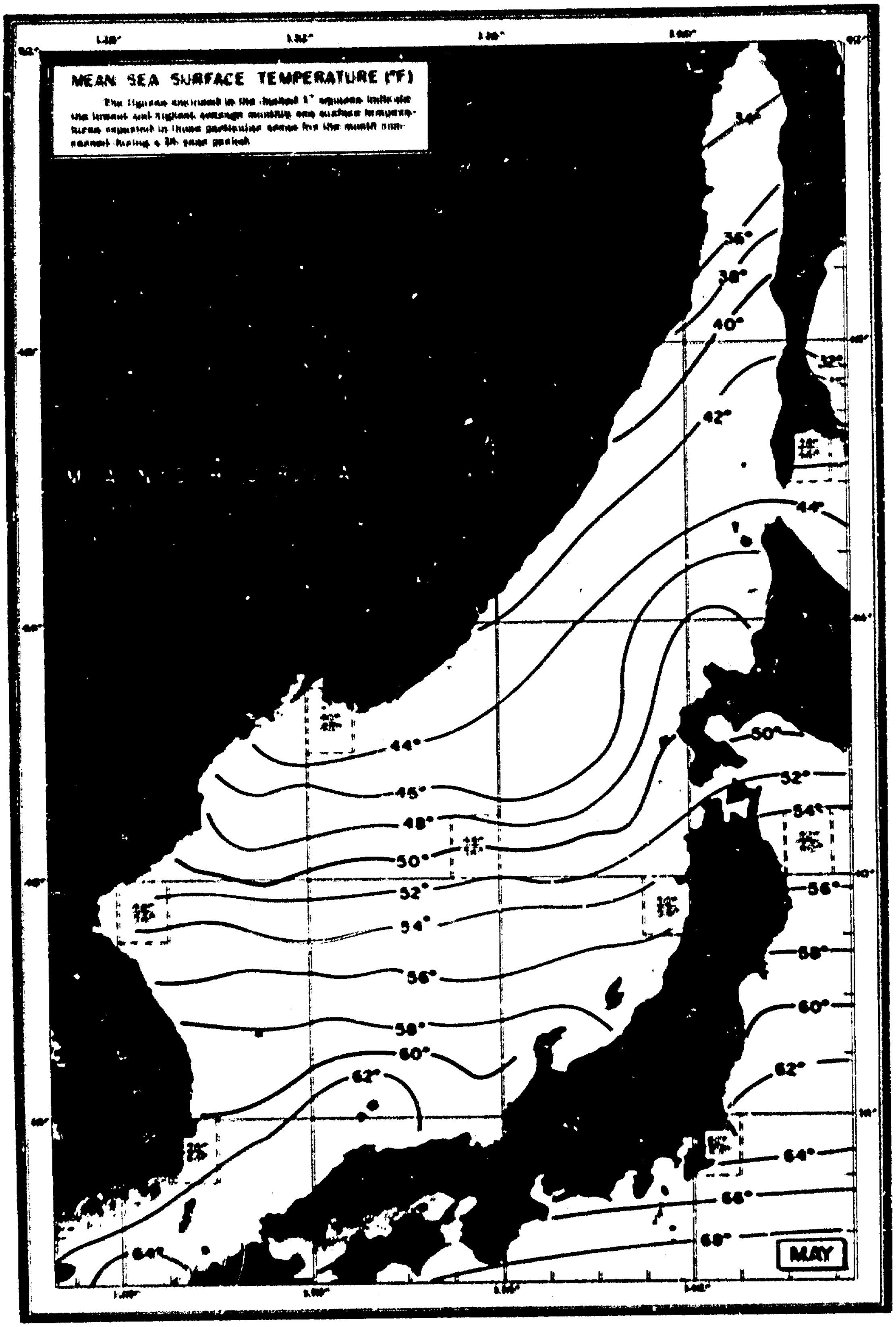
The waters of the eastern part of the Sea of Japan are usually warmer than
western part, due to the effect of the Tsushima Current, a branch of the Kurosh
water of high temperature into the eastern part of the sea to as far north as Ho
along the west coast of Sakhalin. The Liman Current flowing southward from
Okhotsk through Tatar Strait and along the eastern coast of the U.S.S.R. is fel
latitude 41°N. However, it is not believed that the cold water along the weste
Sea of Japan comes entirely from the Sea of Okhotsk through the narrow Tatar
must have been formed in the Sea of Japan by excessive cooling in winter. Th
therefore found to run obliquely from southwest to northeast and to have a grea
toward the north in the eastern half of the sea.



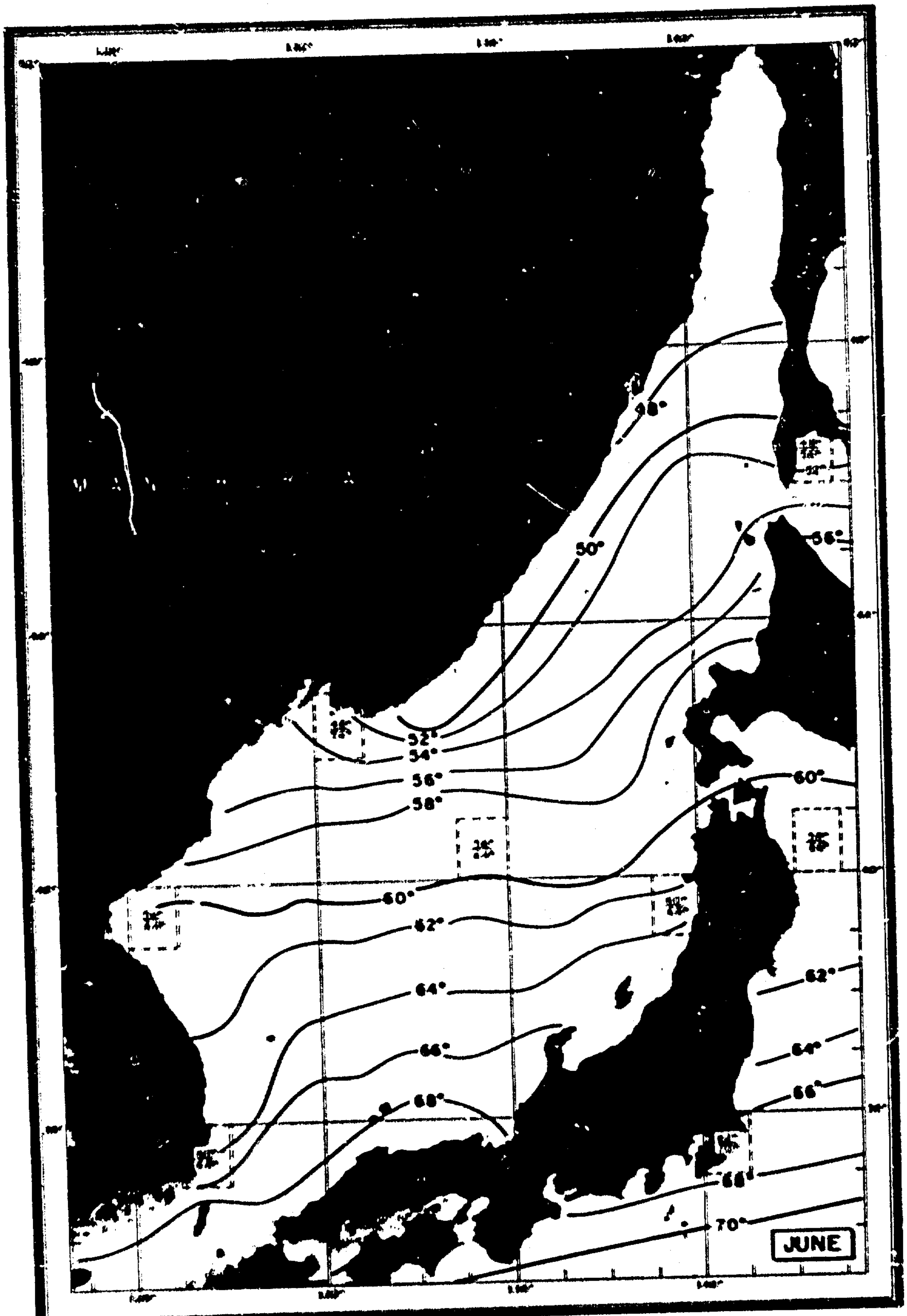

; it can be seen that February has the lowest and August
ea of Japan. For the most part, these temperatures are
stems in the area which transport warm or cold water. In
uroshio has a temperature of about 75°F. in its lower reaches
ses gradually as it moves northward until in its upper reaches
rature falls to about 53°F.

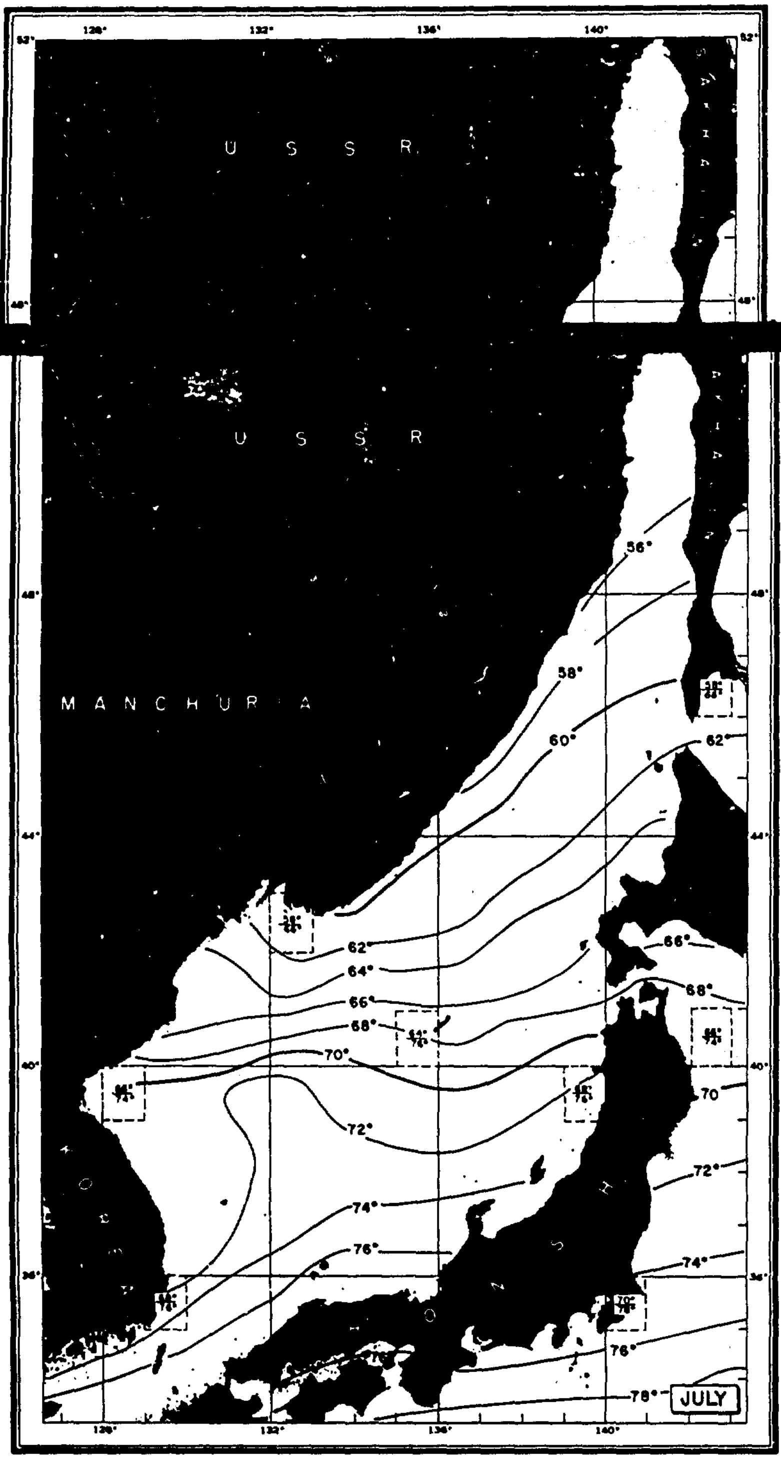
of the Sea of Japan are usually warmer than those of the
the Tsushima Current, a branch of the Kuroshio, which brings
eastern part of the sea to as far north as Hokkaido and even
The Liman Current flowing southward from the Sea of
along the eastern coast of the U.S.S.R. is felt as far south as
believed that the cold water along the western side of the
the Sea of Okhotsk through the narrow Tatar Strait but instead
of Japan by excessive cooling in winter. The isotherms are
rom southwest to northeast and to have a greater inclination
lf of the sea.

RESTRICTED



MEAN SEA SURFACE TEMPERATURE (°F)
34°
36°
38°
40°
42°
44°
44°
46°
48°
50°
50°
52°
52°
54°
54°
56°
56°
58°
58°
60°
60°
62°
62°
64°
64°
66°
68°
MAY

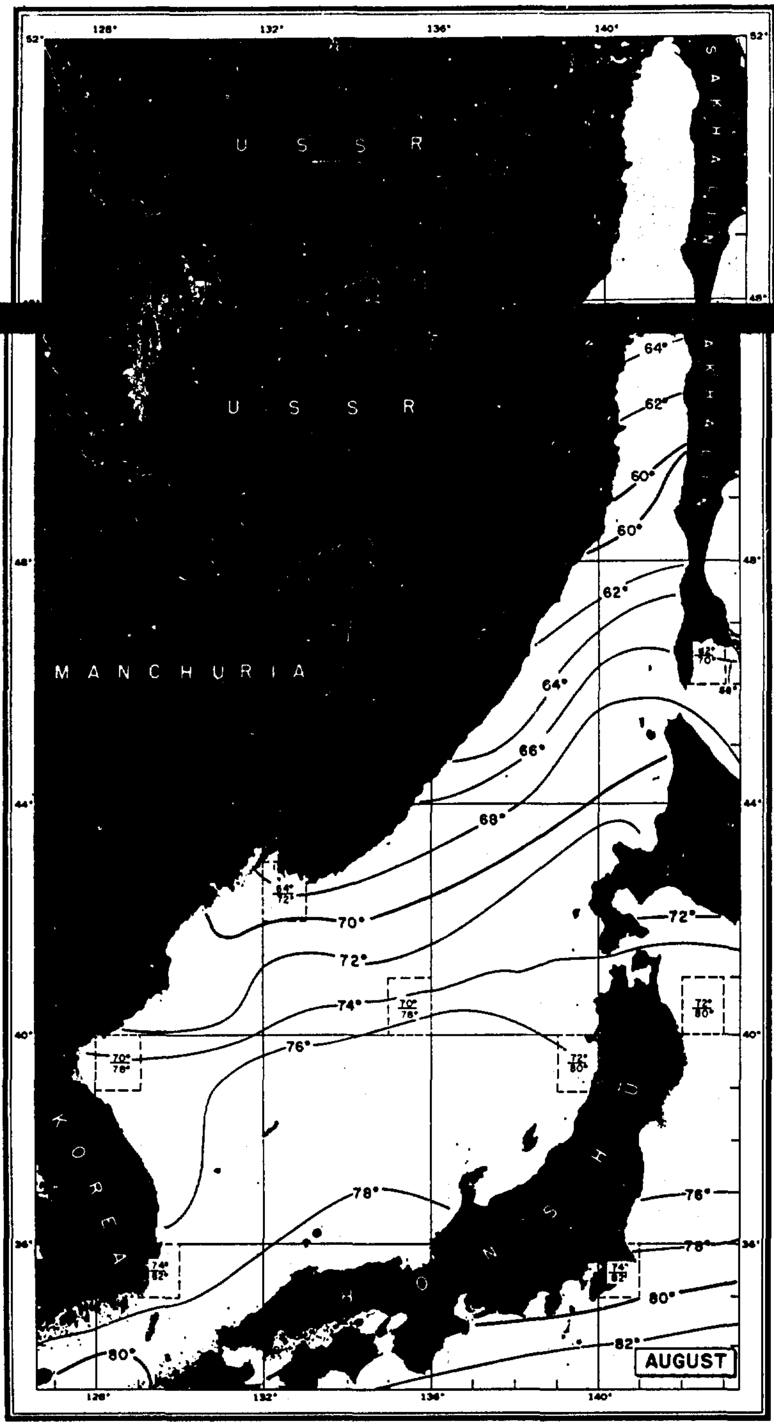

48°
50°
52°
54°
56°
58°
60°
62°
64°
66°
68°
70°
JUNE




The Oyashio flowing southward from the Sea of Okhotsk brings cold water to th of Honshu, its effect being felt as far south as latitude 36°N., where it dilutes the the Kuroshio.

In the early summer months, the coastal waters, especially in the vicinity of ri are usually colder due to the melting of snow and ice in the rivers. In the Gulf of water is likewise present at times as a result of excessive cooling in winter when moving continental polar air masses produce lower temperatures over the area.

In the winter months, the warming effect of the Tsushima water is more noticea result of greater cooling in the western portion of the Sea of Japan. Comparison o sea surface isotherms during the winter shows that they are similar in orientation, confirming the fact that cool air masses prevalent over the northern and western p the Japan Sea are cooling down the Tsushima water. Also, the waters off the wes Honshu are colder than those off the east coast at corresponding latitudes during t months.

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s as a result of excessive cooling in winter when seaward
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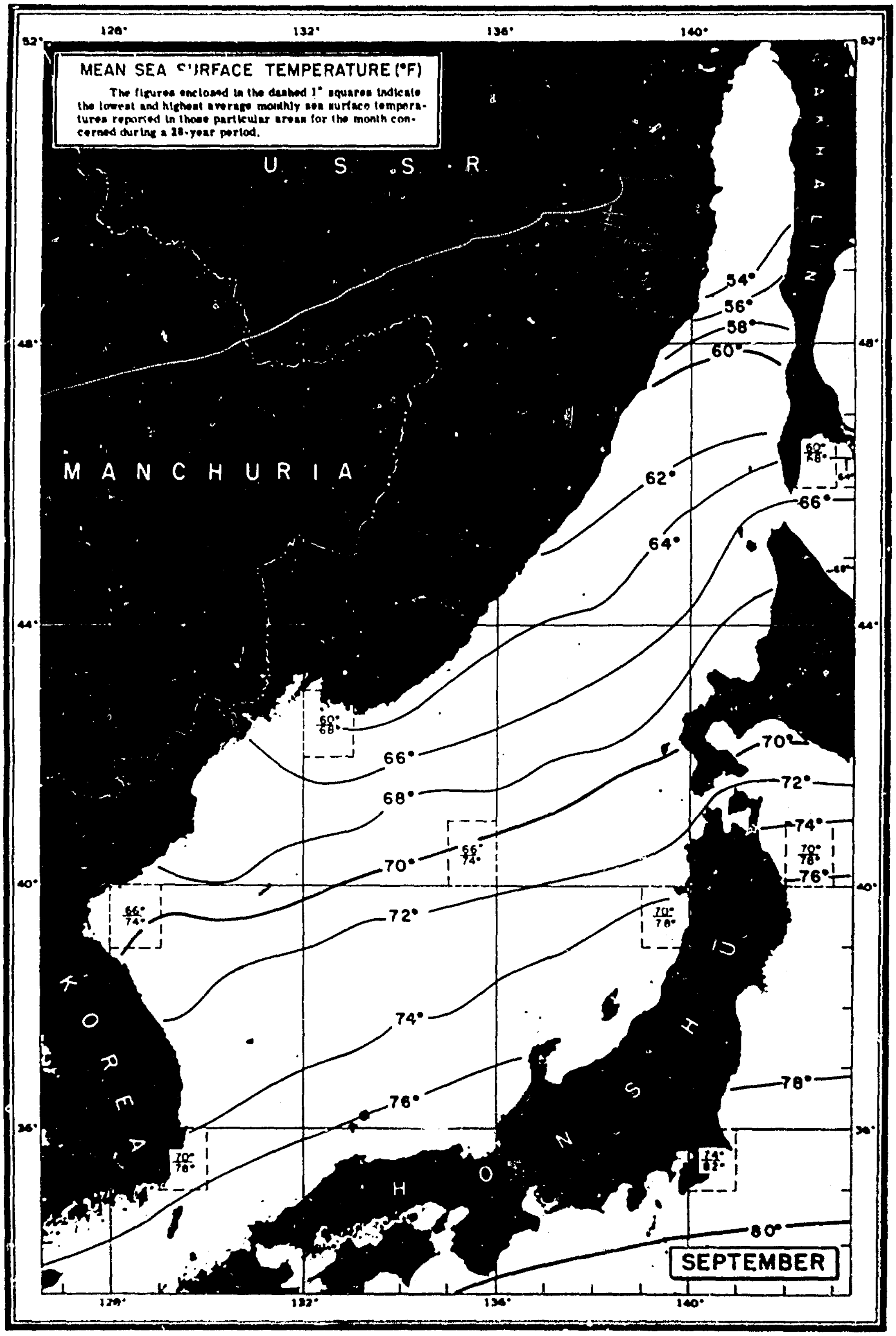
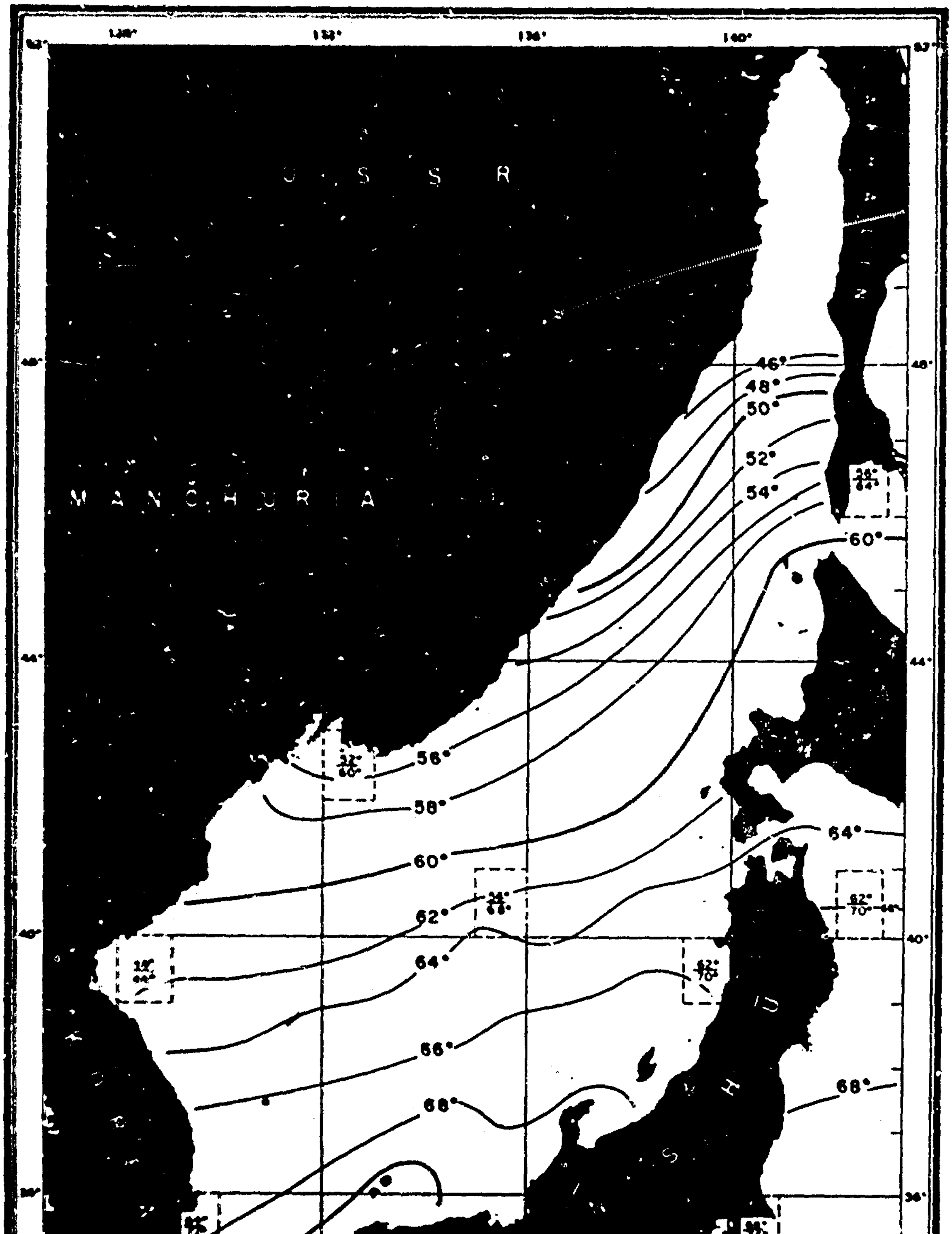
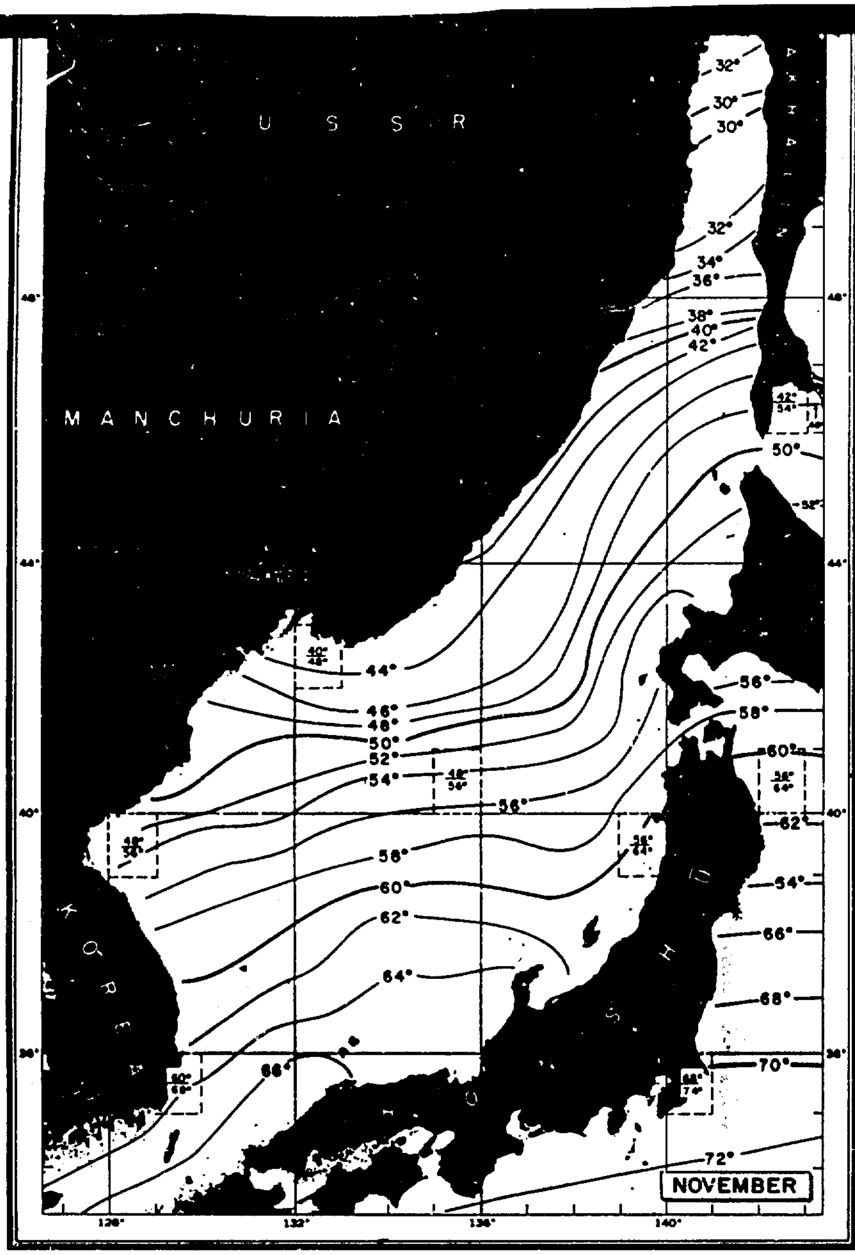
estern portion of the Sea of Japan. Comparison of air and
winter shows that they are similar in orientation, further
masses prevalent over the northern and western portions of
he Tsushima water. Also, the waters off the west coast of
the east coast at corresponding latitudes during the winter


MEAN SEA SURFACE TEMPERATURE (°F)
The figures enclosed in the dashed 1° squares indicate the lowest and highest average monthly sea surface temperatures reported in those particular areas for the month concerned during a 28-year period.
U. S. S. R.
MANCHURIA
KOREA
HONSHU
SAKHALIN
54°
56°
58°
60°
62°
64°
66°
68°
70°
72°
74°
76°
78°
80°
SEPTEMBER
128°
132°
136°
140°
52°
48°
44°
40°
36°

RESTRICTED



U S S R
M A N C H U R I A
128°
132°
136°
140°
48°
44°
40°
36°
46°
48°
50°
52°
54°
60°
56°
58°
60°
62°
64°
66°
68°
70°
72°
64°
68°
70°
OCTOBER

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Temperature of the North Pacific Ocean and the Neighboring Seas for the Y
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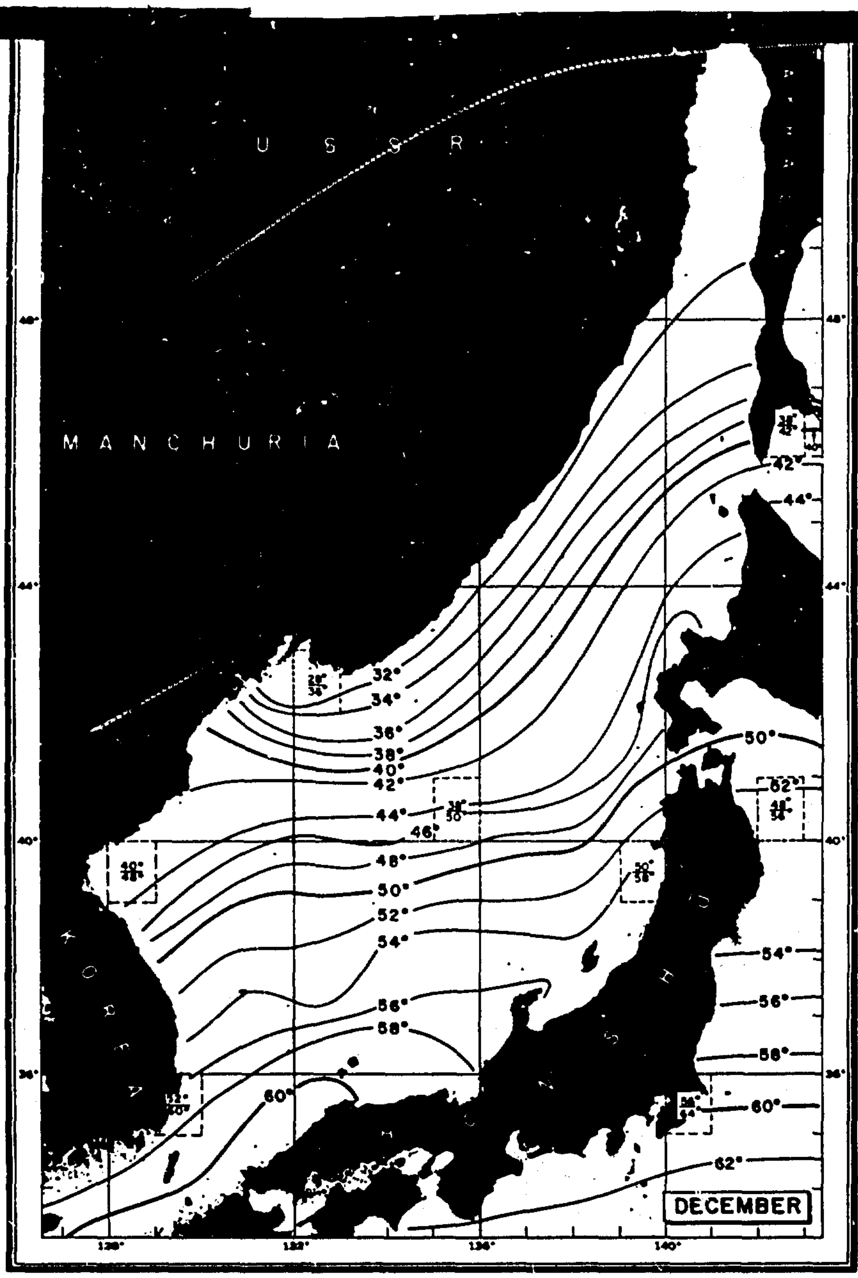


t, "The Japan Sea," Oceanographic Memoirs (Kaizo Iho), Tokyo, (in Japanese).

Research Division, "Oceanographical Charts," Nos. 331-343, Ministry of Agriculture and Forestry, Tokyo, February 1950

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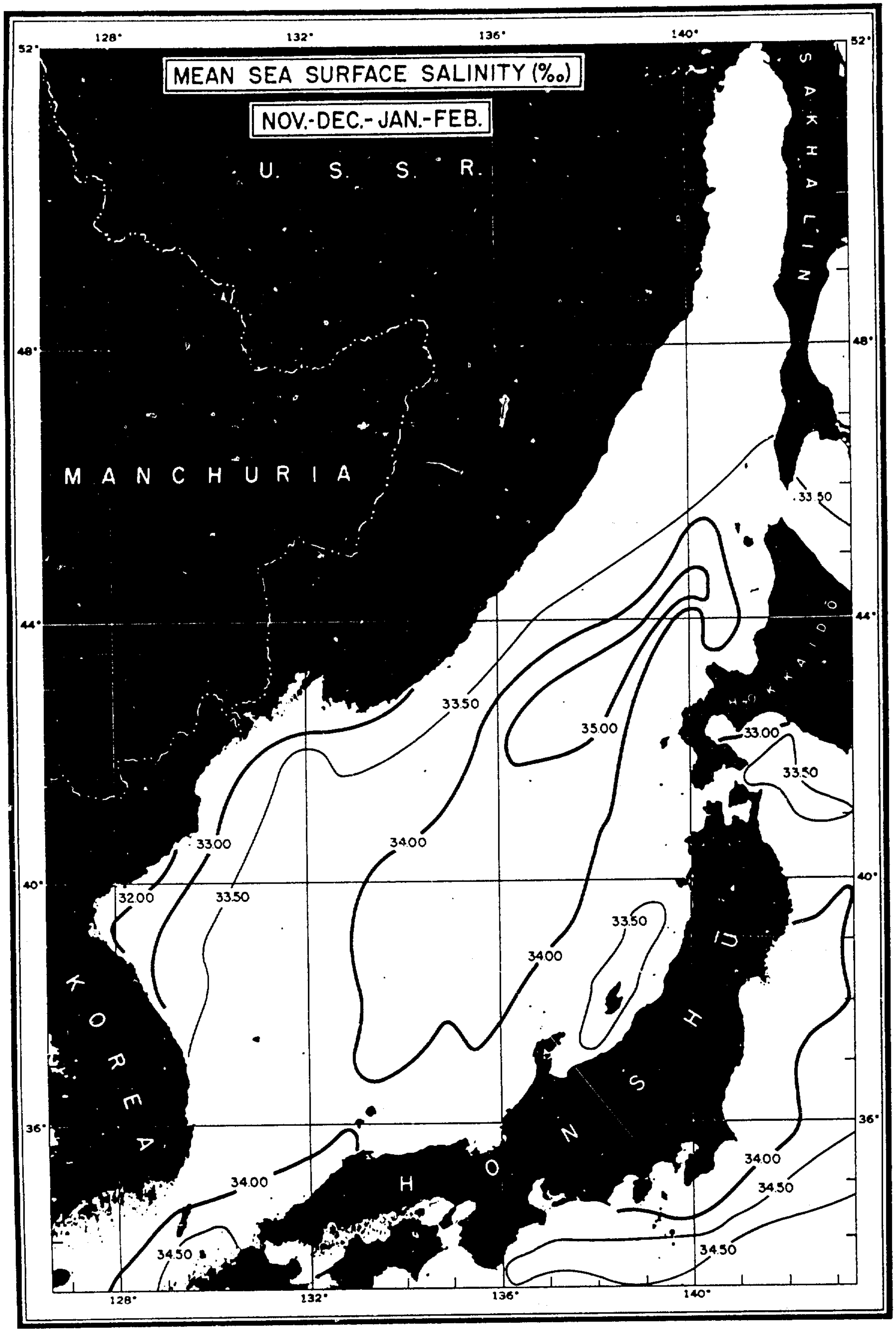
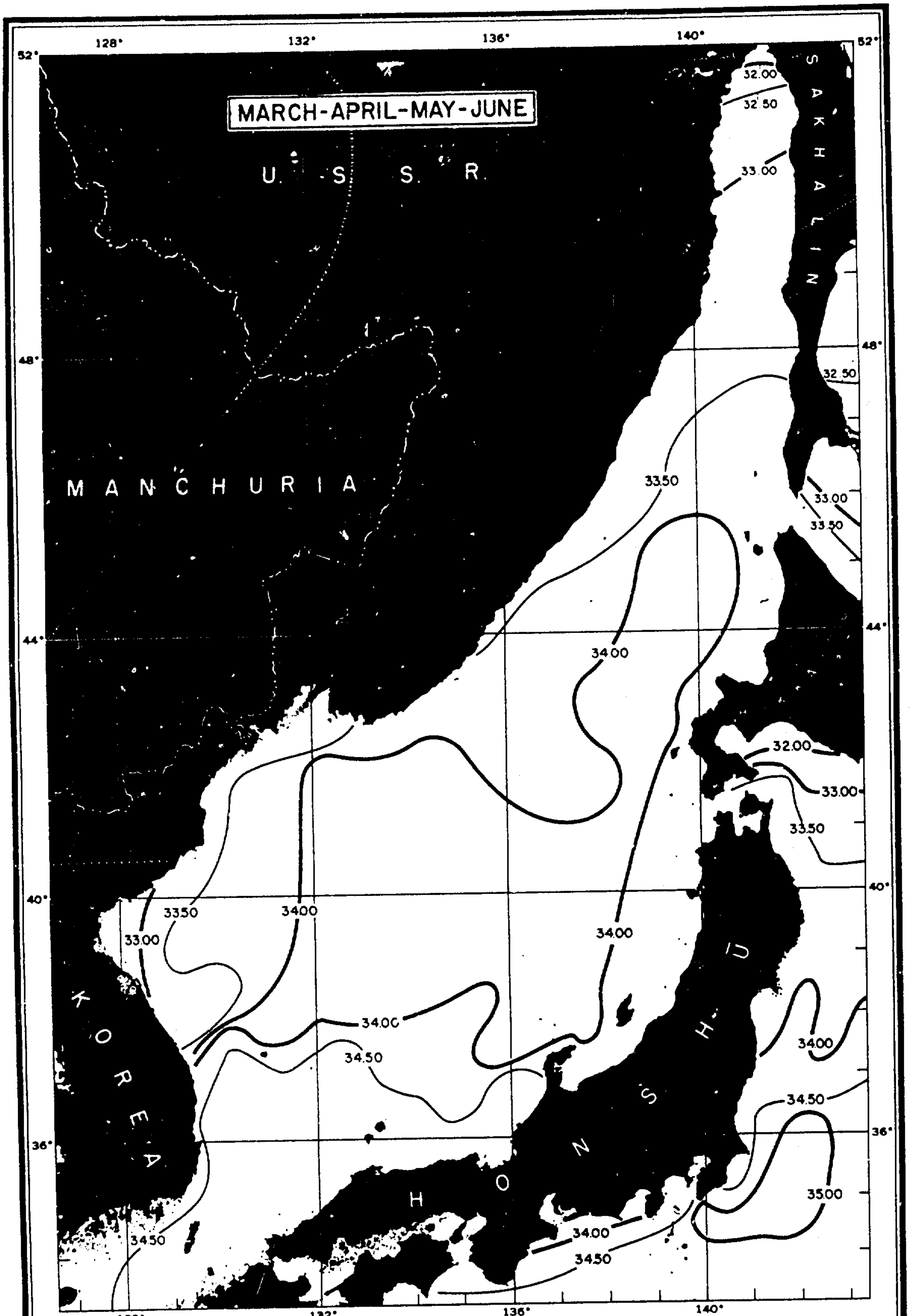
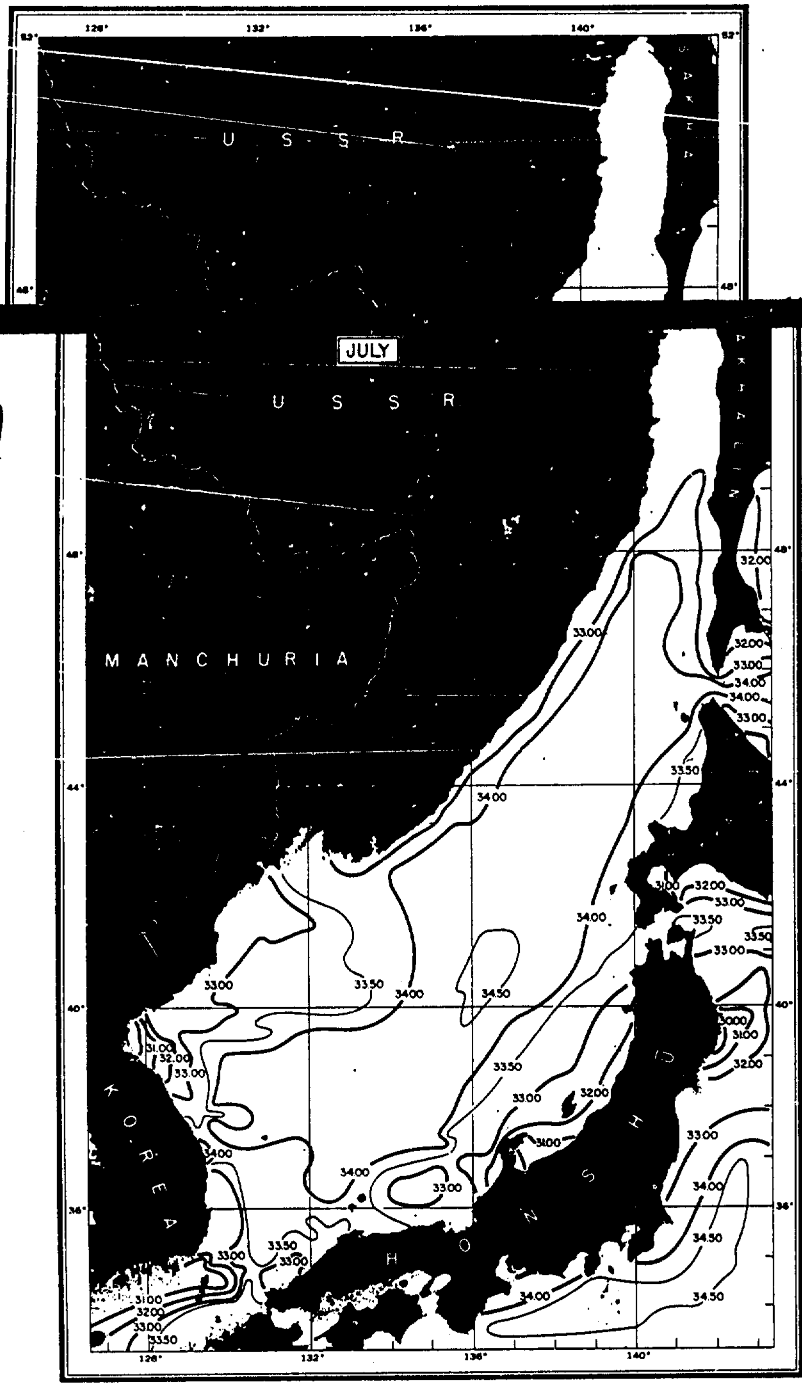


MEAN SEA SURFACE SALINITY (‰)
NOV.-DEC.-JAN.-FEB.
U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
128°
132°
136°
140°
52°
48°
44°
40°
36°
33.50
33.00
35.00
34.00
32.00
34.50

# SEA SURFACE SALINITY

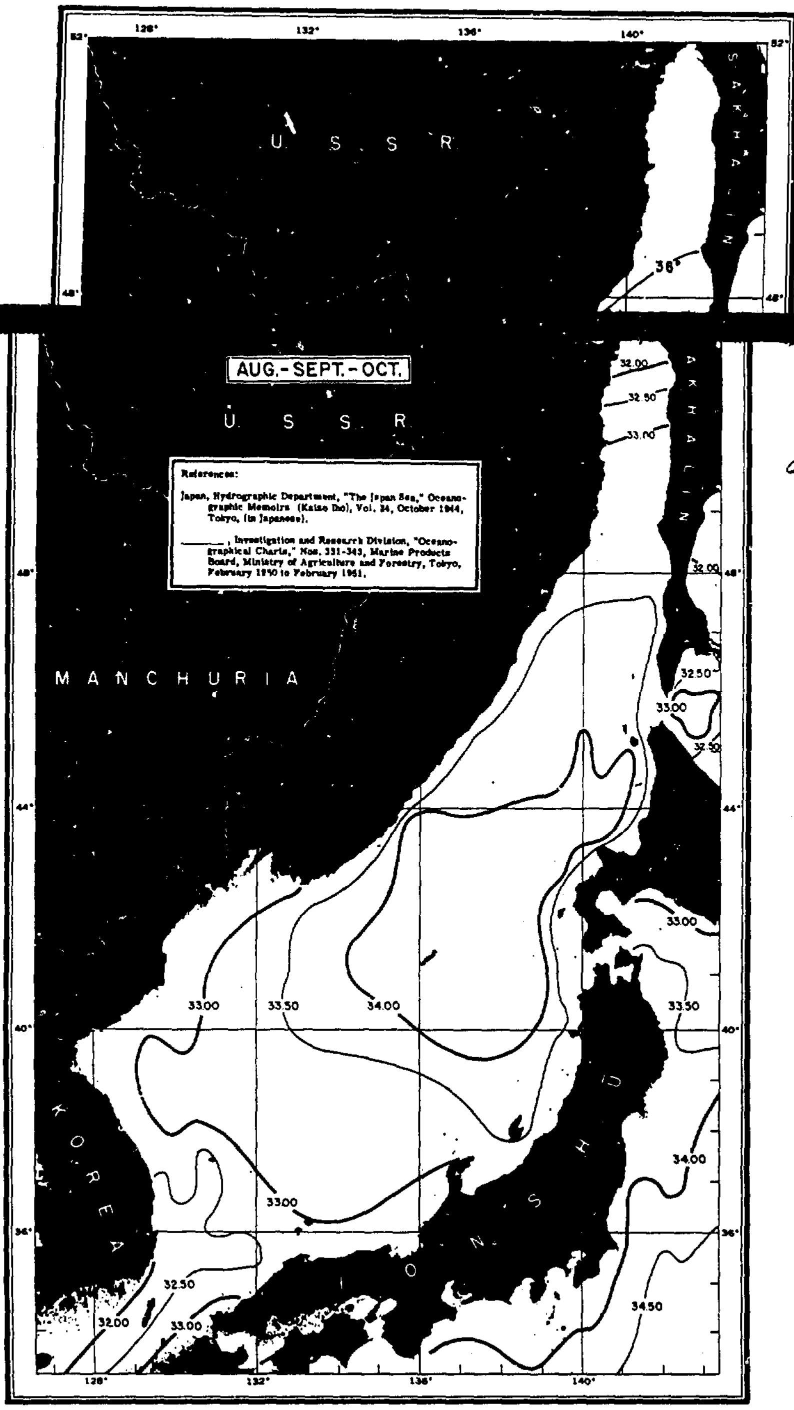





Although there are local variations, salinities in the Sea of Japan tend to be higher during the winter and lower during the summer. Extreme values of 25 and 36 parts per thousand have been recorded in the area, but salinities below 30 or above 35 parts per thousand are uncommon.

In the large region influenced by the relatively warm Tsushima Current, which moves northward along the eastern part of the Sea of Japan, salinities range from 34 to 35 parts per thousand during the winter and 33.5 to 34.5 parts per thousand during the summer. The effect of the current is most easily seen during the summer (chart for July), when the 33.00 isohaline extends as far north as latitude 48°N., because at this time the Tsushima Current attains it greatest speed and is able to overcome the influence of the cold, low saline Liman Current flowing southward through Tatar Strait. During the summer months, the melting of ice and snow and increased river runoff cause small tongues of less saline water, frequently as low as 30.00 parts per thousand, to protrude from river mouths and small embayments along both the China and Japan coasts. Since winds are less severe during the summer months, turbulence and consequent mixing would be at a minimum.

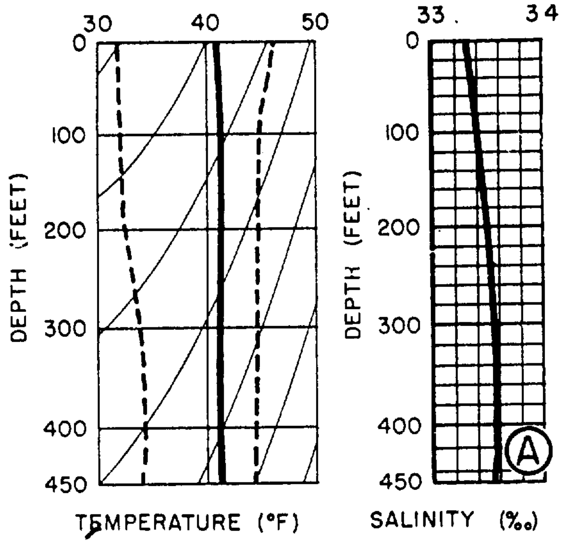
The winter months (November through February) in the Sea of Japan represent a period




of generally higher salinity values as compared to other times of the year. It is the only period during the year when the salinity in the middle of the sea attains a value of 35.00 parts per thousand.

In the western part of the Gulf of Tatary, where the relatively cold Liman Current flows southward at a rate of less than 1 knot, salinities in general are less than 33.50 parts per thousand during the winter and less than 33.00 parts per thousand during the summer. During the period from November to February this low saline current, traveling southward along the east coast of the U.S.S.R., pushes the highly saline water of the Tsushima Current eastward. Also, during the winter months there are strong northwesterly winds which likewise tend to move the saline tongue eastward.

East of Japan the Kuroshio remains more or less constant throughout the year, its highly saline water (34.50 to 35.00 parts per thousand) traveling northward along the east coast of Honshu to about latitude 35° or 36°N., where it turns eastward into the open Pacific Ocean. The salinity of this water remains the same along the Honshu coast except in the neighborhood of latitude 36°N. where it mixes with the cold, low saline waters of the Oyashio flowing southward from the Kurils.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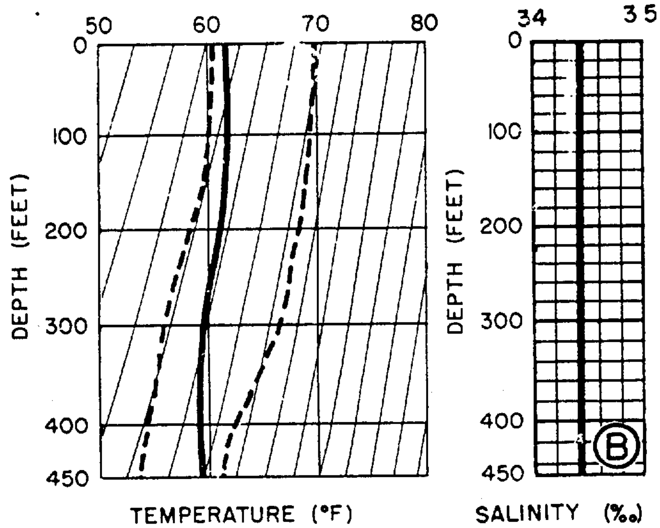
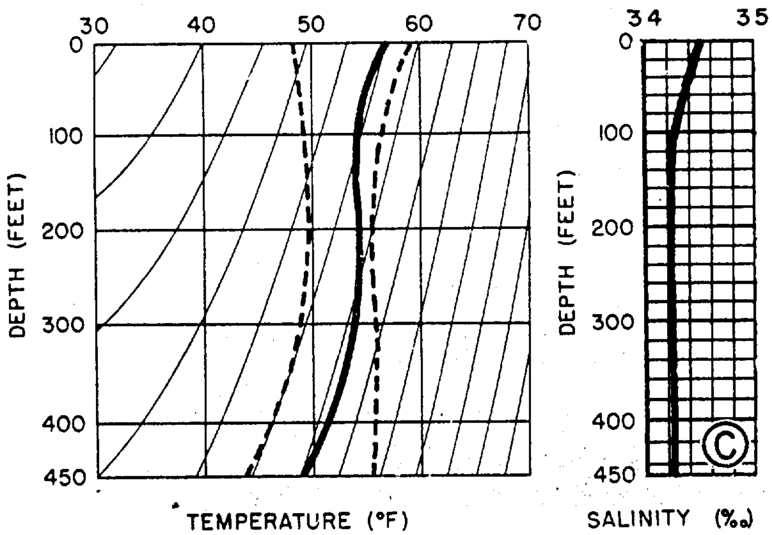
0 100 200 300 400 450
DEPTH (FEET)
TEMPERATURE (°F)
33 34
0 100 200 300 400 450
DEPTH (FEET)
SALINITY (‰)
A


50 60 70 80
0 100 200 300 400 450
DEPTH (FEET)
TEMPERATURE (°F)
34 35
0 100 200 300 400 450
DEPTH (FEET)
SALINITY (‰)
B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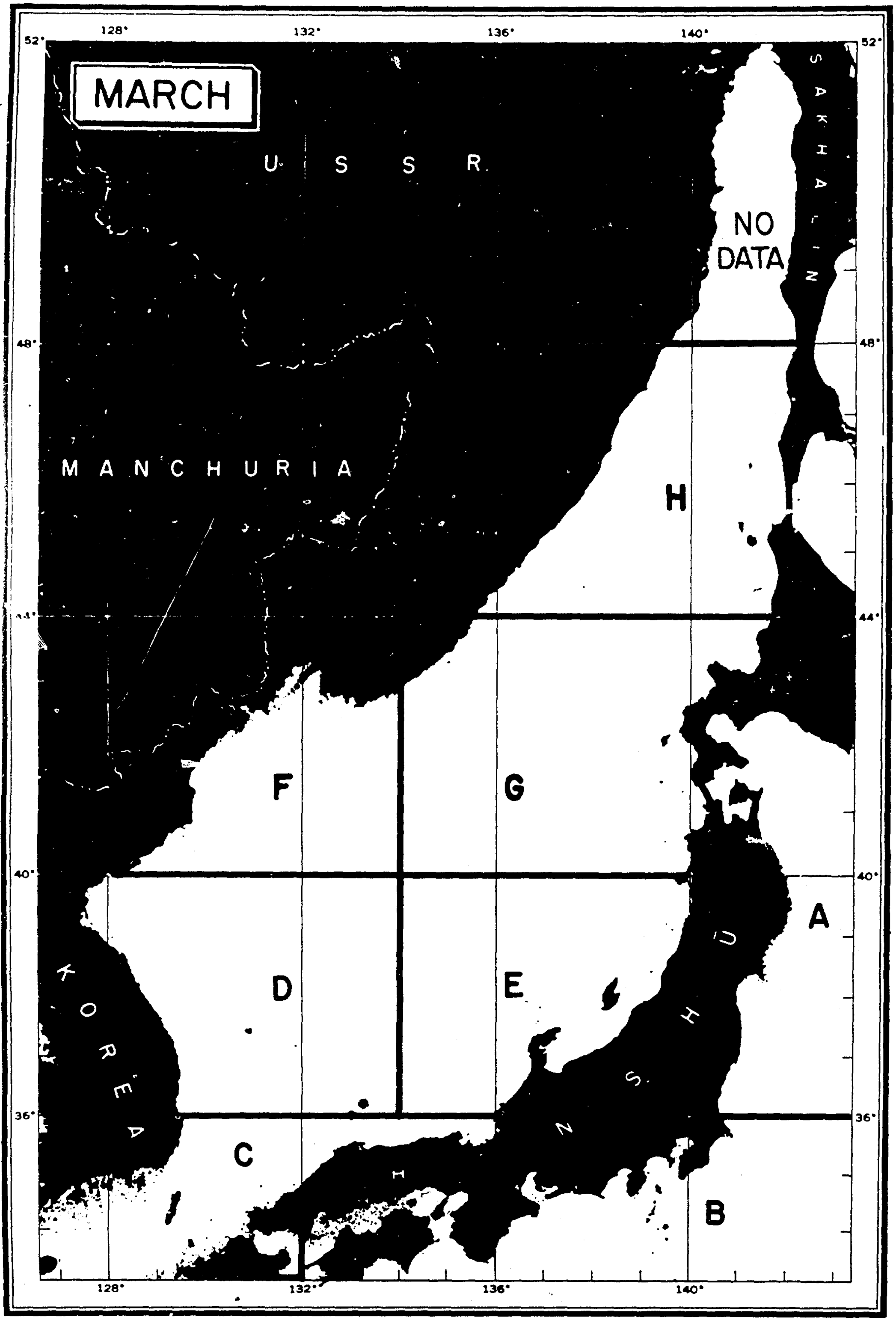
TEMPERATURE (°F)
34 35
0 100 200 300 400 450
DEPTH (FEET)
SALINITY (‰)
C


MARCH
U S S R
MANCHURIA
KOREA
SAKHALIN
NO DATA
HONSHU
A
B
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48°
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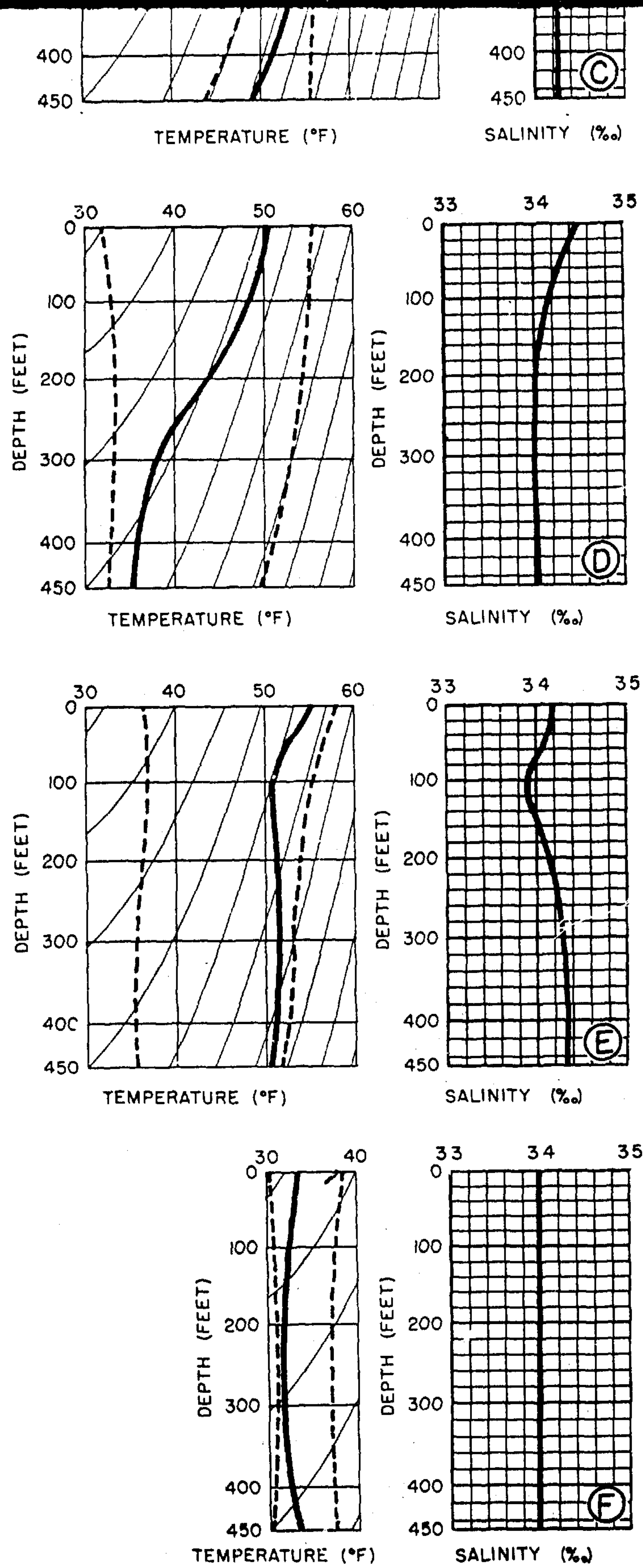
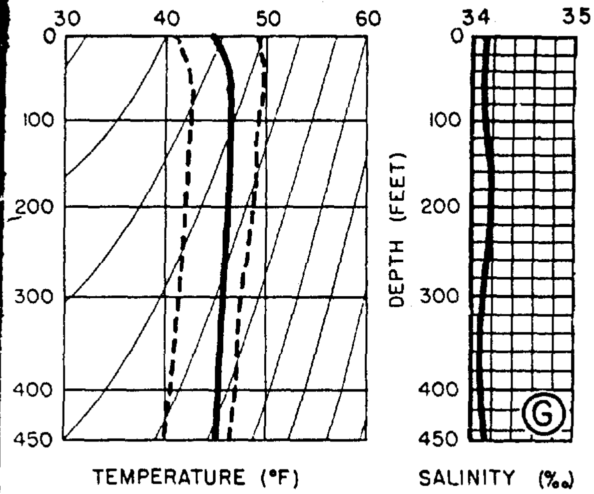
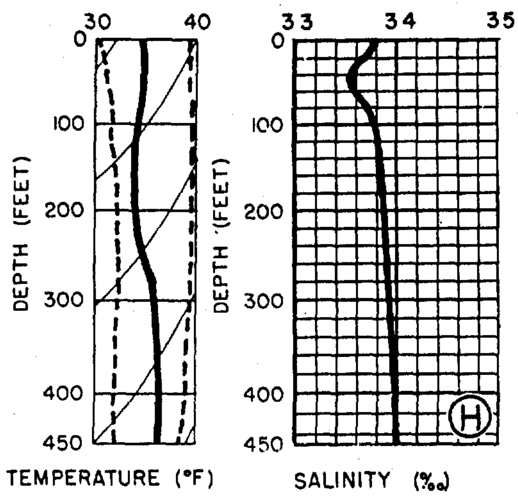
40°
36°

2


400
450
TEMPERATURE (°F)
400
450
C
SALINITY (‰)
30 40 50 60
0 100 200 300 400 450
DEPTH (FEET)
TEMPERATURE (°F)
33 34 35
0 100 200 300 400 450
DEPTH (FEET)
D
SALINITY (‰)
30 40 50 60
0 100 200 300 400 450
DEPTH (FEET)
TEMPERATURE (°F)
33 34 35
0 100 200 300 400 450
DEPTH (FEET)
E
SALINITY (‰)
30 40
0 100 200 300 400 450
DEPTH (FEET)
TEMPERATURE (°F)
33 34 35
0 100 200 300 400 450
DEPTH (FEET)
F
SALINITY (‰)




The envelopes (dashed lines) represent the range in which maximum and minimum temperatures can be expected to fall in a normal year. The solid lines on the temperature charts represent actual serial temperature observations, having been selected as typical temperature curves for the particular time of the year shown, plotted on submarine isoballast cards. Corresponding salinity curves are shown alongside.

The information for these temperature and salinity graphs was obtained from tabulated data on file in the U. S. Navy Hydrographic Office. The graphs indicate actual conditions at specific times and locations within the areas A through I, as shown on the location charts.

In winter isothermal water may be expected throughout the entire area, except along the coast of southern Korea. The southern part of the Sea of Japan (Areas C, D, and E) is warmed by the Tsushima Current flowing northward on the surface. The cold water along the Asiatic coast, resulting from the cooling effect of climatic and meteorological conditions, sinks beneath this warm water and produces the temperature gradients shown for Areas C, D, and E. Thus, a well defined density layer lies off the east coast of Korea during the entire year. The top of this layer is commonly below 150 feet in winter and early spring, but within 100 feet of the surface in summer and autumn.

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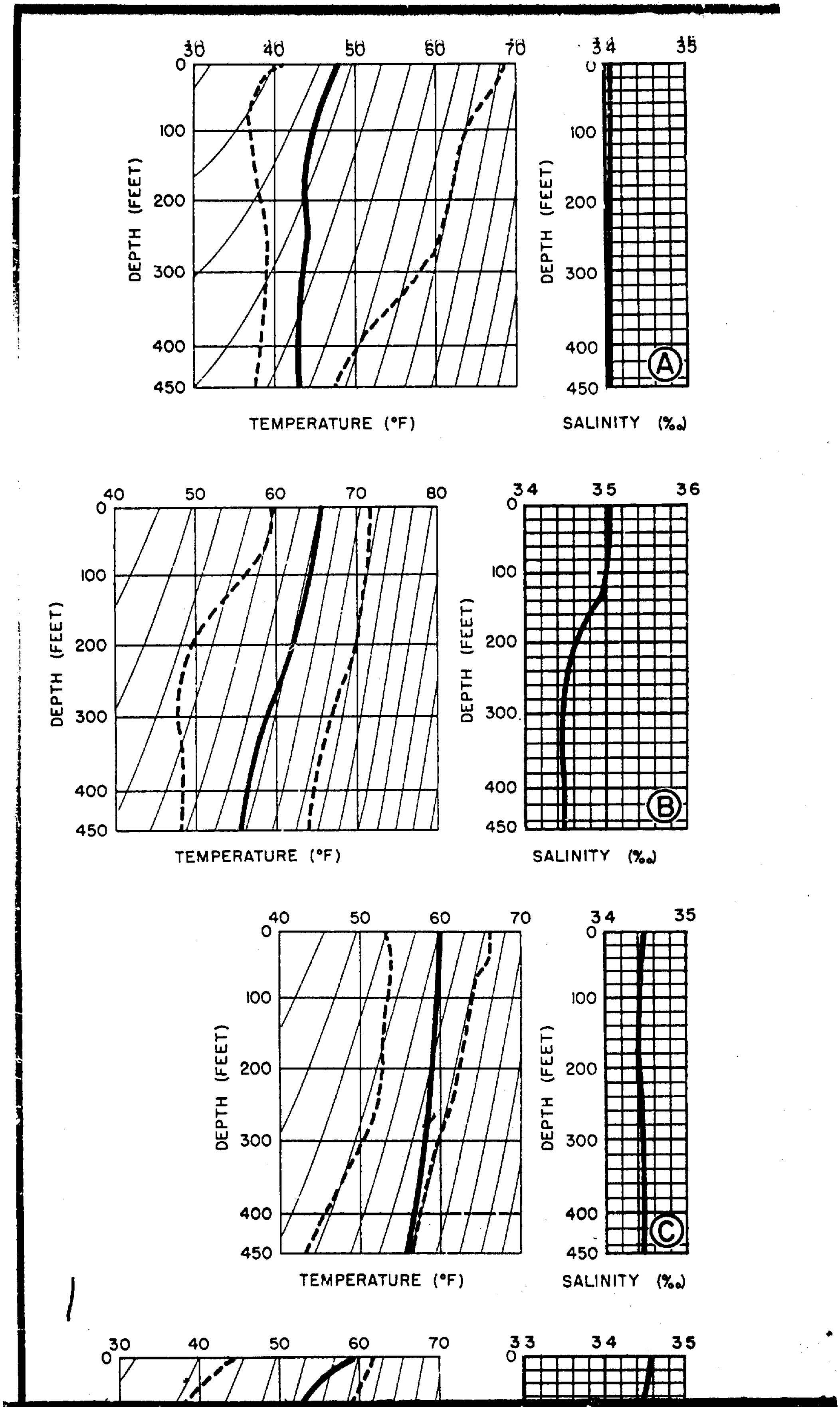

30 40 50 60 70
0
100
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300
400
450
DEPTH (FEET)
TEMPERATURE (°F)
34 35
SALINITY (‰)
A
40 50 60 70 80
TEMPERATURE (°F)
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B
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TEMPERATURE (°F)
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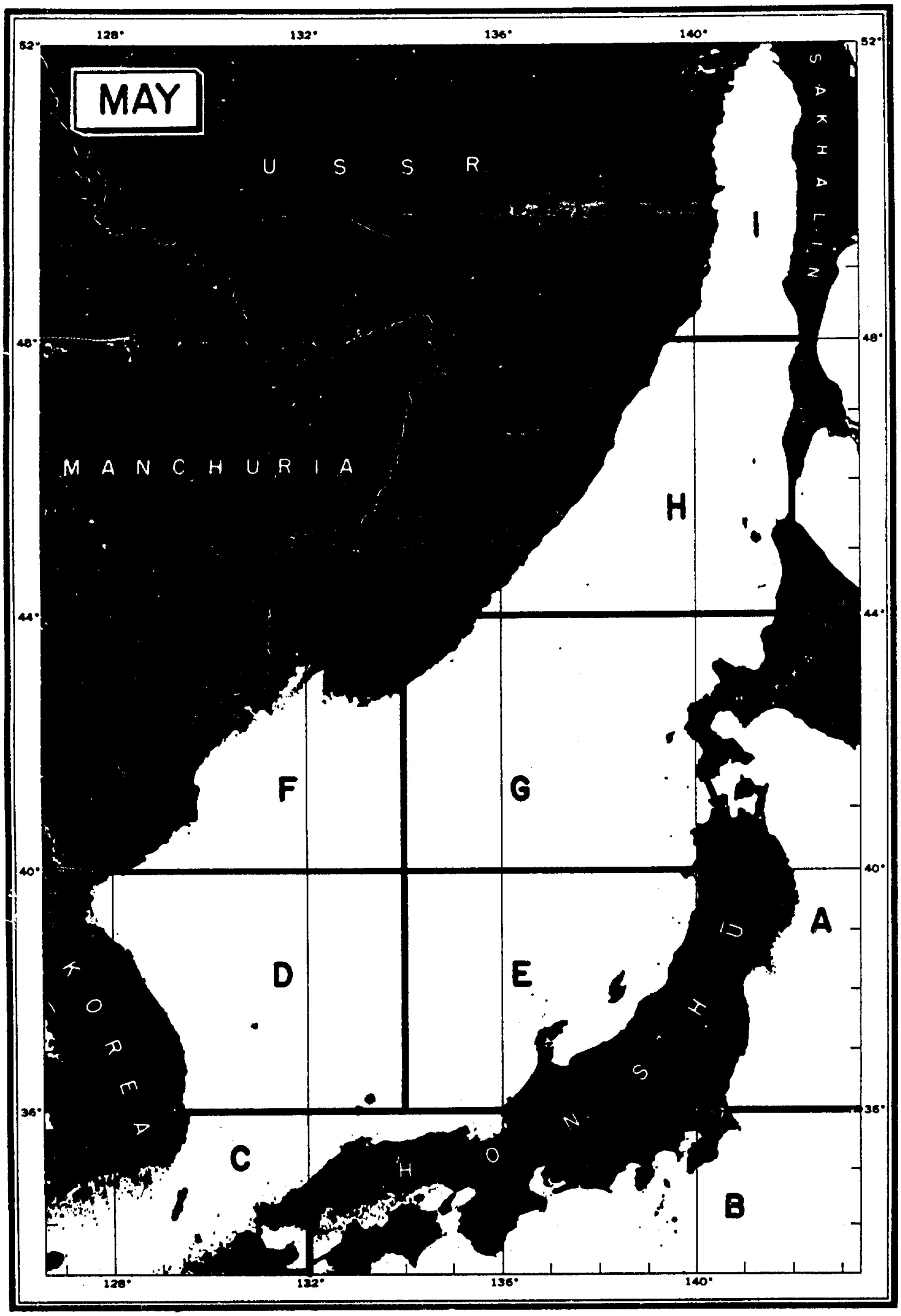
SALINITY (‰)
C
30 40 50 60 70
33 34 35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U S S R
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MANCHURIA
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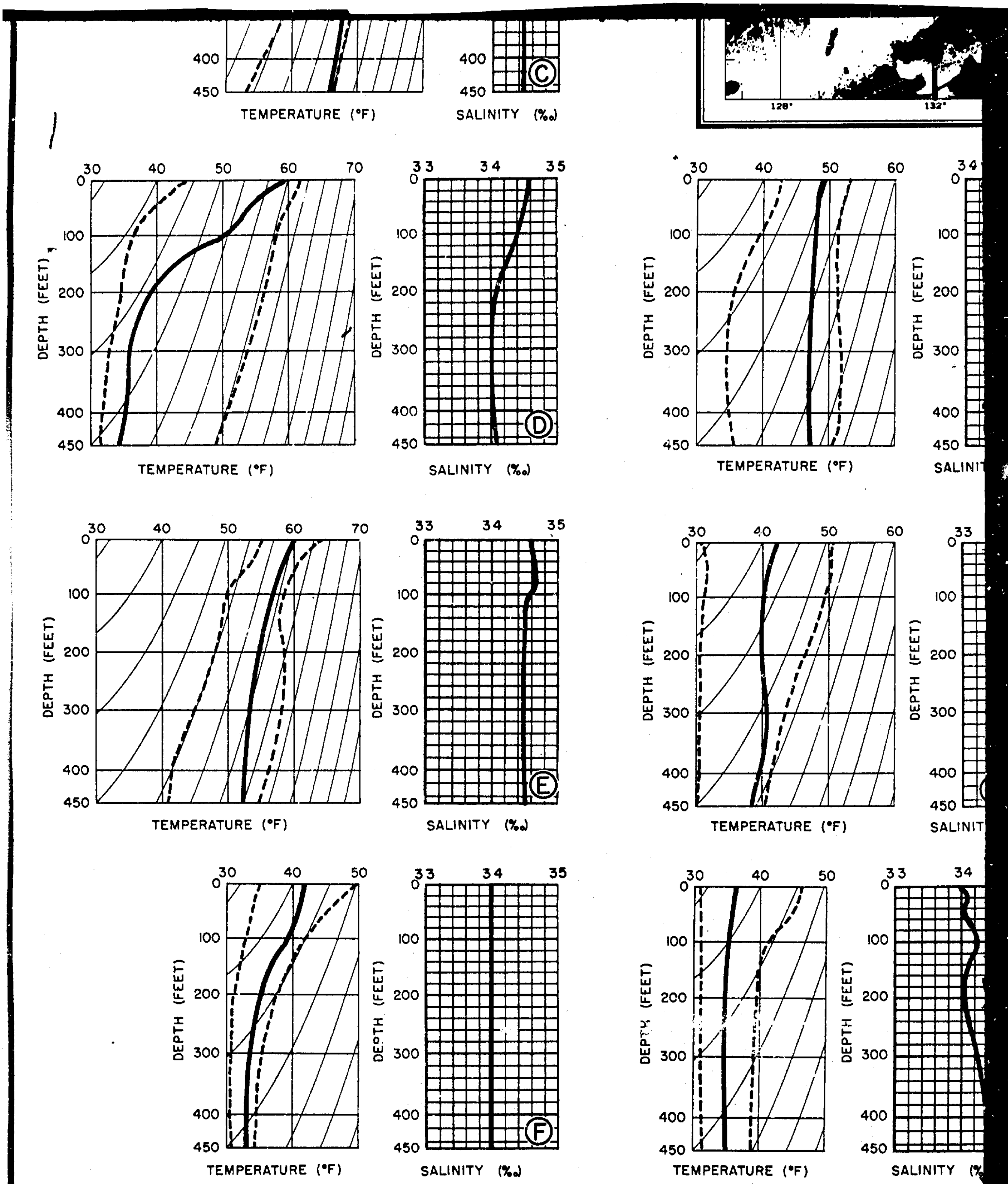
I

2



TEMPERATURE (°F)
SALINITY (‰)
DEPTH (FEET)
C
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E
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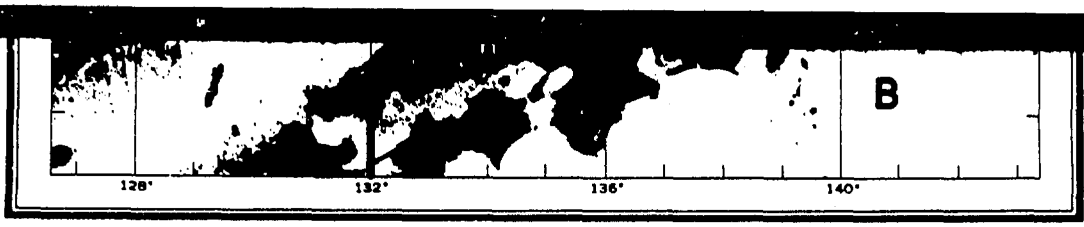
128°
132°
30 40 50 60 70
33 34 35
0 100 200 300 400 450

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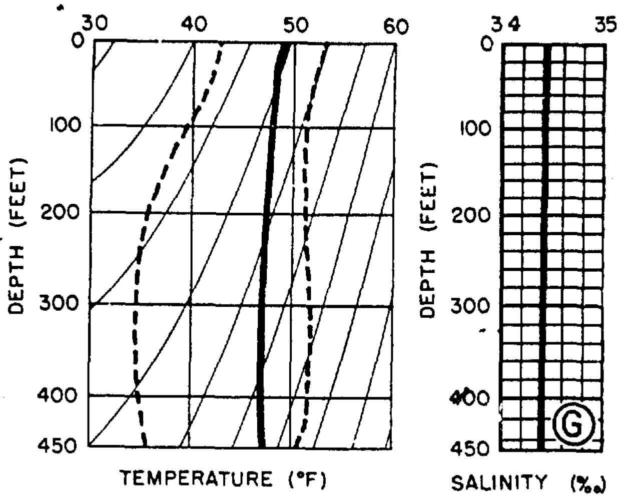


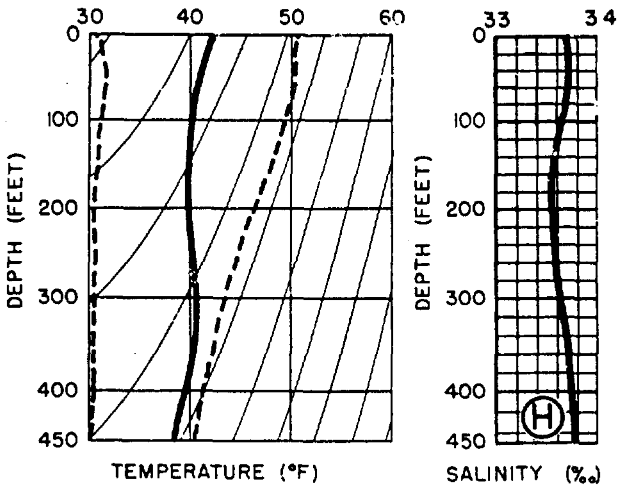


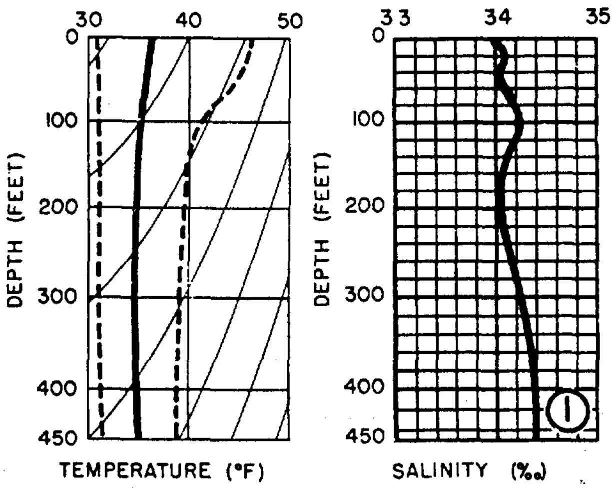


During the spring transition period, the cold (western) waters rapidly develop warm layers at shallow depths. In the eastern waters the thermoclines are not so sharp and are somewhat masked by current mixing. The negative gradients, having temperature ranges of less than 10°F. between 0 and 450 feet, show the warming process taking place at or near the surface.

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Japan, Imperial Marine Observatory, "The Results of the Oceanographical Observations on board R. M. S. 'Syunpu Maru' in the Japan Sea during the Summer of 1930," by K. Suda, K. Hidaka, Y. Matudaira, M. Mizuuti, T. Takahata, and H. Kurasige, Journal of Oceanography, Parts 1 and 2, Vol. III, No. 1, pp. 291-374, July 1931, No. 2, pp. 545-620, February 1932, Kobe.

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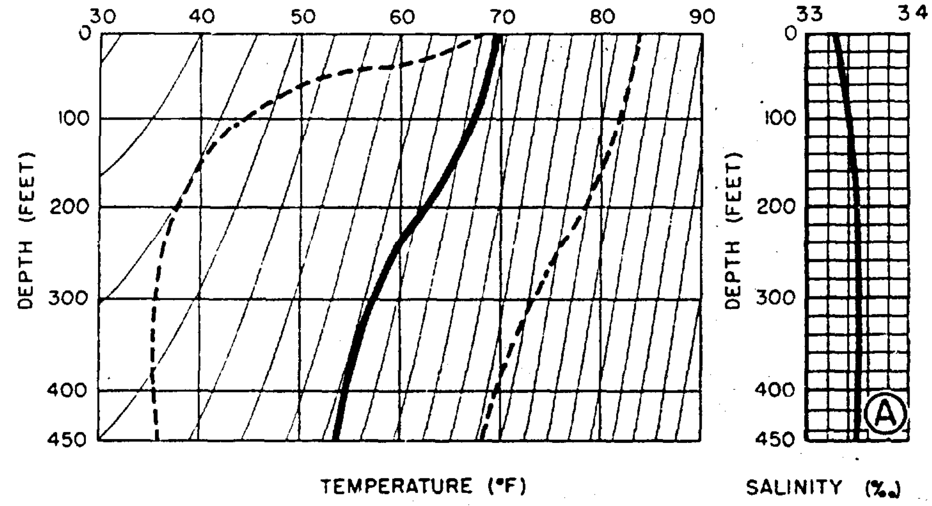
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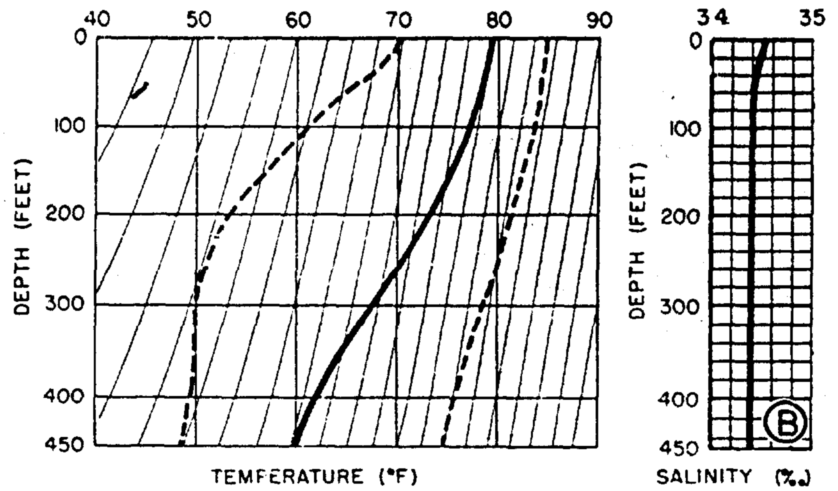
DEPTH (FEET)
TEMPERATURE (°F)
33 34
0 100 200 300 400 450
DEPTH (FEET)
SALINITY (‰)
A


40 50 60 70 80 90
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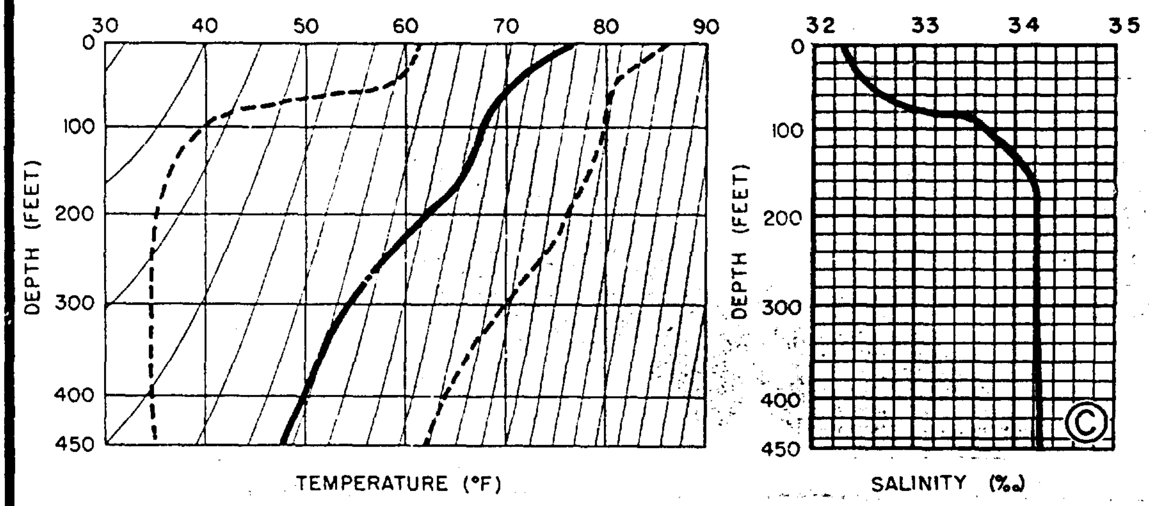
B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DEPTH (FEET)
TEMPERATURE (°F)
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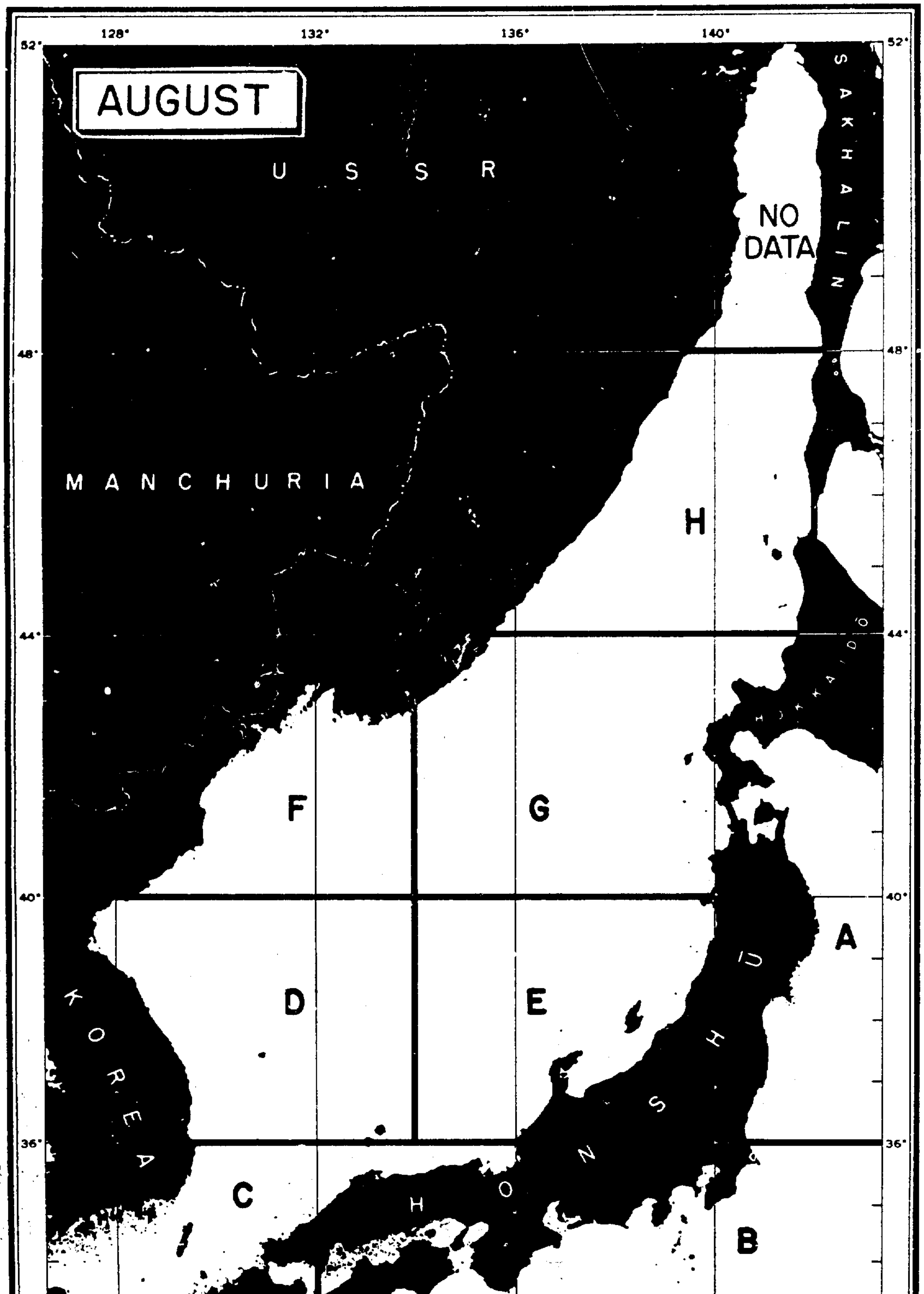
0 100 200 300 400 450
DEPTH (FEET)
SALINITY (‰)
C


AUGUST
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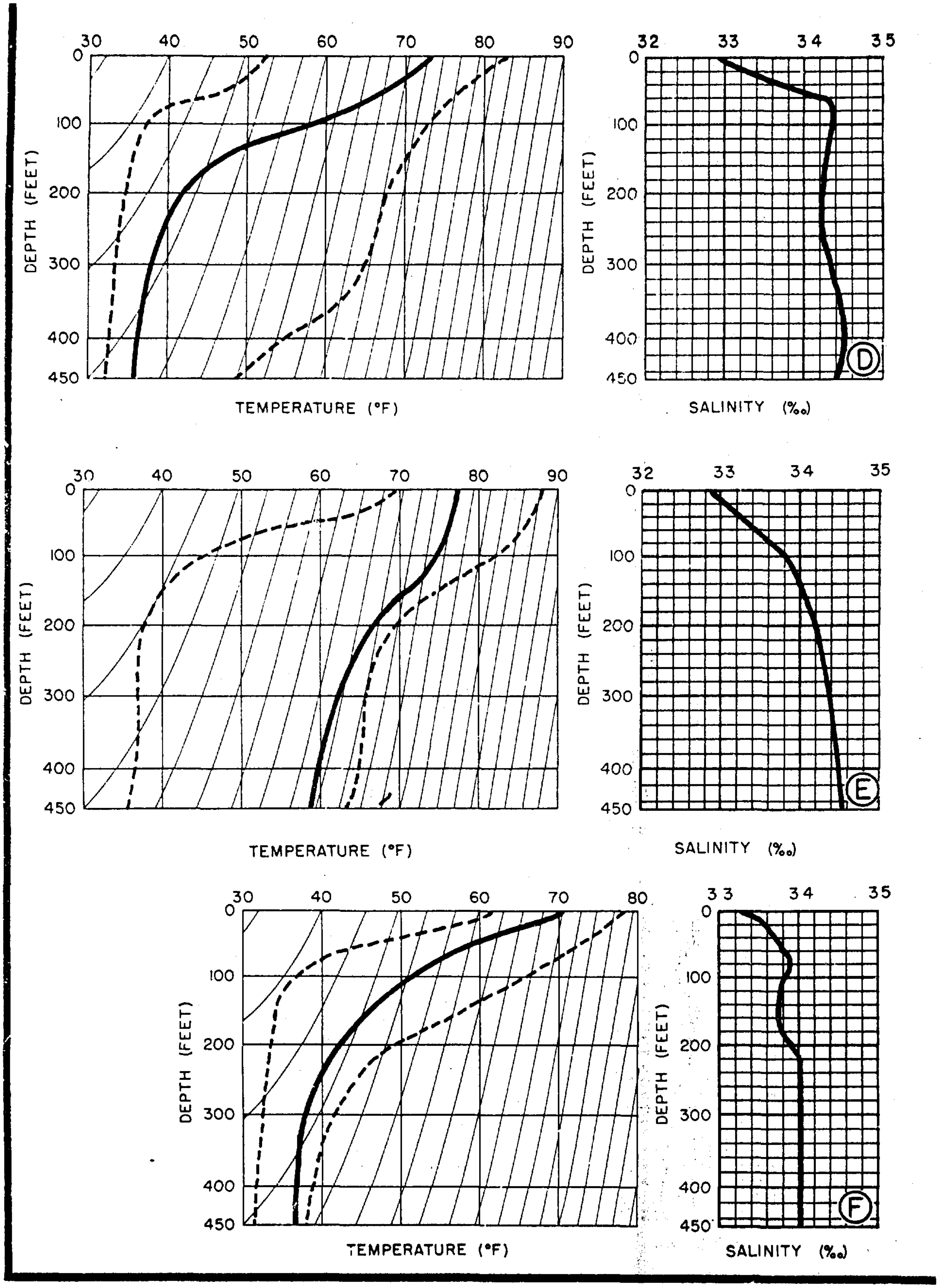

30 40 50 60 70 80 90
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DEPTH (FEET)
TEMPERATURE (°F)
32 33 34 35
SALINITY (‰)
D
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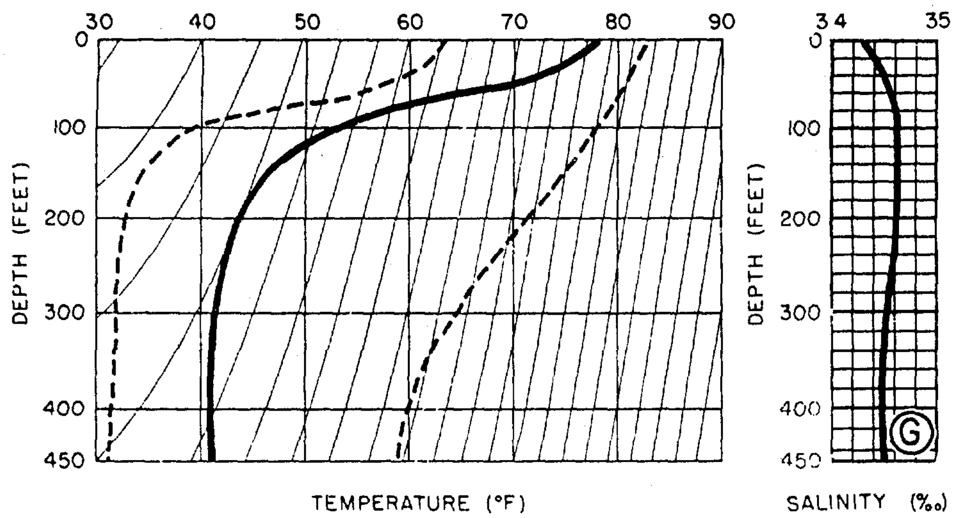
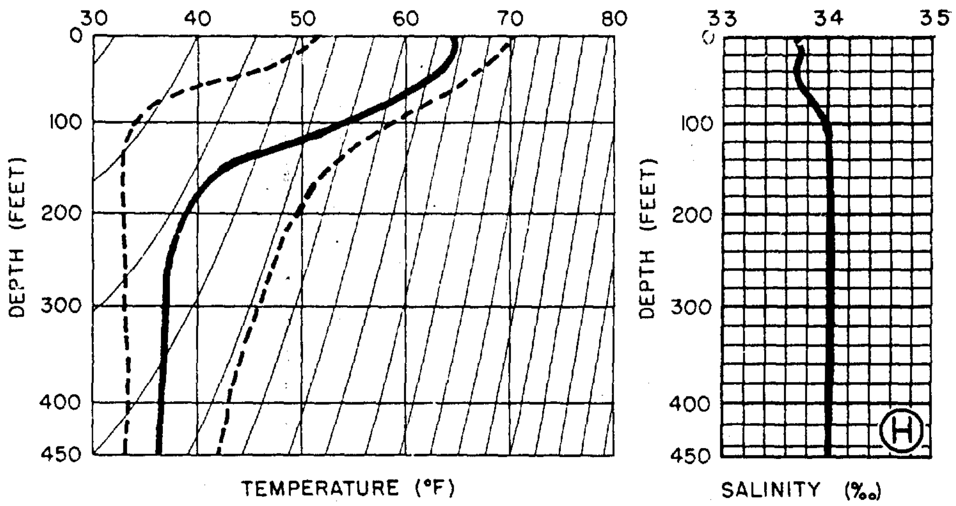
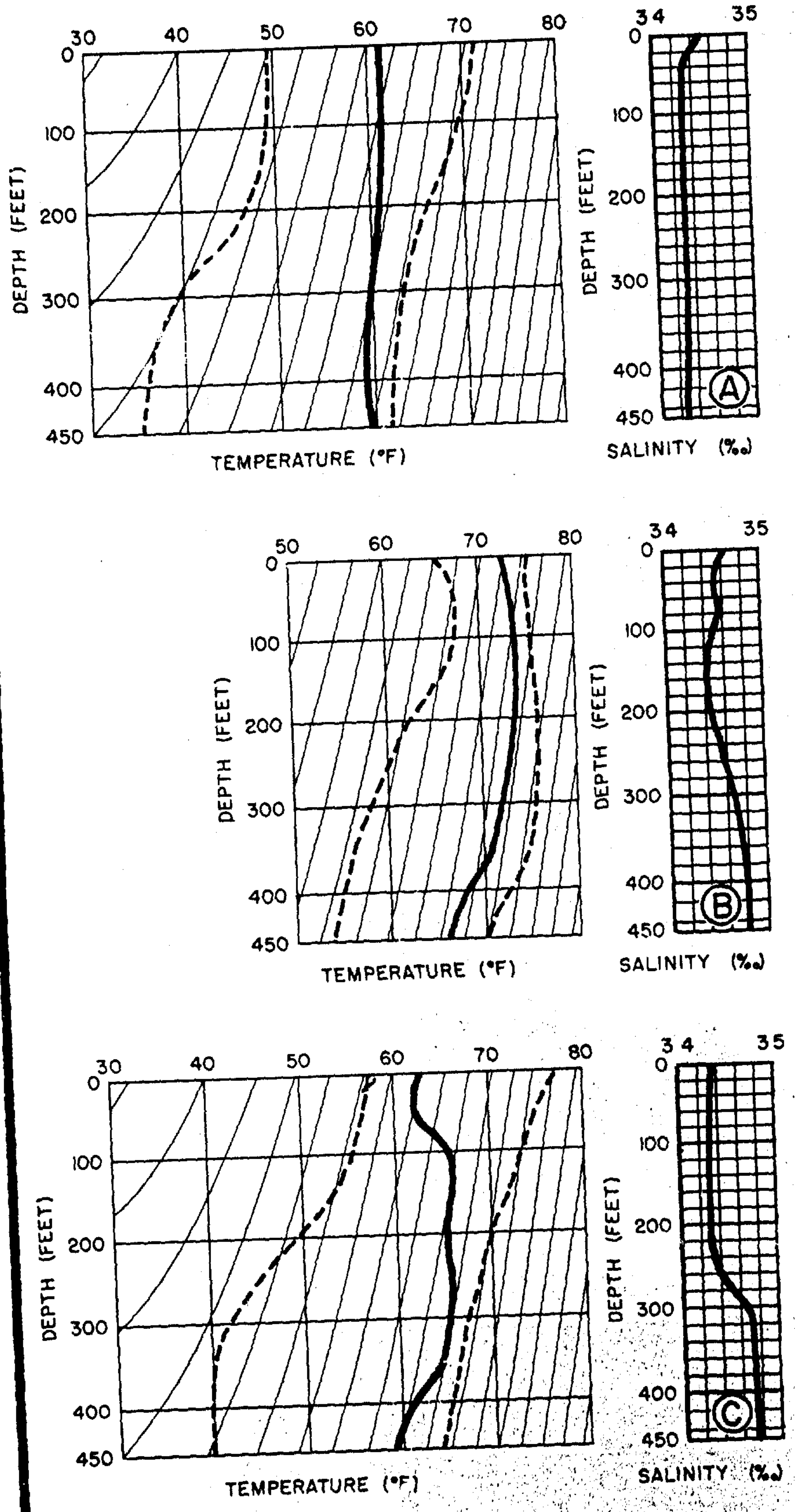



The summer months are characterized by strong negative gradients in the upper 200 feet throughout the entire Sea of Japan. These gradients can range about 40°F. from the surface to 450 feet. East of Honshu, where the precipitation and the frequency of extratropical cyclones are greater than in the Sea of Japan, surface heating is less pronounced and density layers within the first 100 feet are frequent. In the deep and open waters off the Pacific coast of Japan the heating effects reach greater depths and remain for a greater period of time than in the Sea of Japan proper. In the latter area, the surface heating effect is very evident, temperatures ranging from 78°F. at the surface to 36°F. at 450 feet (Areas C and D). Likewise, surface salinity gradients are most pronounced, especially in the south-western part of Tsushima Kaikyo (Area C), where the salinity increases from 32.2 parts per thousand at the surface to 34.2 parts per thousand at a depth of 180 feet.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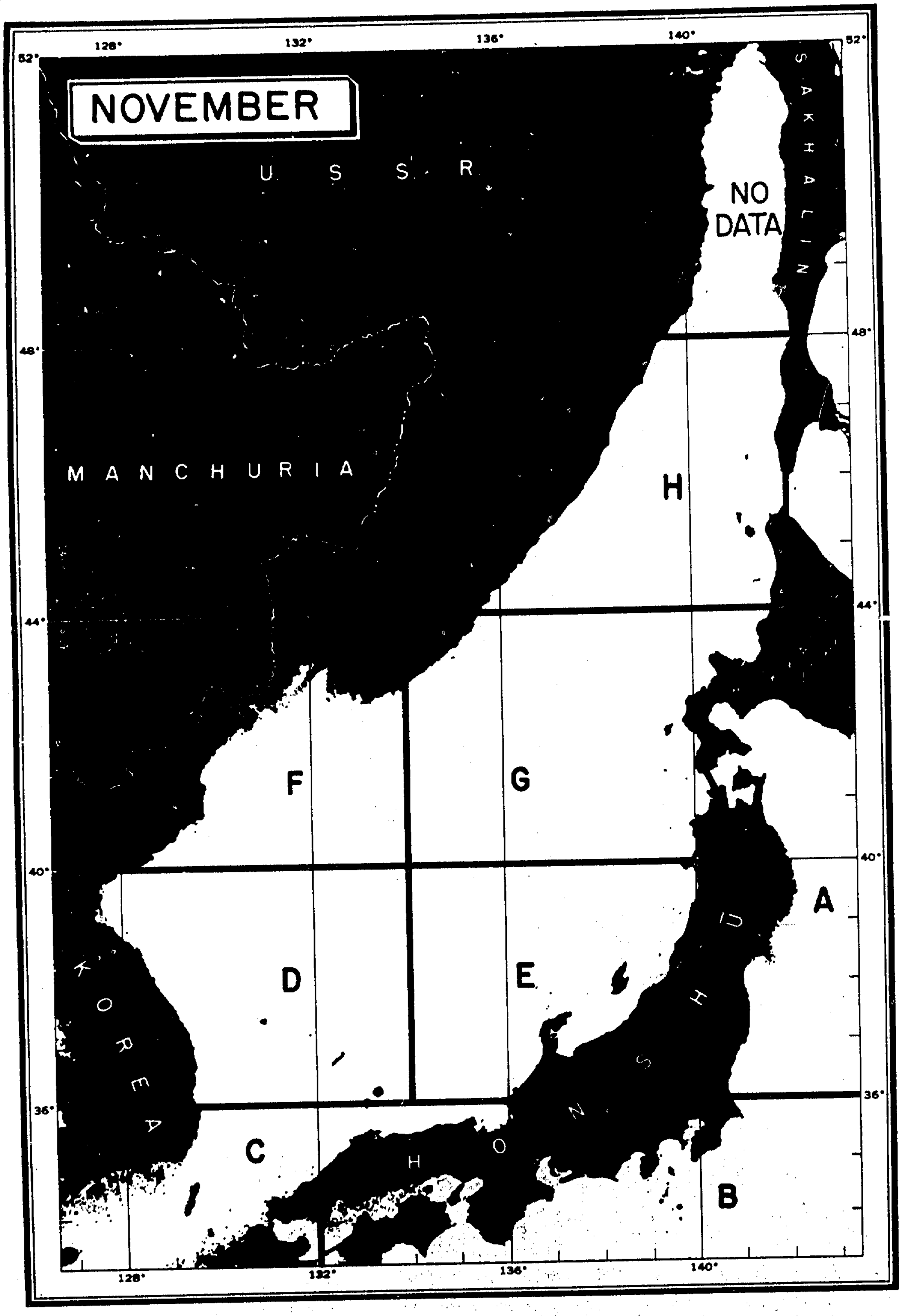
0 100 200 300 400 450
DEPTH (FEET)
TEMPERATURE (°F)
34 35
SALINITY (‰)
A
50 60 70 80
TEMPERATURE (°F)
SALINITY (‰)
B
30 40 50 60 70 80
TEMPERATURE (°F)
SALINITY (‰)
C


NOVEMBER
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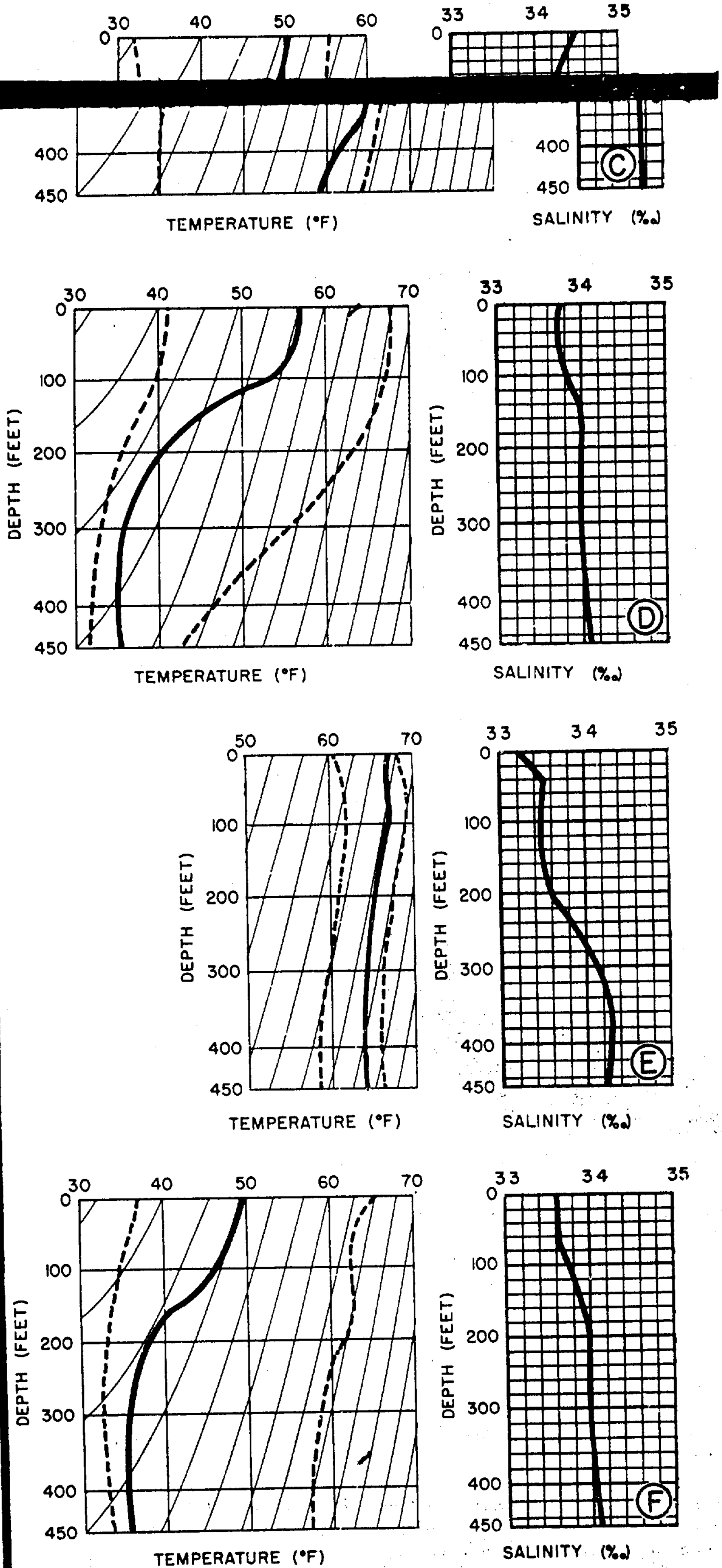

30 40 50 60
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TEMPERATURE (°F)
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C
SALINITY (‰)
30 40 50 60 70
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SALINITY (‰)
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DEPTH (FEET)
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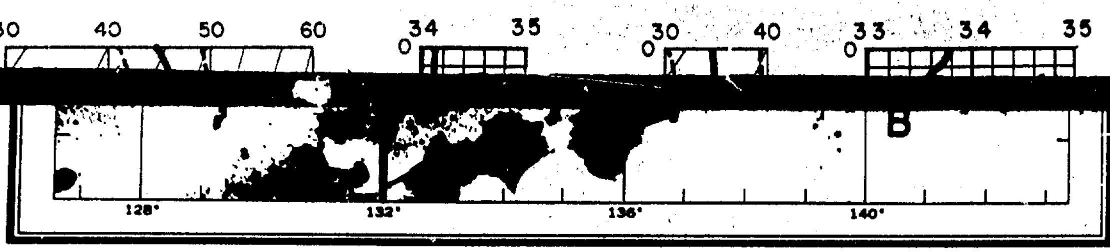
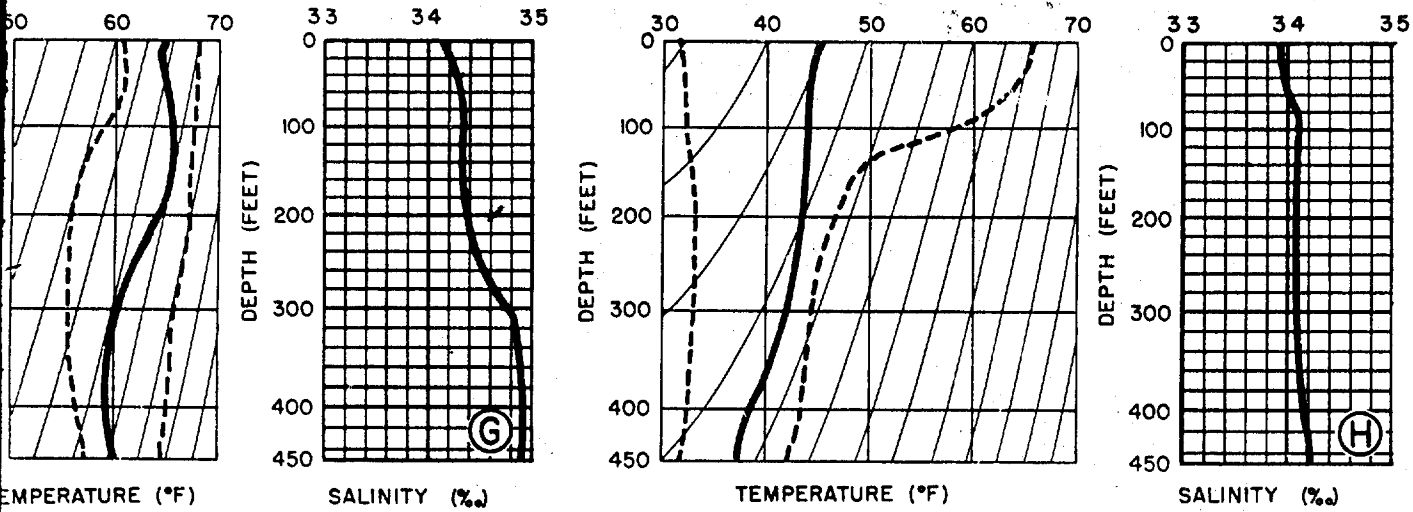
SALINITY (‰)




During the autumn transition in the Sea of Japan, there is surface cooling of 10° to 20°F. below that of August, the thermocline grows deeper, and the salinity gradients diminish, primarily a result of both increased cloudiness and precipitation. However, in some of the deeper layers at about 450 feet the heat is retained and the temperature is higher than in August.

Summary:

As a general statement, the water in the middle of the Sea of Japan from 300 to 450 feet and below can be considered stabilized at about 36°F. The differences in the upper 300 feet can be attributed to currents, monsoons, surface heating and cooling, and other climatic and atmospheric factors. Salinity values remain more or less uniform at about 34 parts per thousand at all depths since there is relatively little fresh water river discharge entering the Sea of Japan. A description of density layers for this region is given in H. O. Pub. No. 231, Submarine Supplement to the Sailing Directions, "Japanese Empire Area," Washington, D. C., May 1945 (Confidential).

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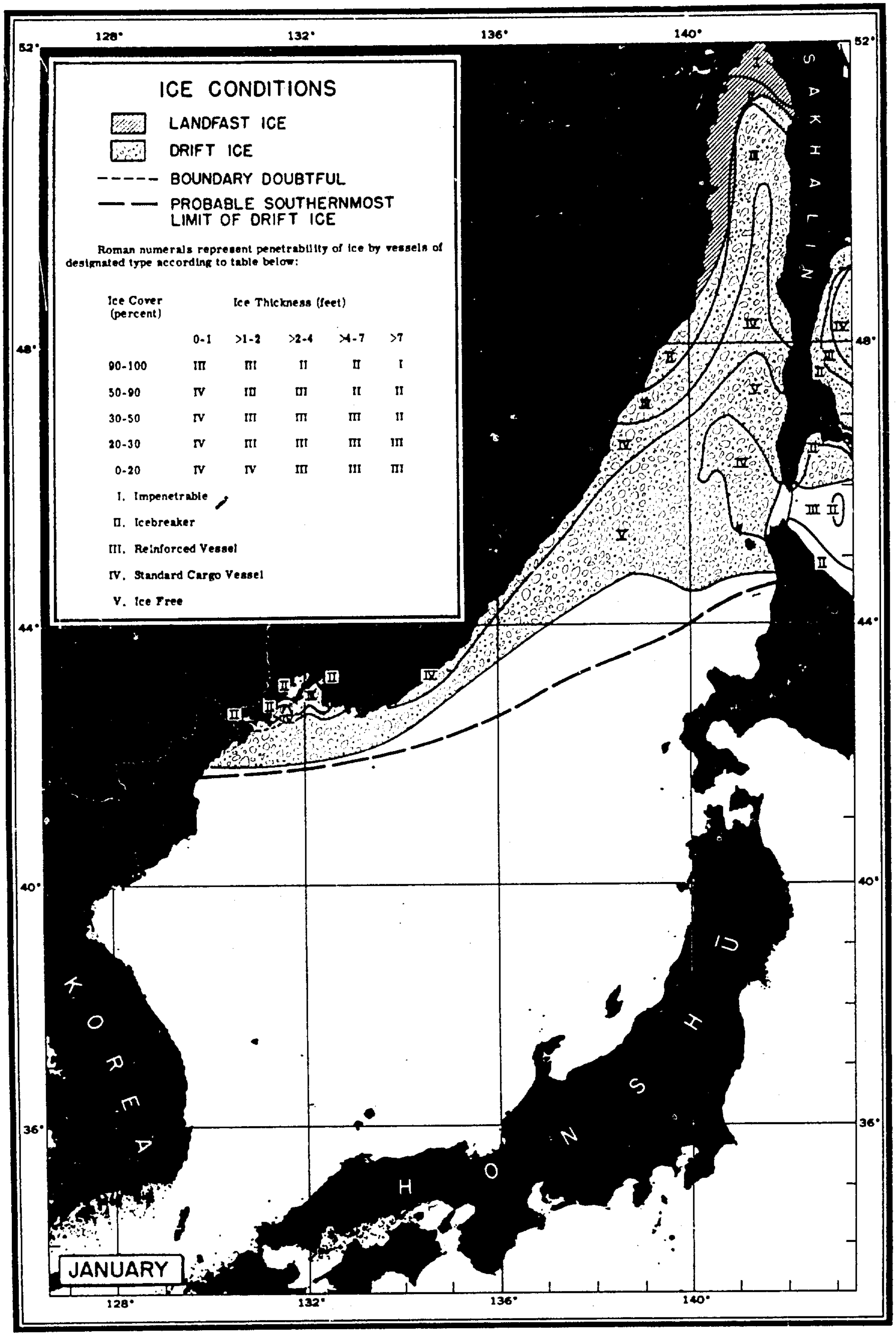
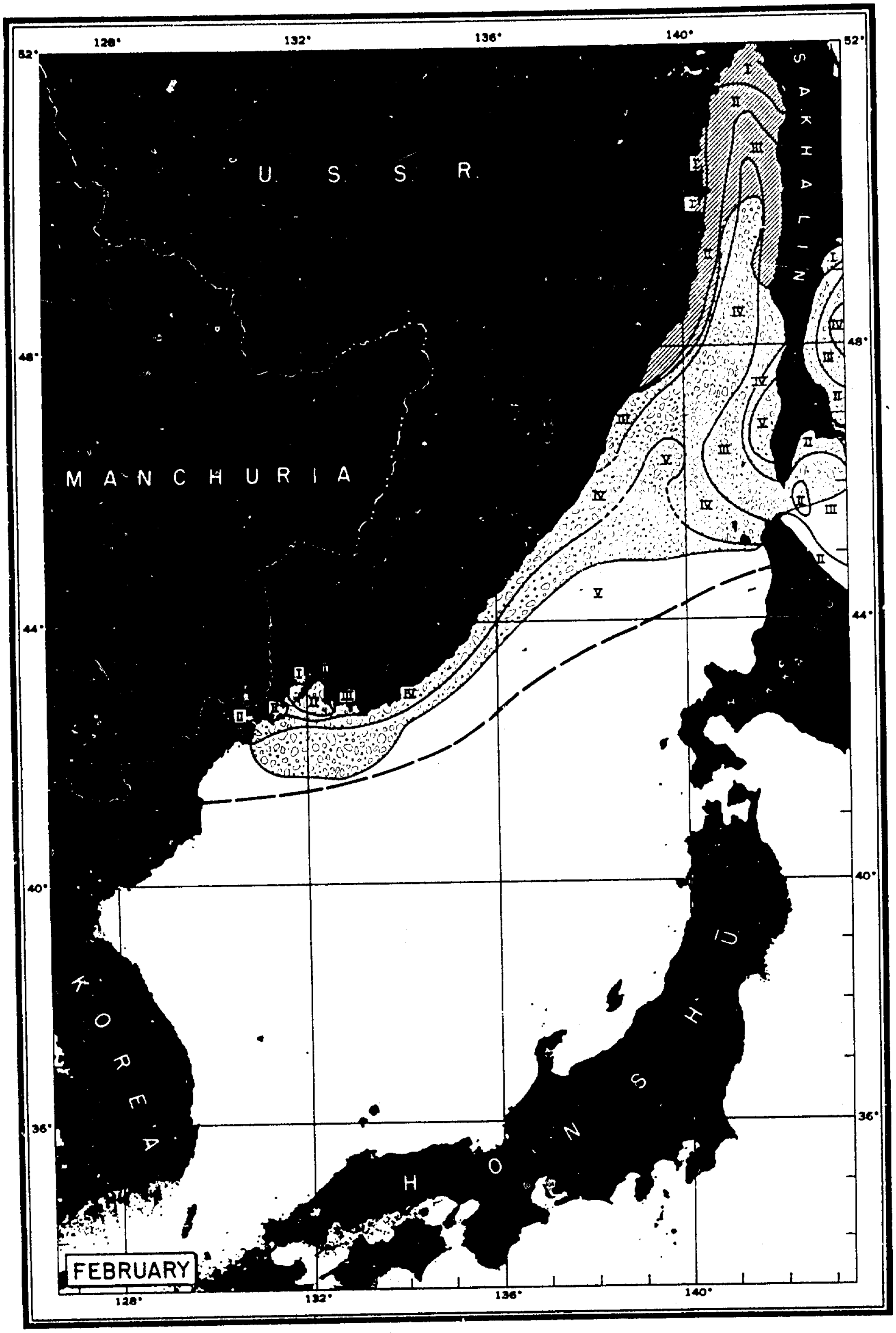
# SEA ICE CONDITIONS




U. S. S. R.
MANCHURIA
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KOREA
HONSHU
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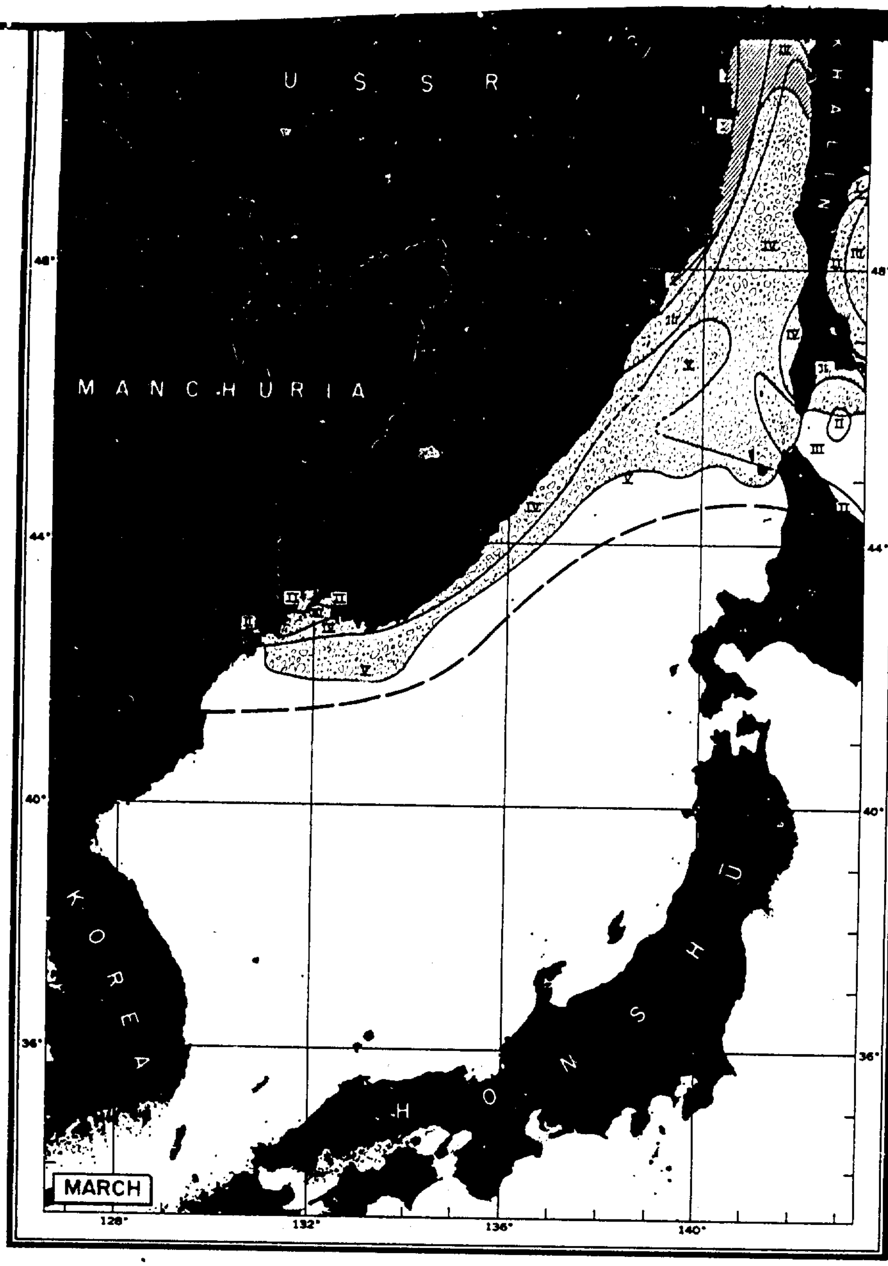
36°

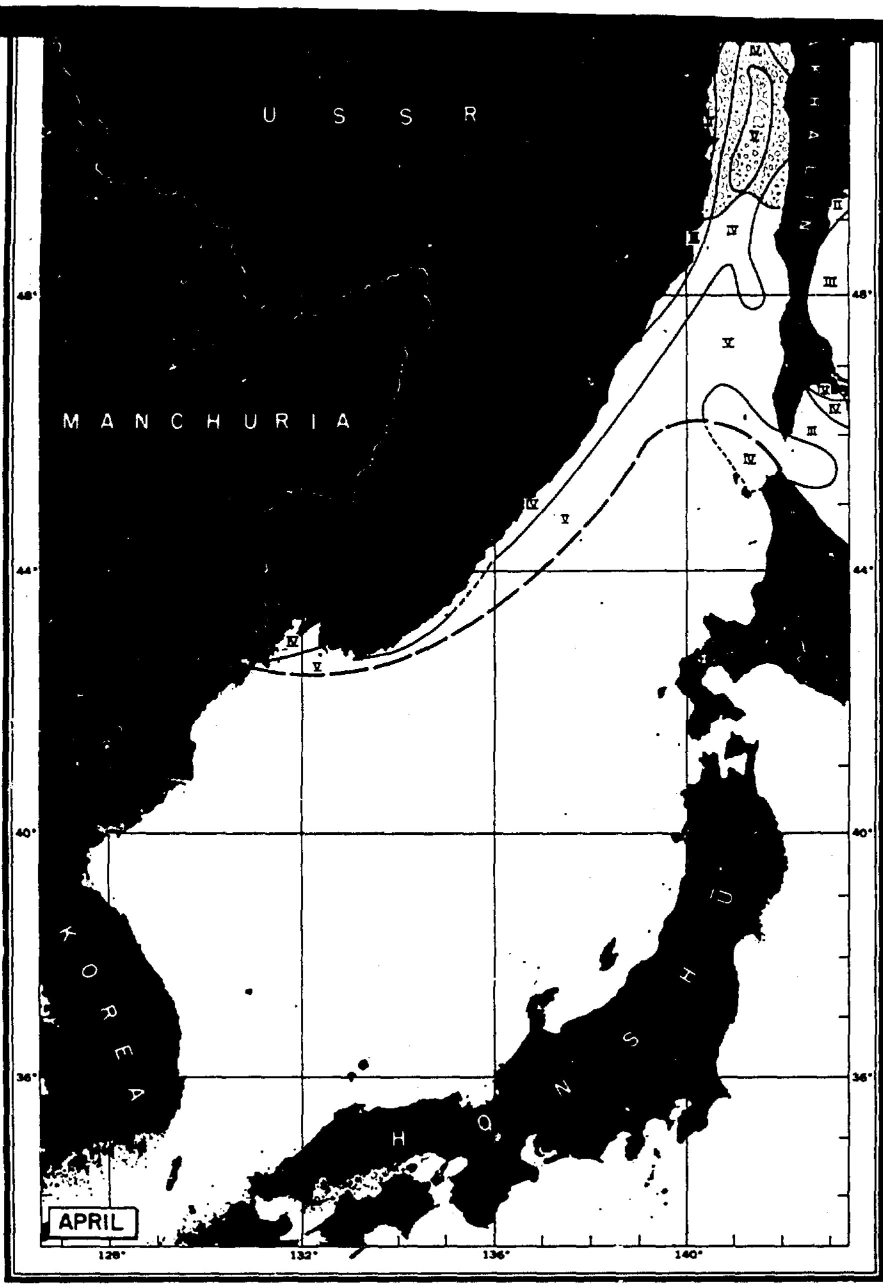



The harbors and bays on the west coast of Hokkaido usually do not freeze over. Some drift ice passes through Soya Kaikyo and reaches Rishiri Shima which is usually just within the southern limit of drift ice in the Sea of Japan. From December to March the northern coast of Hokkaido is icebound to a distance of 6 to 8 miles off the coast. Although Soya Kaikyo never freezes over, it may be completely blocked by drift ice which arrives in January or February and usually clears by May. Northeast winds bring in the ice, while south and west winds clear the ice.

The east coast of Sakhalin may have drift ice from January to June, usually 3 to 4 feet thick, which may form hummocks over 8 feet high. Aniwa Wan on the south coast has a considerable amount of fast ice which is thickest along the western part of the bay. Leads often occur between the fast ice and the ice fields in the middle of the bay. Drift ice is brought in by east winds occasionally in April and May. On the west coast at Aleksandrovski during fresh offshore winds large cracks appear in the ice and part of it may be carried away. With onshore (west) winds hummocking may result.

Ordinarily the ice extends several miles offshore at the southern part of Sakhalin. Occasionally, drift ice combines with the fast ice to block the harbors, but only for a few days. Honto is open all winter and is usually free of ice. The southernmost tip of the island is usually surrounded by ice floes which have drifted around Nishi Notoro Misaki.

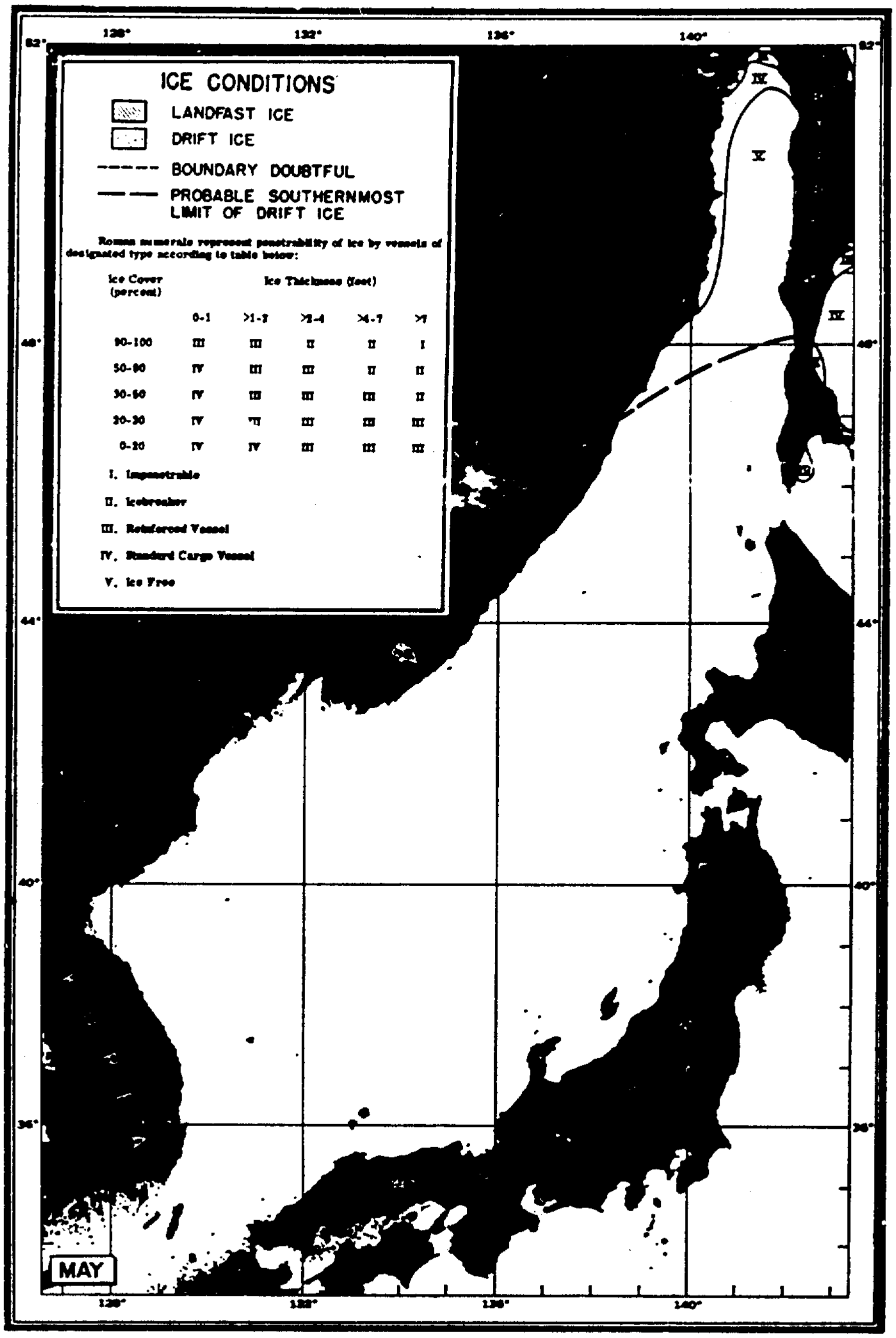
The Gulf of Tatary usually contains ice from the middle of November to the last of April.

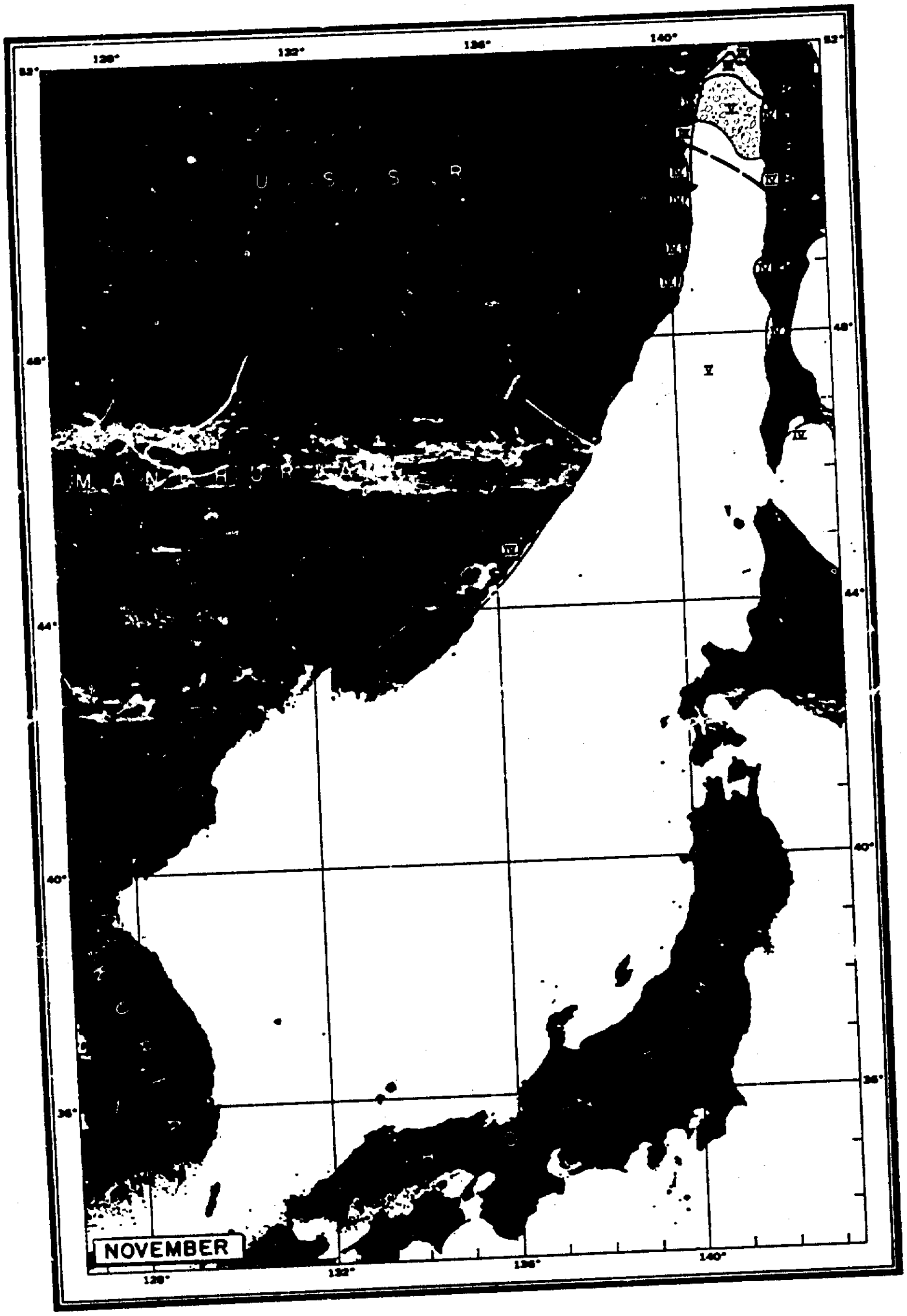



There are some places in the middle of the gulf where the ice is thin or open water often occurs. Navigation is usually unimpeded by about the end of May. The coves, bays, and rivers of the gulf are normally blocked by ice from the end of December to the end of April, but can be navigated with the assistance of icebreakers. The Amur estuary remains frozen until May.

The ice on the west side of the Gulf of Tatary is stronger than that off the Sakhalin side and ordinarily remains stationary, while that on the east side sometimes breaks up during the winter. The prevalence of northwest winds in the winter plays an important part in the distribution of the drift ice in the gulf.

Along the Siberian coast between latitudes 46° to 48° N., narrow strips of landfast ice form along the shore but continually keep breaking away. In latitudes 44° to 46° N., there are times, even in midwinter, when the area is practically ice free due to the prevailing winds and currents. Thus, along the Russian coast southward from the Gulf of Tatary, ice does not constitute a serious hazard to navigation even though conditions here are the severest found in the Sea of Japan proper. Zaliv Vladimira freezes over; the southern part containing most of the ice. The northern part may be free due to the prevailing winds. Ice in Zaliv Ol'gi is not constant, but it has been known to impede traffic. In Zaliv Amerika the fields are continually breaking and being carried out to sea. Icebreakers operating in the vicinity of Vladivostok have been able to keep the port open throughout the winter months.


ICE CONDITIONS
LANDFAST ICE
DRIFT ICE
BOUNDARY DOUBTFUL
PROBABLE SOUTHERNMOST LIMIT OF DRIFT ICE
Roman numerals represent penetrability of ice by vessels of designated type according to table below:
Ice Cover (percent)
Ice Thickness (feet)
0-1 >1-2 >2-4 >4-7 >7
90-100 III III II II I
50-90 IV III III II II
30-50 IV III III III II
20-30 IV III III III III
0-20 IV IV III III III
I. Impenetrable
II. Icebreaker
III. Reinforced Vessel
IV. Standard Cargo Vessel
V. Ice Free
128°
132°
136°
140°
52°
48°
44°
40°
36°
IV
V
MAY


U. S. S. R.
M A N C H U R I A
NOVEMBER
128°
132°
136°
140°
52°
48°
44°
40°
36°

des Nord- und Sudpolargebietes," Hamburg, 1950.

Deutsche Seewarte, "Atlas der Vereisungsverhaltnisse Russlands und Finnlands, ihrer Kustengewasser sowie Wirtschaftlich und Militarisch Wichtigen Binnenwasserstrassen mit Textlichen Vorbemerkungen und Tabellen," Oberkommando der Kriegsmarine, 1942.

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_______, and K. Seki, "On the First and Last Date of the Ice-Drift and Freezing of Sea Water at Several Ports along the Coast of Bering, Okhotsk, and Adjacent Seas of Japan," Journal of Oceanography, Vol. 3, pp. 687-708, 1932, Imperial Marine Observatory, Kobe, (in Japanese).

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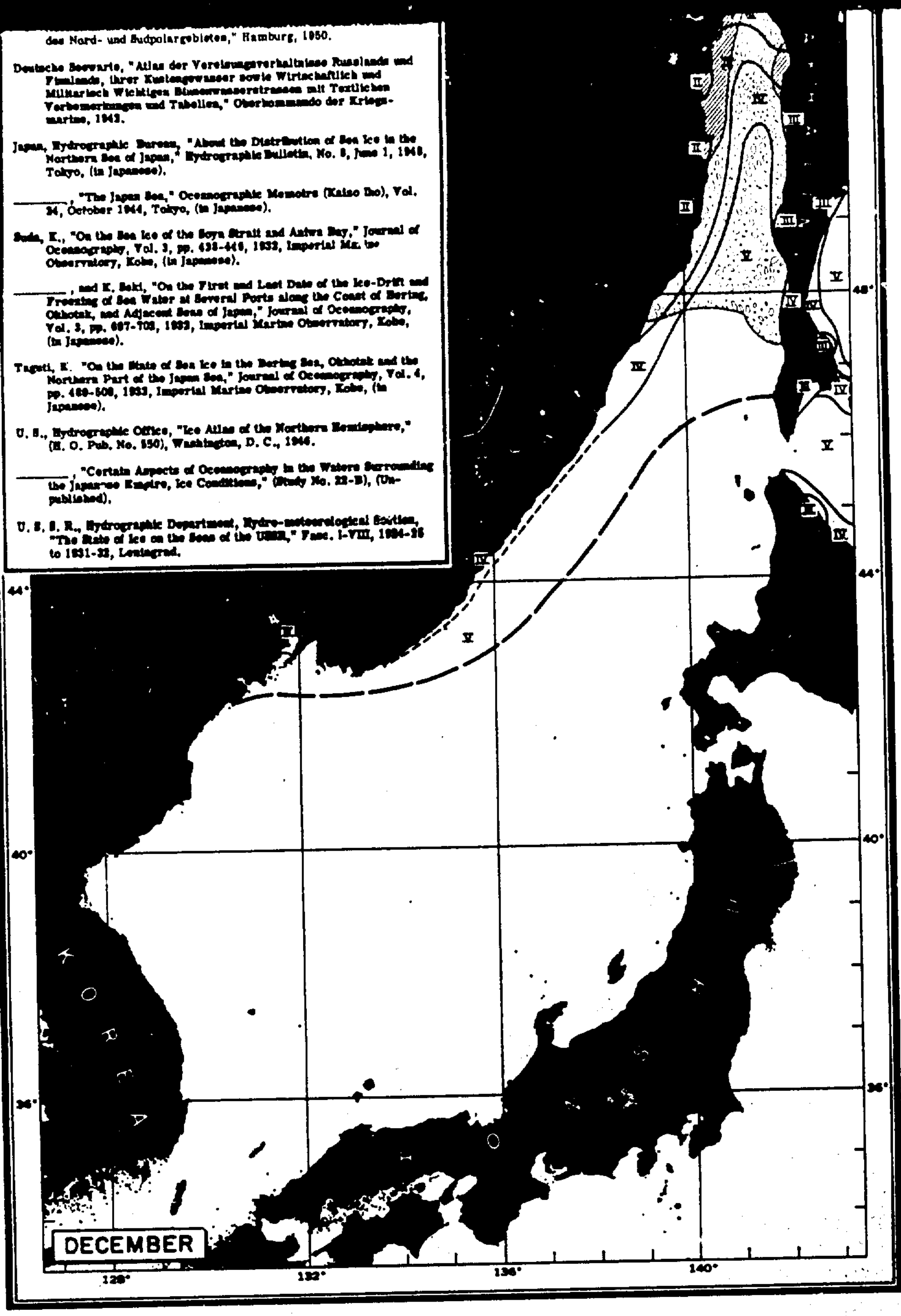
U. S. S. R., Hydrographic Department, Hydro-meteorological Section, "The State of Ice on the Seas of the USSR," Fasc. I-VIII, 1924-25 to 1931-32, Leningrad.



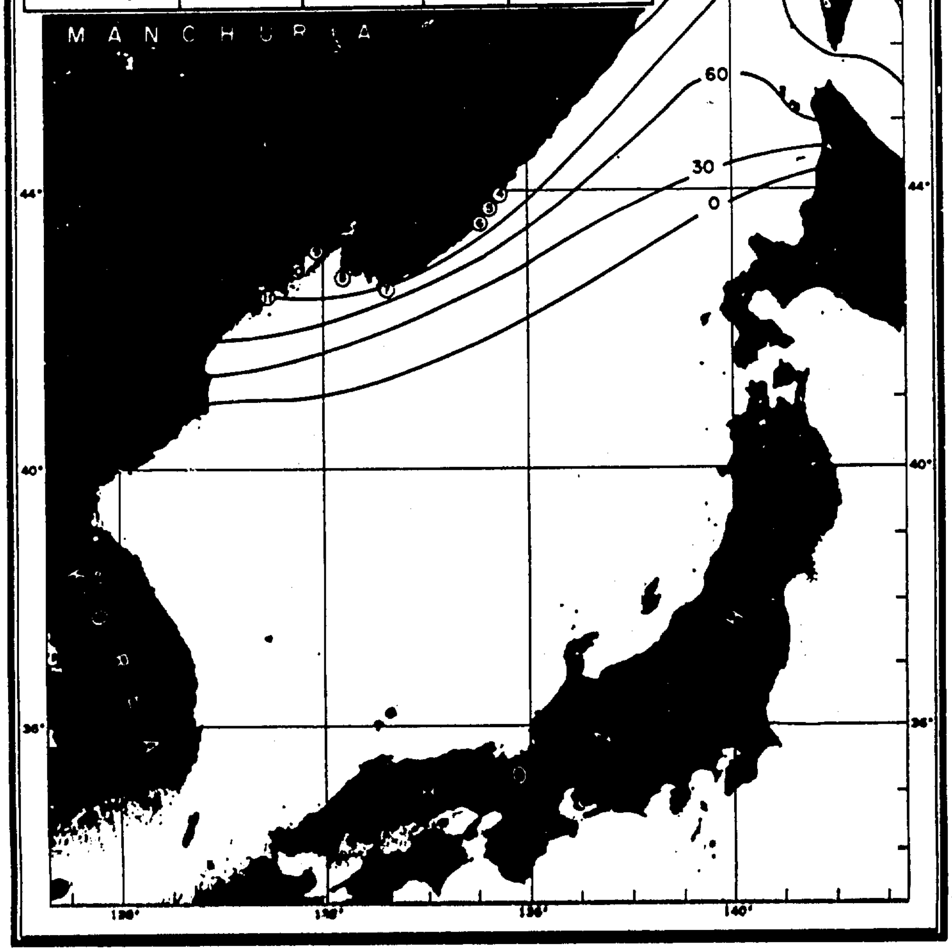

Sea ice has rarely been reported south of 39° N. latitude al
In the most severe winters, ice is limited to bays and harbors,
for any appreciable distance. Some drift ice occasionally come
coast from the mouth of the Tumen River.

During severe winters it has been found necessary to opera
in 1933 the ice reached a thickness of 8 inches, extended to 1
in that condition for 1 month. Ice has also been reported at Ch
Wonsan.

In areas with ice of Class IV (see charts) large vessels hav
may have considerable difficulty since they are not suited for b
relatively thin ice. LCVP's and LCM's have a tendency to ride
ject to holing and rudder and screw damage. These small craf
difficulty with congestion of ice in the intakes of their cooling
is a very frequent occurrence during the early part of the ice se
are common. Boats should avoid such areas, even though they
cause of the above-mentioned clogging of the circulation syste
using small craft in ice are outlined in "Naval Arctic Operation
Operational Notes, Washington, D. C., 1949 (Restricted), and "
H. O. Pub. No. 551, Washington, D. C., 1950 (Restricted).

3

| STATION | NAVIGATION INTERRUPTION Early | Late | NAVIGATION RESUMPTION Early | Late | MAXIMUM THICKNESS (inches) | DURATION OF ICE (days) Max. | Min. |
|---|---|---|---|---|---|---|---|
| 1 Aleksandrovsk - Sakhalinskiy | Nov. 5 | Dec. 17 | Mar. 15 | Jun. 3 | 73 | 162 | 118 |
| 2 Mys Kloster-Kamp | Nov. 21 | Dec. 31 | Mar. 19 | Jun. 3 | 52 | 227 | 126 |
| 3 Sovetskaya Gavan' | Nov. 16 | Jan. 10 | Mar. 20 | May 12 | 75 | 224 | 122 |
| 4 Zaliv Vladimira | Dec. 20 | | Mar. 14 | Apr. 21 | 36 | 129 | 94 |
| 5 Ol'ga | Nov. 24 | | Apr. 9 | Apr. 23 | 23 | 178 | 24 |
| 6 Nizmennyy Mayak | | | | | | 72 | 14 |
| 7 Mys Povorotnyy | | | | | | 50 | 8 |
| 8 Askol'dskiy Mayak | | | | | | 63 | 40 |
| 9 Vladivostok | Nov. 15 | Jan. 12 | Feb. 22 | Apr. 21 | 37 | 169 | 40 |
| 10 Mys Bryusa | Dec. 20 | Jan. 13 | Mar. 1 | Mar. 24 | 28 | 132 | 80 |
| 11 Nastimovskiy Ogon' | Dec. 1 | Dec. 18 | Apr. 2 | Apr. 16 | 18 | 157 | 97 |




n reported south of 39° N. latitude along the east coast of Korea. ;, ice is limited to bays and harbors, none of it extending offshore ce. Some drift ice occasionally comes down along the northeast e Tumen River.

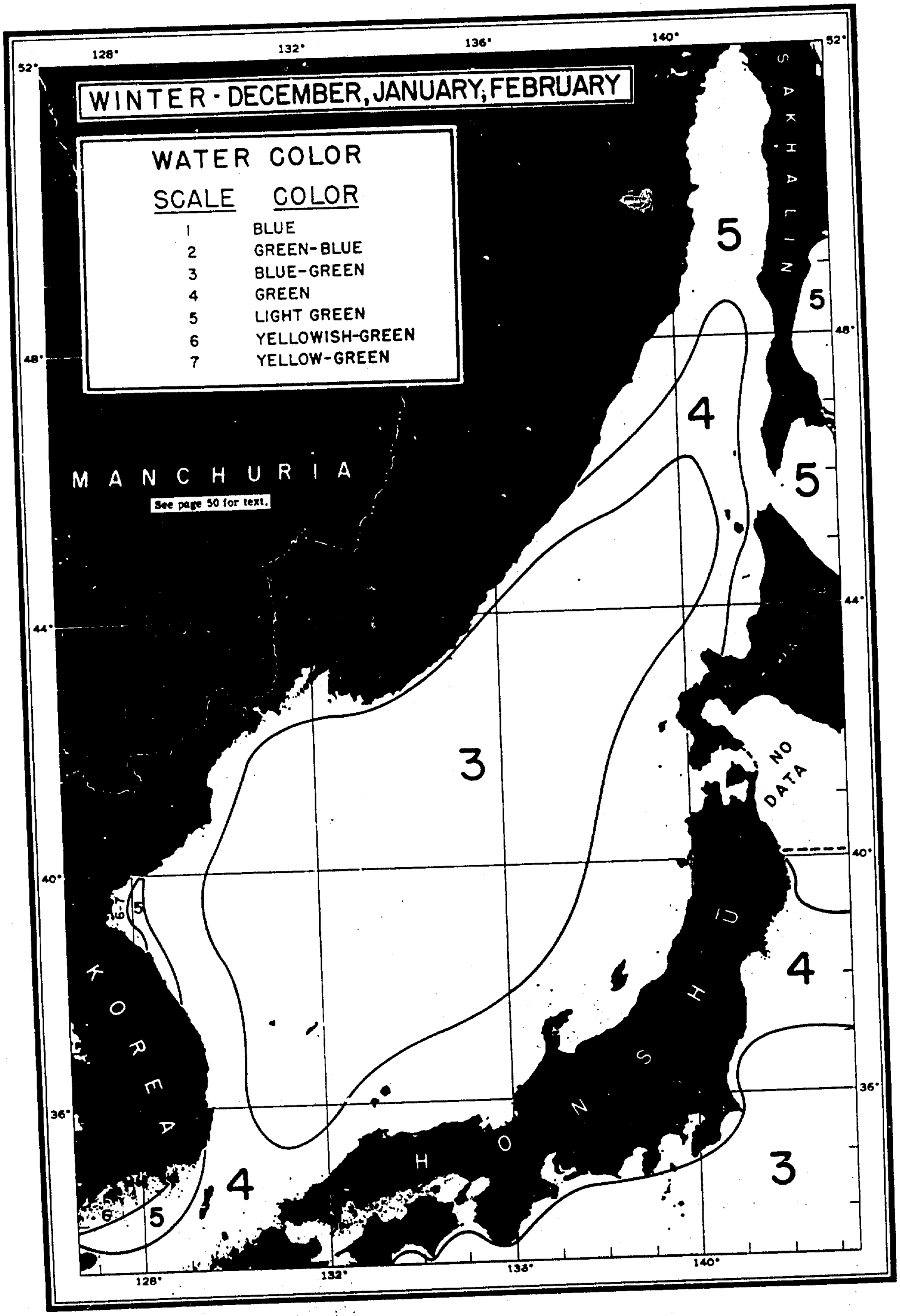
it has been found necessary to operate icebreakers at Najin, where thickness of 8 inches, extended to 1 mile offshore, and remained th. Ice has also been reported at Ch'ongjin, Songjin, Hungnam, and

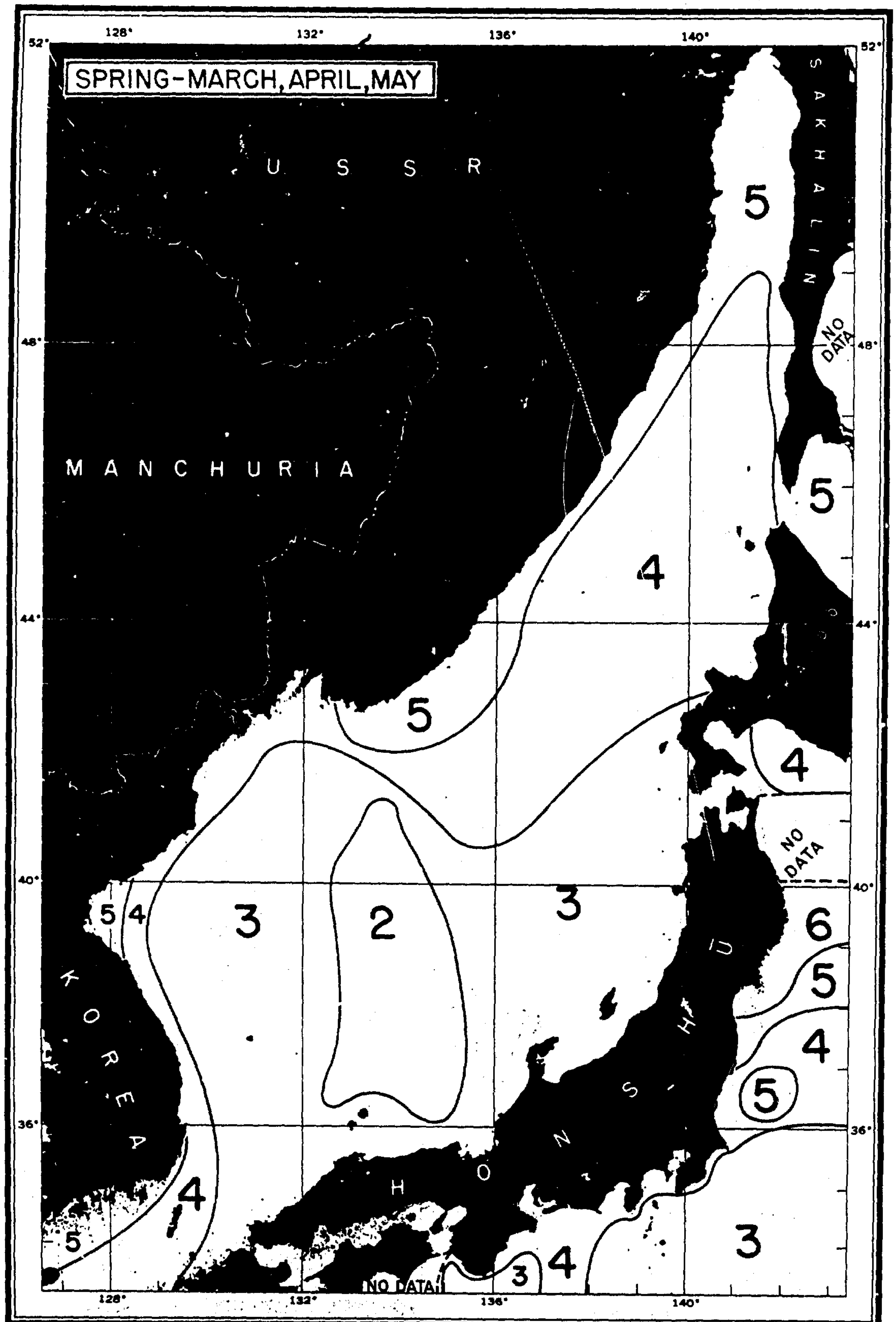
ass IV (see charts) large vessels have no difficulty, but small craft ficulty since they are not suited for breaking channels through even 's and LCM's have a tendency to ride up on ice floes and are sub- and screw damage. These small craft also may have considerable of ice in the intakes of their cooling systems. This complication nce during the early part of the ice season when slush and brash ice l avoid such areas, even though they may be easily traversed, be- ned clogging of the circulation system. Suggested procedures for e outlined in "Naval Arctic Operations Handbook", Part II, gton, D. C., 1949 (Restricted), and "Manual of Ice Seamanship", ngton, D. C., 1950 (Restricted).



RESTRICTED

# WATER COLOR CHART




SPRING-MARCH, APRIL, MAY
U S S R
MANCHURIA
SAKHALIN
KOREA
HONSHU
NO DATA
NO DATA
NO DATA
128°
132°
136°
140°
52°
48°
44°
40°
36°
5
5
4
5
4
3
2
3
6
5
4
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4
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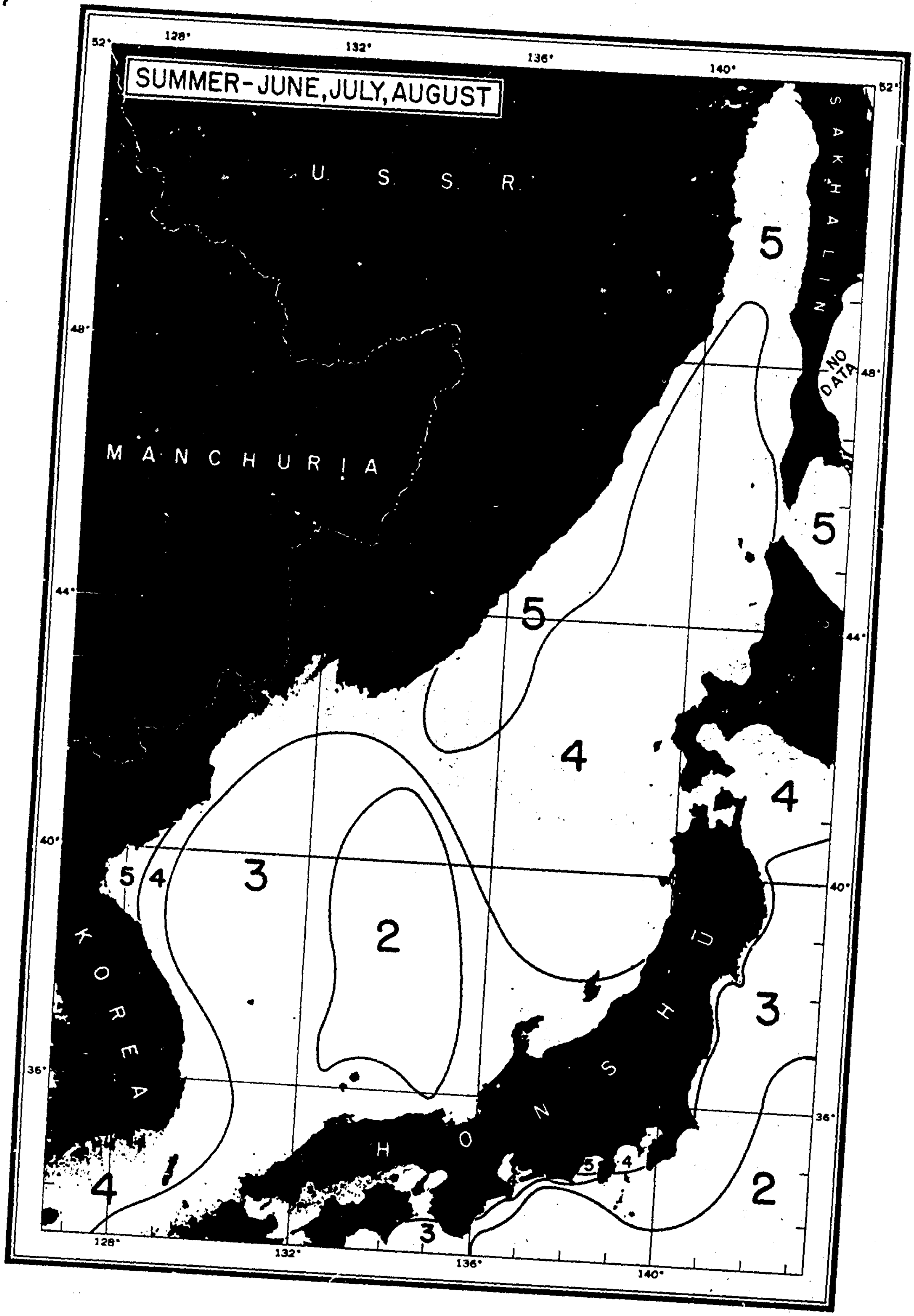
3
4

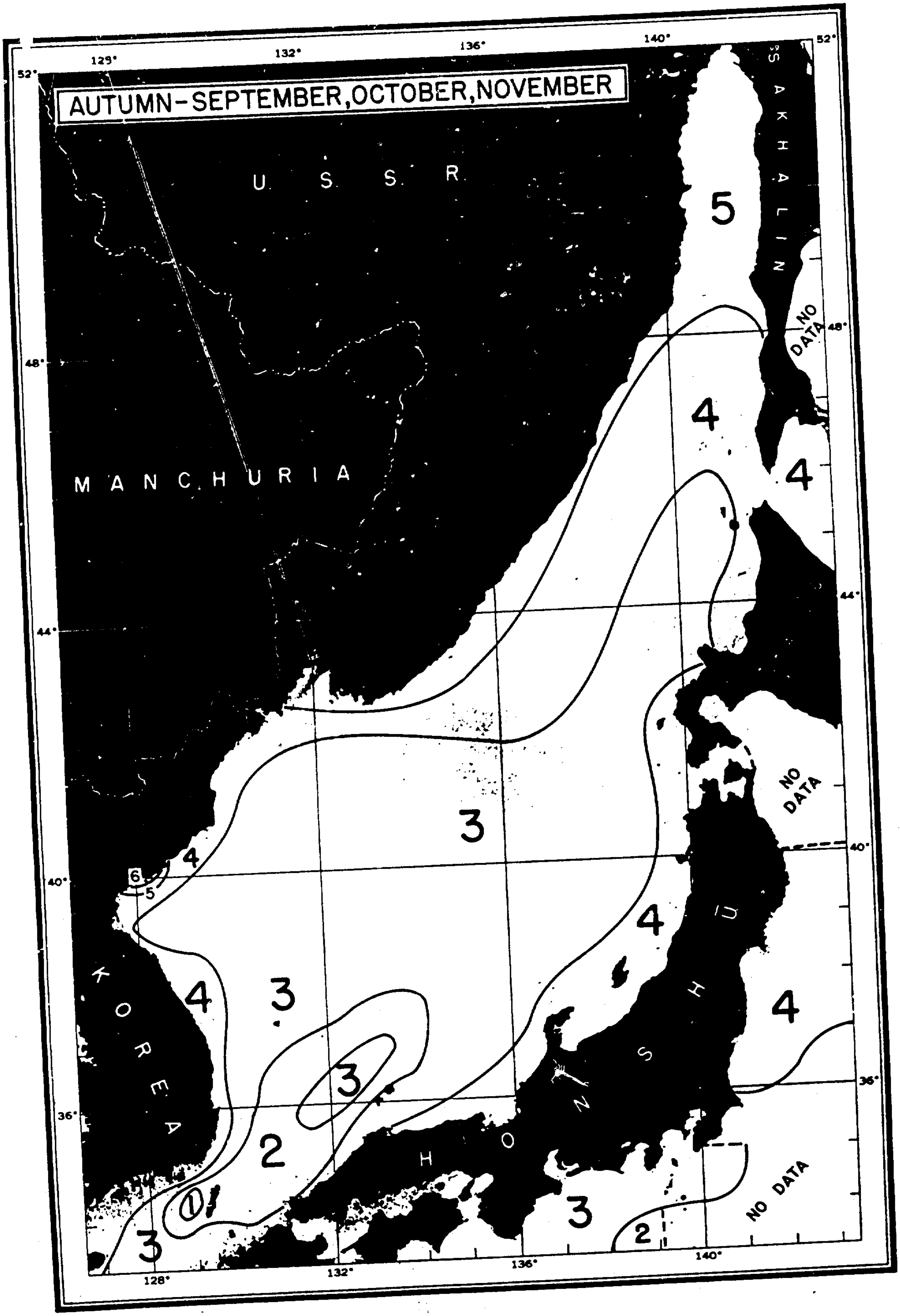
1



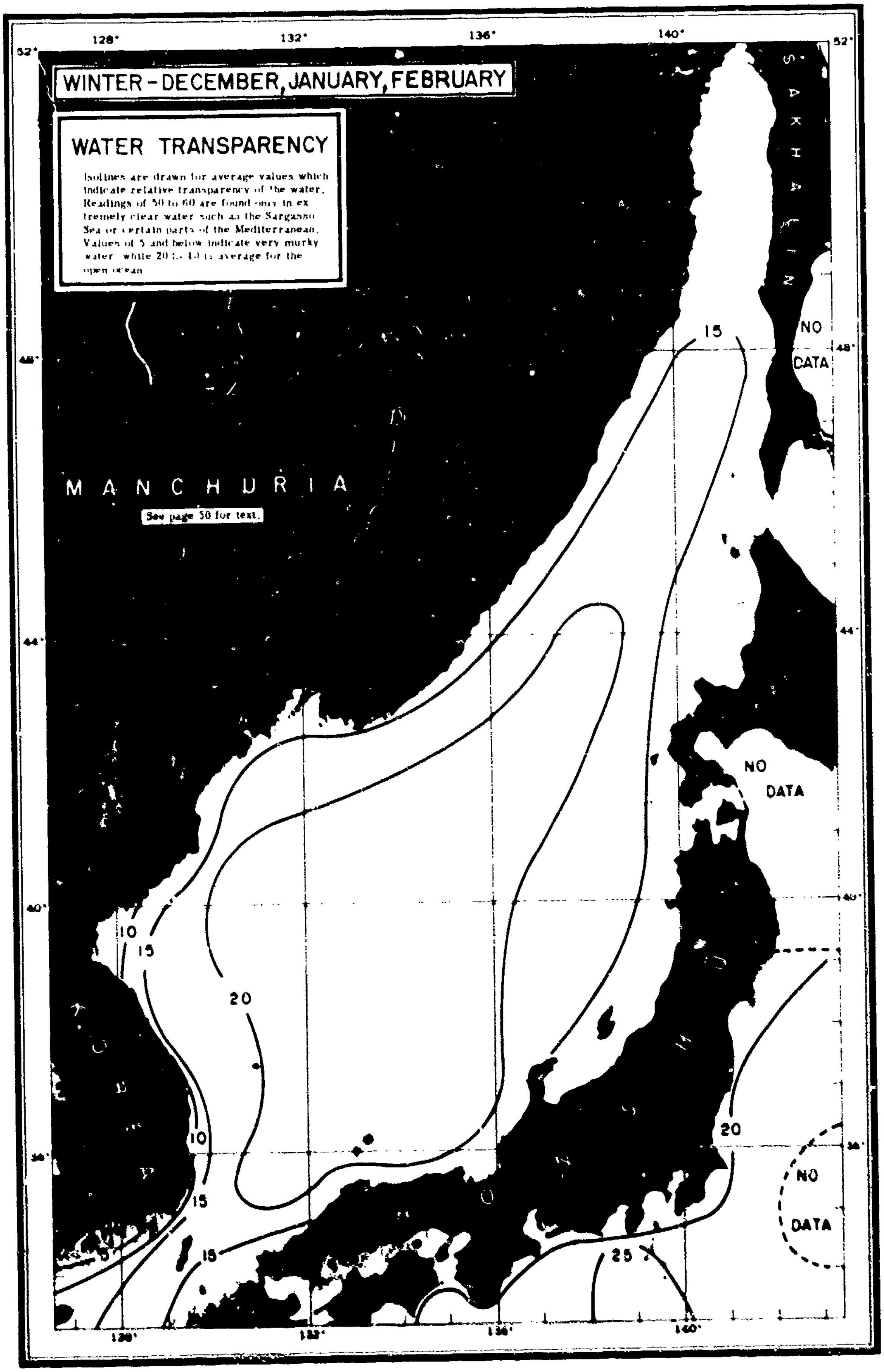

3

RESTRICTED

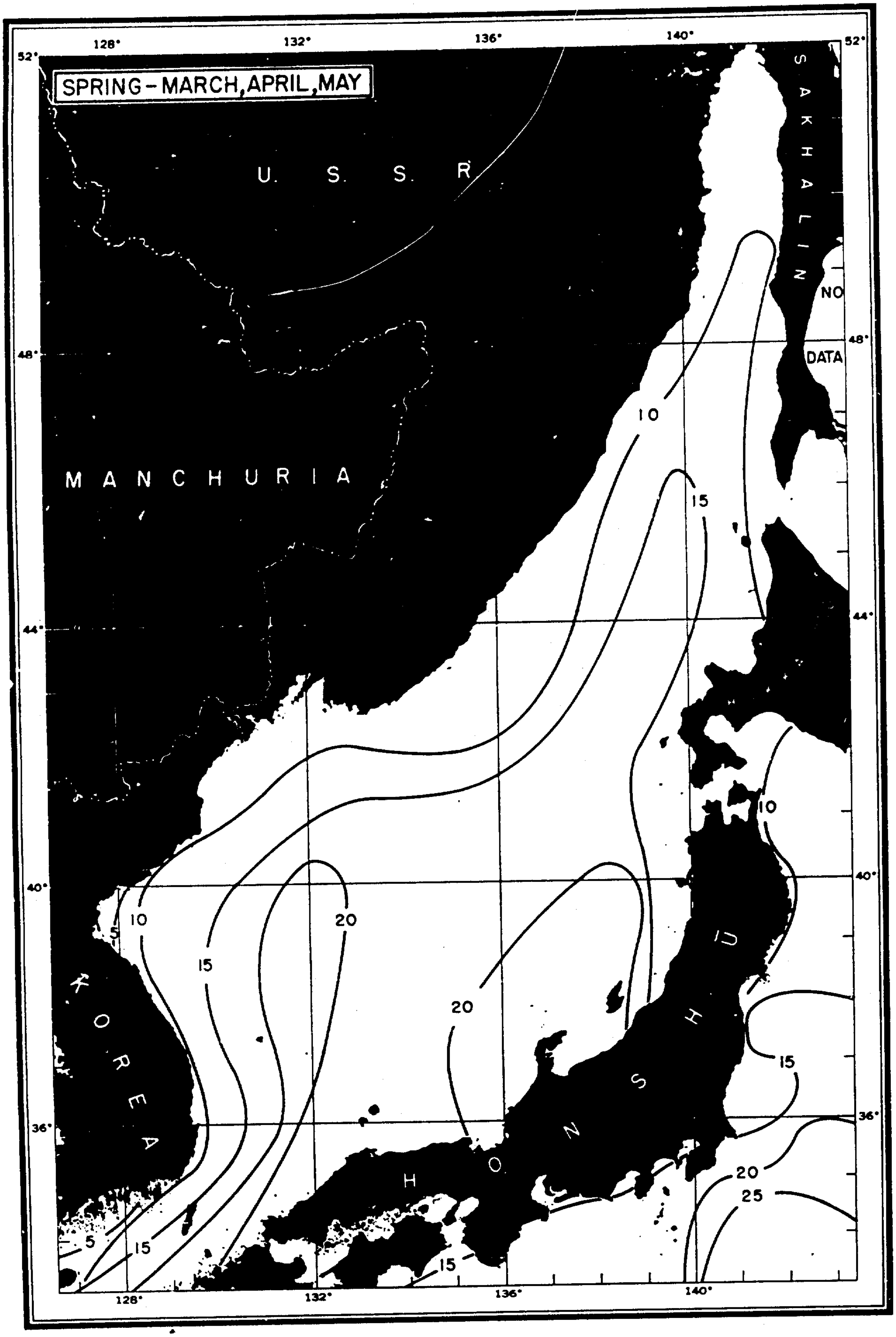
2


AUTUMN-SEPTEMBER,OCTOBER,NOVEMBER
U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HONSHU
NO DATA
NO DATA
NO DATA
5
4
4
4
3
6
5
4
4
3
3
2
1
3
3
2
4
52°
48°
44°
40°
36°
128°
132°
136°
140°

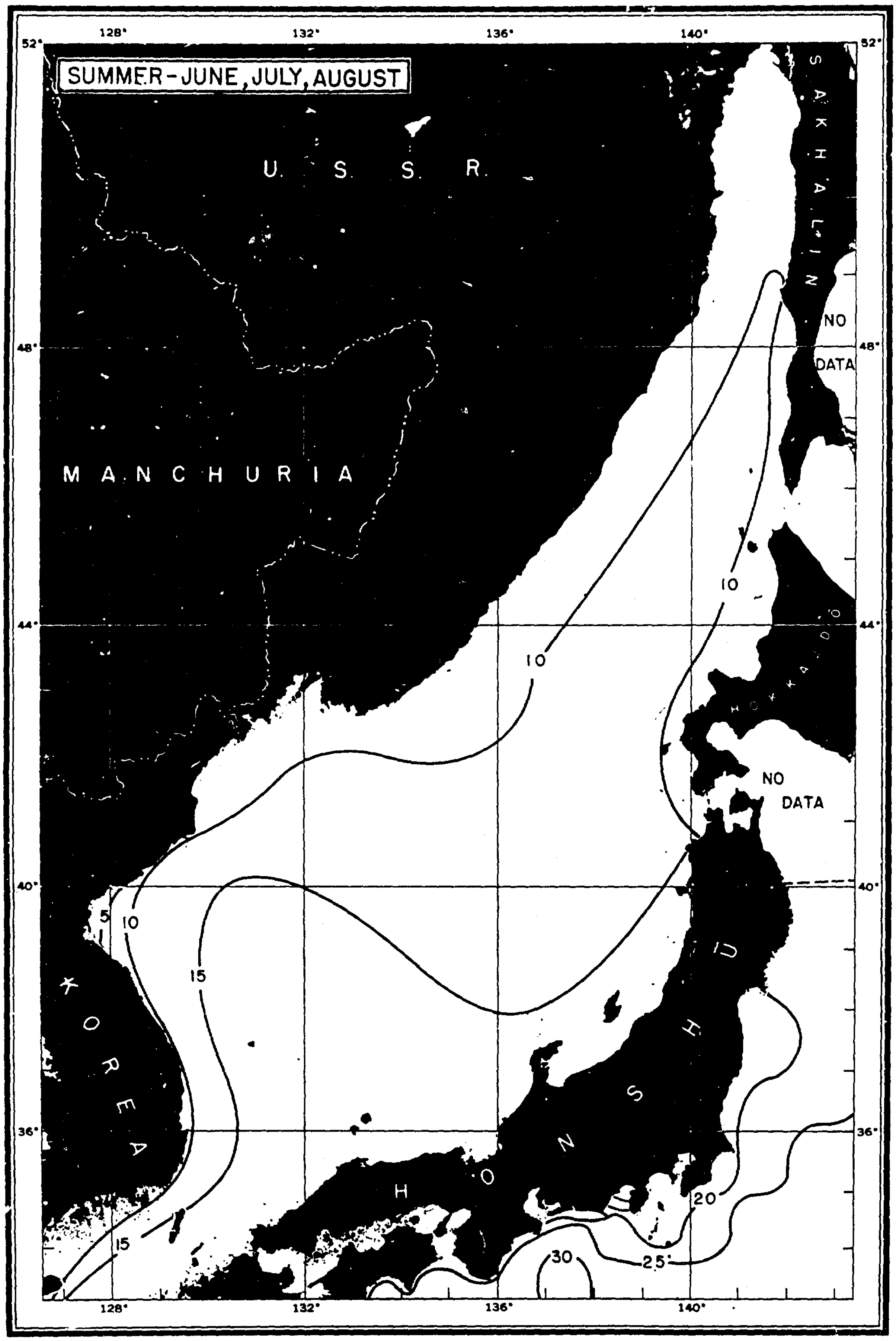
4


WINTER - DECEMBER, JANUARY, FEBRUARY
WATER TRANSPARENCY
Isolines are drawn for average values which indicate relative transparency of the water. Readings of 50 to 60 are found only in extremely clear water such as the Sargasso Sea or certain parts of the Mediterranean. Values of 5 and below indicate very murky water while 20 to 40 is average for the open ocean.
MANCHURIA
See page 50 for text.
SAKHALIN
NO DATA
NO DATA
NO DATA
128°
132°
136°
140°
52°
48°
44°
40°
36°
10
15
20
25

# WATER TRANSPARENCY CHART

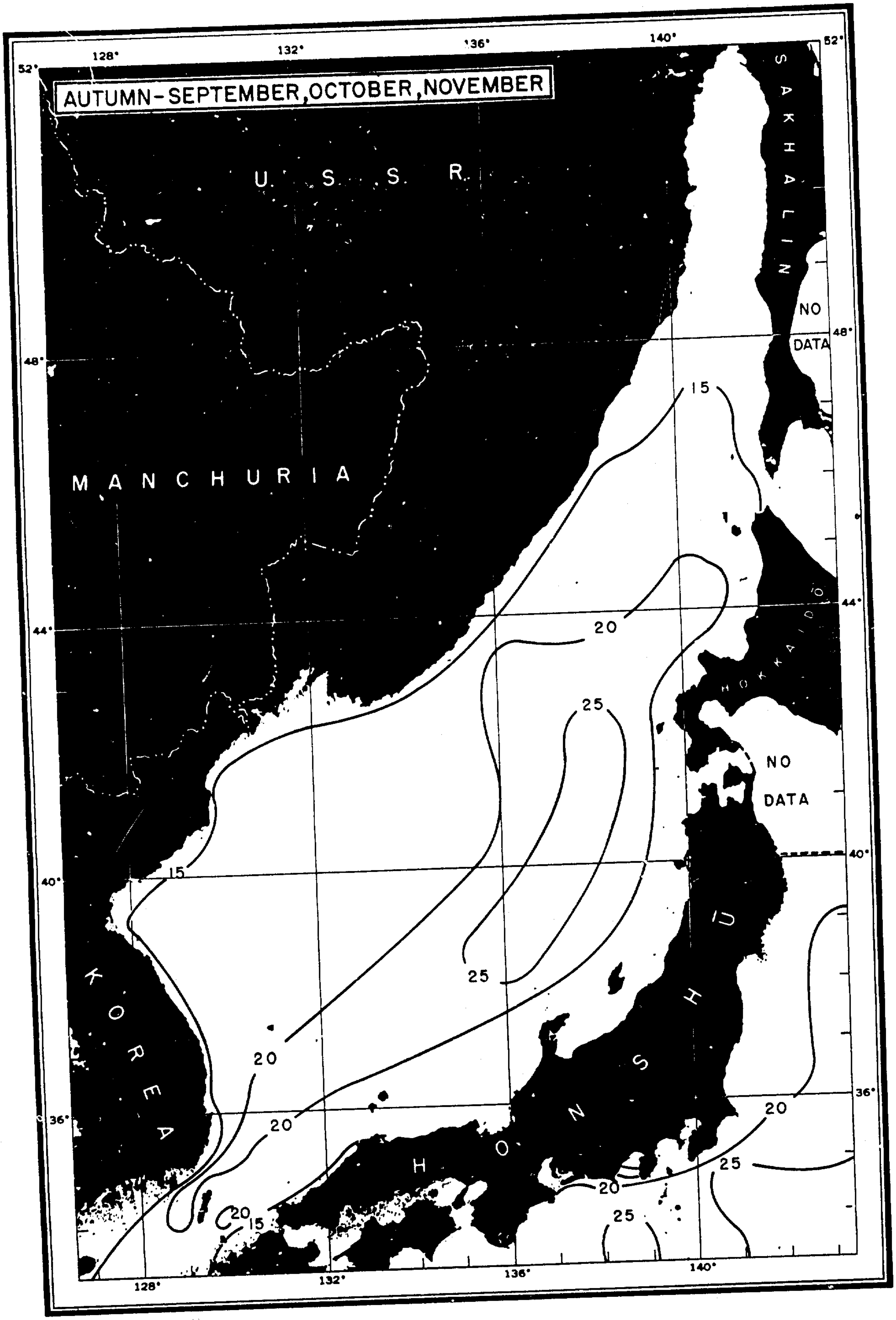


1



SUMMER-JUNE, JULY, AUGUST
U. S. S. R.
MANCHURIA
SAKHALIN
NO DATA
HOKKAIDO
NO DATA
KOREA
HONSHU
10
10
5
10
15
15
20
25
30
128°
132°
136°
140°
52°
48°
44°
40°
36°


3




4

RESTRICTED

## WATER COLOR

Water color is closely related to transparency, although one can not be predicted from the other. Knowledge of water color may be useful for camouflage purposes. In shallow water the color of the bottom may influence the color of the surface water, while in turbid water particle size and composition may affect color. Clear, open waters are normally blue. In the Sea of Japan the blue color is deepest in the southern part, gradually becoming greener northward from Tsushima Strait, and finally becoming light green in the Gulf of Tatary. The harbors, bays, and Inland Sea of Japan generally have a water color ranging from green to yellow. The Sea of Japan and the Japanese Pacific waters will be bluest during autumn and winter, and greenest during spring and summer. Close to shore the color is variable, changing with climatic and local conditions of river and stream discharge as well as beach erosion.

In Japanese waters marked discoloration of the sea caused by the "red tide" may occur during any season of the year. This phenomenon has been recorded most frequently in Ago Wan. Next in frequency is Tokyo Bay. However, it may occur elsewhere. When the "red tide" does occur, the water takes on a brownish red color and transparency decreases as a result of the vast numbers of planktonic organisms suspended. It should be noted that during these periods of red water it is not advisable for persons to swim in the water as these organisms may be toxic to certain individuals if accidentally ingested.

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Japan, Hydrographic Department, "Hydrographic Data on Northern Sea Areas," Vol. 1, No. 8105, November 1941.

U. S., Hydrographic Office, "Marine Geography of Korean Waters," (H. O. Pub. No. 752), Washington, D. C., 1951.

## TRANSPARENCY

The transparency of water is affected by many factors, among which are the following: (1) the angle at which the sun's rays strike the surface of the water, varying with the time of day, the season of the year, and the latitude; (2) reflection from the water surface, which is related to the angle at which the light strikes the surface (reflection increases when the surface is uneven); (3) thickness of the layer through which the light must pass; (4) clearness of the water; (5) the wave length of the light; and (6) the intensity of the light striking the water surface. Variations in these factors can produce great changes in daily and even hourly transparency observations.

Transparency is generally considerably greater in offshore waters than in nearshore waters. Light may penetrate a thousand meters or more in the subtropical ocean, while it may penetrate only several meters beneath the surface in coastal waters. Usually, particulate matter or surface scum in open water decreases transparency. Inshore, where the plankton population and erosion products are more abundant, transparency may be reduced considerably. However, in certain inshore areas where there is very little river runoff, the water may be very clear.

The transparency of sea water in a given area is of military importance in mine and submarine warfare. Submarines riding at shallow depths may become easily visible from search planes in very transparent water. Turbid waters, on the other hand, can conceal underwater operations effectively from searching aircraft.

In the Sea of Japan and adjacent waters, the transparency is greater offshore than inshore.

BIOLUMINES
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FOULING --
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the coast. It
being mollusc
will be simil
ALGAE -- I
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winter to early

## BIOLOGY

BIOLUMINESCENCE — Phosphorescence or "sea fire" in the sea is caused by the firefly-like action of millions of minute organisms in the plankton. The disturbance of the sea surface by the passage of a ship will cause the wake to become illuminated, sometimes making the ship's silhouette clearly visible from above. The phenomenon is erratic and unpredictable, occurring most frequently in the summer and early fall.

FOULING — The fouling of marine equipment begins as soon as the equipment is placed in the water. The process can be divided into three phases which may take place more or less simultaneously: (1) the formation of a slime film, (2) the attachment of macroscopic, or visible, fouling organisms, and (3) the growth of larger forms.

Numerous factors influence the amount of fouling on a submerged object. In tropical and subtropical waters fouling is more rapid than that in northern, colder waters. Generally, in southern waters fouling takes place the year around, whereas in northern waters very little fouling occurs during the winter, although the amount may be heavy in summer. Fouling is always heavier in harbors than in the open ocean. Since salinity of the water will influence the ability of marine organisms to grow and reproduce, fouling will be greatly reduced at the mouths of large rivers where the salinity is very low. However, while some species are adapted to brackish water, others will tolerate only very limited ranges of salinity.

Fouling occurs almost everywhere along the coasts of Korea. The heaviest fouling will occur from late spring to early autumn. Along the Siberian coast of the Sea of Japan fouling will be greatest in the vicinity of Vladivostok, decreasing the farther north one moves along the coast. It will also be heaviest during the summer months, the chief fouling organisms being molluscs and algae. North of Honshu (i.e., western Hokkaido and Sakhalin) fouling will be similar to that on the Siberian coast.

ALGAE — In the Gulf of Tatary, Zaliv Ol'gi, Bukhta Preobrazheniya, and other portions of the Sea of Japan adjacent to Siberia, the rocks on the bottom are entirely covered with large kelps. These kelps are also found throughout the Japanese archipelago where the bottom is rock or firm sand. "Eel grass," which is not an alga but a "seaweed like" marine plant, will be found in shallow water near shore where the bottom is sandy or firm mud, but not attached to rock. It will not grow along beaches exposed to heavy, rough surf. On the east coast of Korea seaweed has been reported in the vicinity of Chumunjin. Floating seaweeds are common in the southern islands of the Japanese archipelago, are most abundant during the spring, and are almost absent during the autumn and early winter.

Small forms of algae will make rocky shores slippery for waders but will not trouble small craft. The large kelps will foul propellers on small craft and may clog water intake lines on craft of all sizes.

DANGEROUS ANIMALS — Several marine animals inhabiting this area possess poison glands that discharge a toxic substance into wounds made by their teeth or other sharp body structure. The toxicity of the poisons varies greatly in different species, and may even vary in the same species in different latitudes. The number of forms capable of producing serious injury and at times death is sufficient to warrant the attention of anyone having occasion to wade or swim in these waters.

A small jellyfish known as the "sea wasp" (Carybdea rastonii), described as dangerous, is found in bays and brackish waters on the surface during morning and evening hours for periods of days to weeks at a time. This organism is found in the Sea of Japan and Japanese Pacific coastal area. A larger form attaining a length of 9 inches is found in the Inland Sea during the winter season. A large jellyfish (Cyanea capillata) which attains a diameter of 1 to 2 feet, is particularly abundant in summer along the Pacific coasts of Sakhalin and Hokkaido and in Aomori Wan. The sting of this jellyfish can be considered uncomfortable, but not dangerous. Certain species of jellyfish are found along the Japanese coast from

Transparency is generally considerably greater in offshore waters than in nearshore waters. Light may penetrate a thousand meters or more in the subtropical ocean, while it may penetrate only several meters beneath the surface in coastal waters. Usually, particulate matter or surface scum in open water decreases transparency. Inshore, where the plankton population and erosion products are more abundant, transparency may be reduced considerably. However, in certain inshore areas where there is very little river runoff, the water may be very clear.

The transparency of sea water in a given area is of military importance in mine and submarine warfare. Submarines riding at shallow depths may become easily visible from search planes in very transparent water. Turbid waters, on the other hand, can conceal underwater operations effectively from searching aircraft.

In the Sea of Japan and adjacent waters, the transparency is greater offshore than inshore. In the sea itself transparency is greatest in autumn, less during the winter and spring, and at a minimum in the summer (June, July, and August). The lowest transparencies, 5 to 10, are found in the western, northern, and northeastern portions of the Sea of Japan. In the southern and eastern portions, the minimum varies from 10 to 15. During all seasons, transparency in the central offshore waters ranges from 15 to 25. Values of 25 are most likely to occur during the autumn season.

An interesting feature of the transparency pattern in the vicinity of Honshu is the manner in which the isolines conform to the general current circulation pattern. In the area between 35° and 39° N. off the east coast of Honshu there is a bending of the isolines showing the effect of the Kuroshio. Since the effect of this current is even more pronounced on the water color, it is possible to observe an interrelationship between water transparency, water color, and current circulation.

Although transparency data on the Inland Sea of Japan are incomplete, the following summary of conditions found is based on scattered observations made during the winter by Japanese investigators. In January and February 1939, a series of observations made in the Inland Sea showed the following ranges of transparency: western end 3 to 10, central part 4 to 9, eastern end 5 to 10, and southern part 9 to 19. In December 1931 some isolated transparency values were obtained in the Inland Sea which correspond closely to the values given above. It was found that the most turbid water occurred in the narrower portion of the Inland Sea, to the north of Shodo Shima, in the straits, and among the islands to the west of Shodo Shima. The water apparently tends to become progressively clearer as the Inland Sea widens to the west and discharges into Bungo Suido. In the lower part of Bungo Suido transparencies are somewhat lower than those of Kii Suido at the eastern end of the Inland Sea. Since only one series of observations was taken in each area, caution must be used in interpreting these data. The variation within any one bay may easily be greater than the variation in different parts of the Inland Sea at any one time.

References:

Allee, W. C., A. E. Emerson, O. Park, T. Park, and K. P. Schmidt, "Principles of Animal Ecology," p. 124, W. B. Saunders and Company, Philadelphia and London, 1949.

Japan, Hydrographic Department, "Hydrographic Data on Northern Sea Areas," Vol. 1, No. 8105, November 1941.

————, Journal of Oceanography, Vol. 1, pp. 173-367, 1929; Vol. 2, pp. 537-644, 1931; Vol. 4, pp. 371-445, 1933; Vol. 8, pp. 1-65, 201-213, and 265-313, 1935; Vol. 9, pp. 101-271, 1936; Vol. 11, pp. 221-363, 1938; Vol. 12, pp. 175-235, 235-259, 1940, Imperial Marine Observatory, Kobe.

U. S., Hydrographic Office, "Marine Geography of Formosan Waters," (H. O. Pub. No. 755), Washington, D. C., 1951.

————, "Marine Geography of Korean Waters," (H. O. Pub. No. 752), Washington, D. C., 1951.

injury and at times death is sufficient to warrant the attention of anyone having occasion to wade or swim in these waters.

A small jellyfish known as the "sea wasp" (Carybdea rastonii), described as dangerous, is found in bays and brackish waters on the surface during morning and evening hours for periods of days to weeks at a time. This organism is found in the Sea of Japan and Japanese Pacific coastal area. A larger form attaining a length of 9 inches is found in the Inland Sea during the winter season. A large jellyfish (Cyanea capillata) which attains a diameter of 1 to 2 feet, is particularly abundant in summer along the Pacific coasts of Sakhalin and Hokkaido and in Aomori Wan. The sting of this jellyfish can be considered uncomfortable, but not dangerous. Certain species of jellyfish are found along the Japanese coast from winter to early summer. Others, sessile forms, can cause severe pain and frequently high fever for some days or weeks.

2

Divers in Japan claim that a common shallow water sea urchin is capable of causing death from the effects of its sting.

Among the dangerous and venomous fishes of this area are small sharks which possess a poisonous dorsal spine, sting rays, scorpion fish, catfishes which also have poisonous dorsal spines, and siganids which are a perch-like group having two stinging spines on each pelvic fin. These animals are troublesome only if handled or accidentally stepped upon with bare feet. They are not aggressive and in all probability will leave an area at the sound of an intruder in the water.

Sea snakes are found in the coastal waters of the southern Japanese islands, i.e., Kyushu, Shikoku, and southern Honshu, as well as southern Korea. On occasion they have been reported from the central and northern parts of the Sea of Japan. These animals are not aggressive, but if disturbed accidentally they will strike. Their bite is dangerous because they inject a deadly venom into the wound. Sea snakes can be differentiated from terrestrial forms by their paddle-like tail and from eels by their scaly skin.

Certain fishes of this area are dangerous because they are capable of inflicting physical damage upon their victims. Among this group are included the sharks, barracuda, moray eels, and certain puffers that are sometimes vicious.

BIOLOGICAL NOISES -- The waters of this area contain marine animals that generate noise. The noisiest areas are those in the vicinity of rocky shore lines, coral, and hard sand bottoms because these are the haunts of many noisemaking fish as well as snapping shrimp colonies. Whales and porpoises that inhabit open waters and shallower coastal regions are troublesome not only because of their noise production but also because of their large size. They interfere with echo ranging operations by returning pings. They are also very curious animals and will frequently follow a submarine about. Some porpoise noise resembles a fast, small boat screw. Their whistles, which are rising ping sounds, can be differentiated from echo range pings by the fact that they cannot be tuned out of the receiver.

References:

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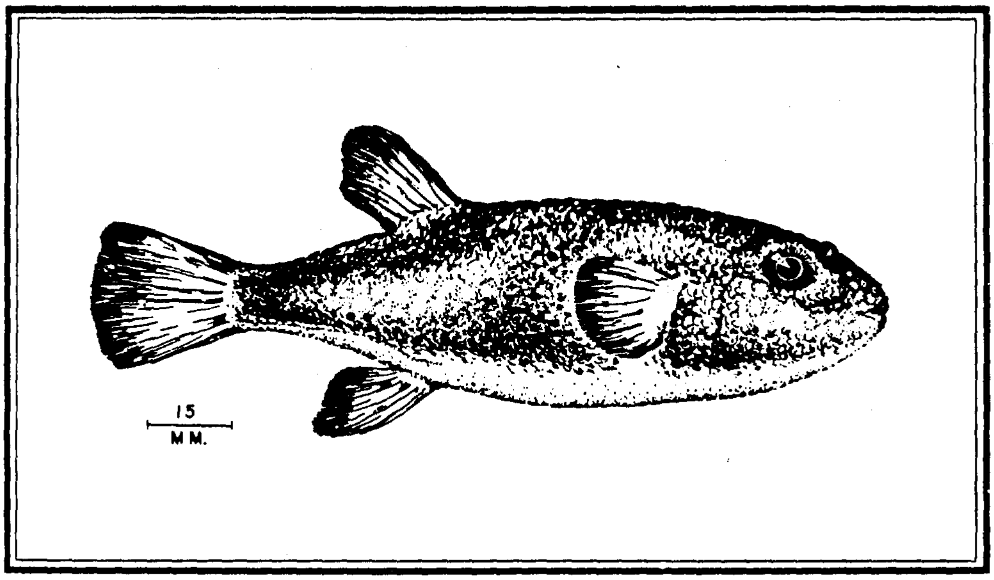
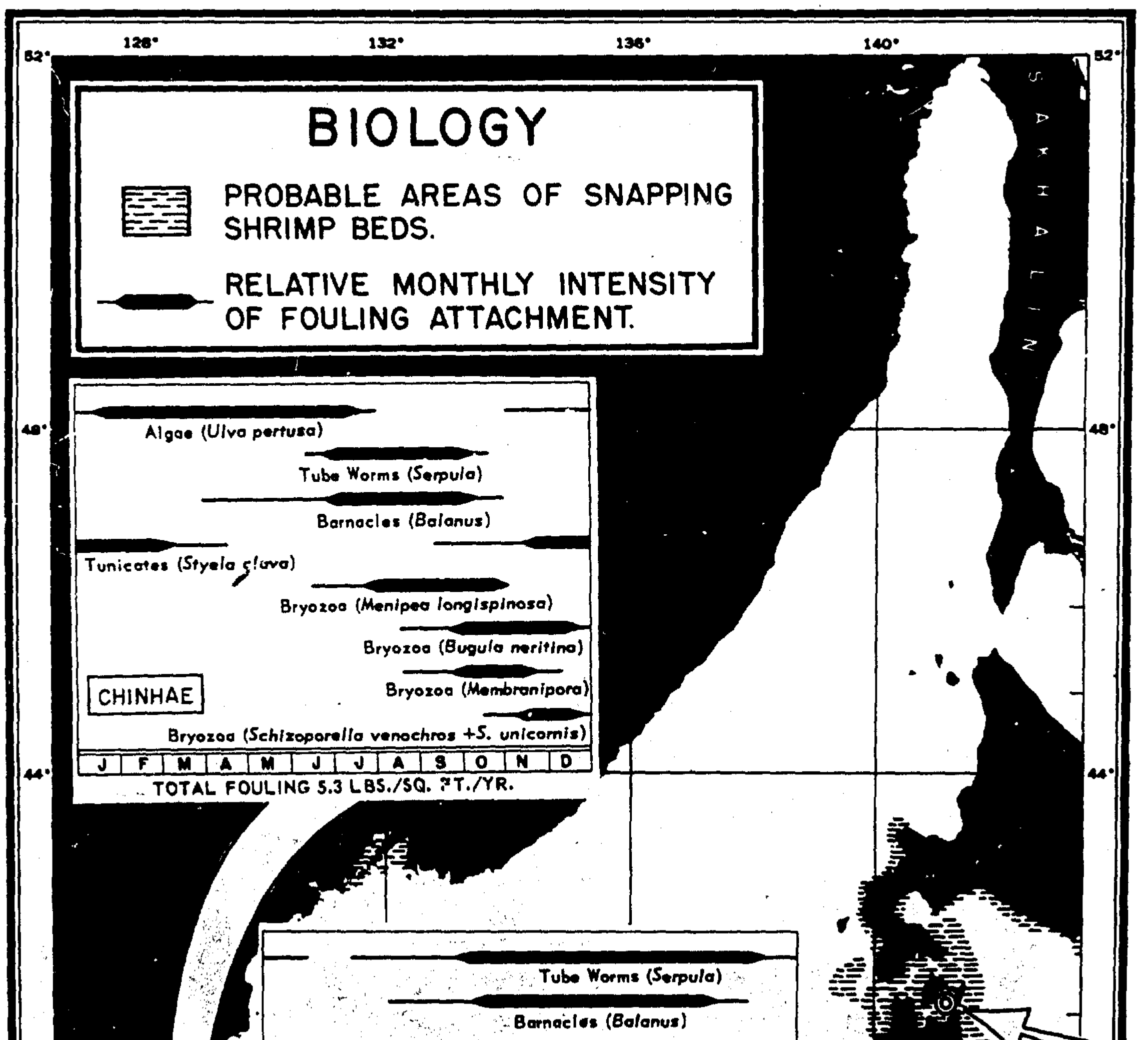
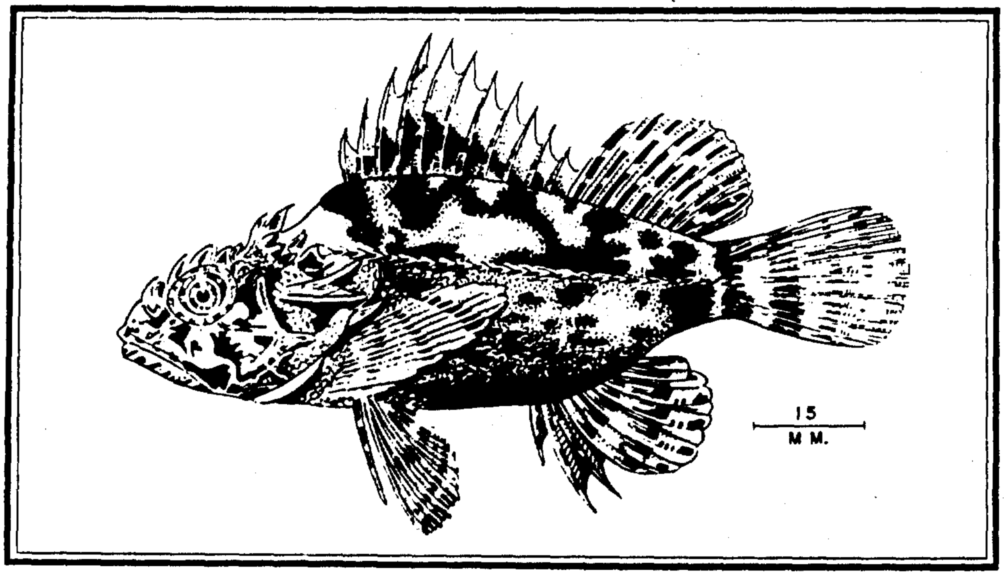
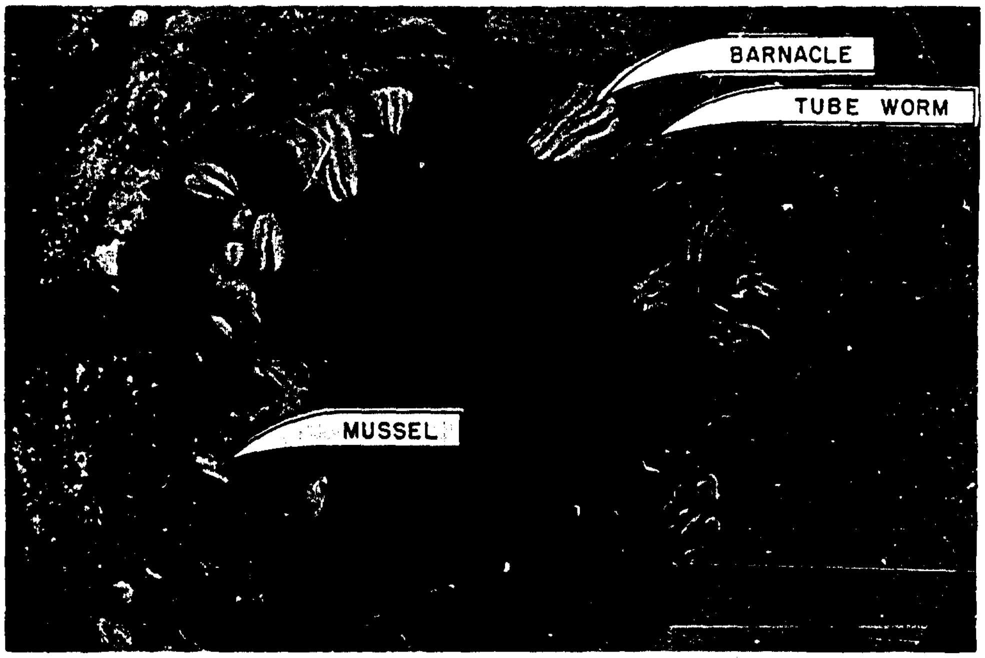



Puffer Fish. Certain members of this group are vicious and will attack swimmers and waders. Most species are inedible.

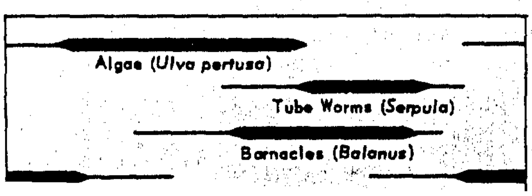


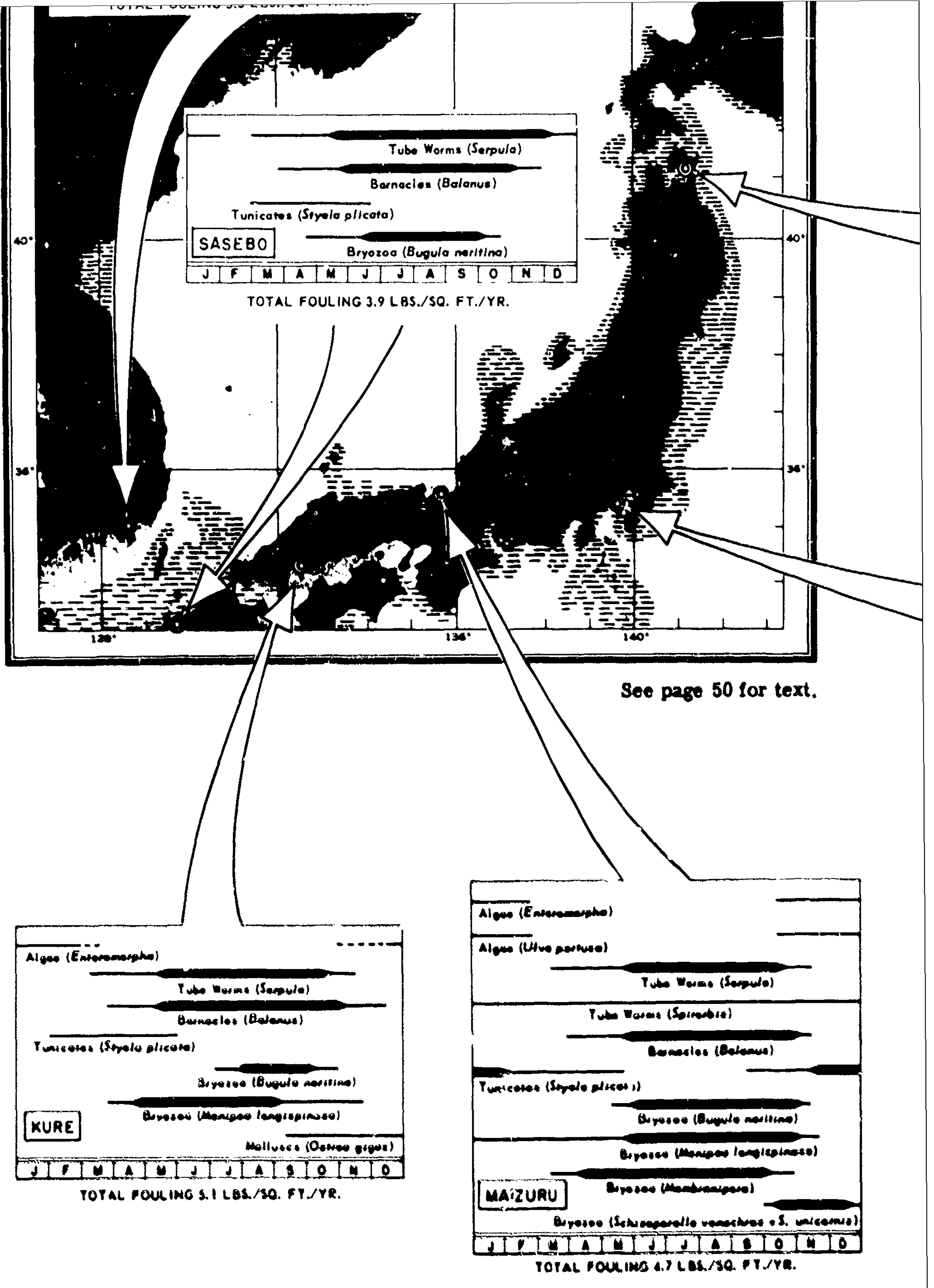



Scorpion Fish. Fin rays of this fish possess poison glands at their base.




Fouling by mussels, barnacles, and other forms in ship fire main.






See page 50 for text.

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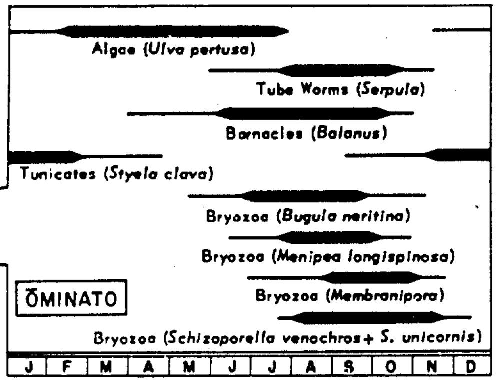
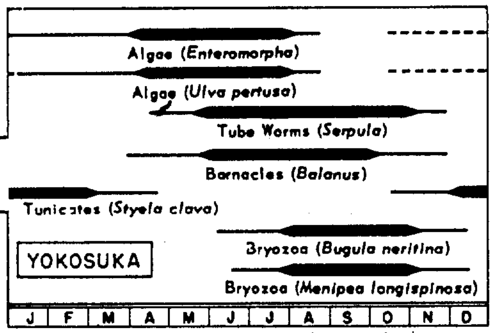
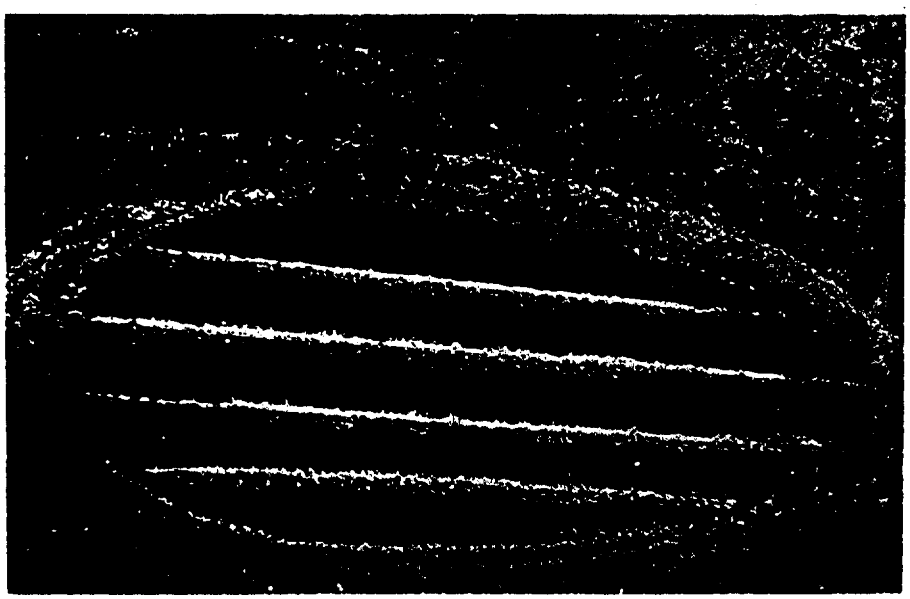



TOTAL FOULING 6.9 LBS./SQ. FT./YR.




TOTAL FOULING 5.2 LBS./SQ. FT./YR.



**Tube worm fouling ship intake.**



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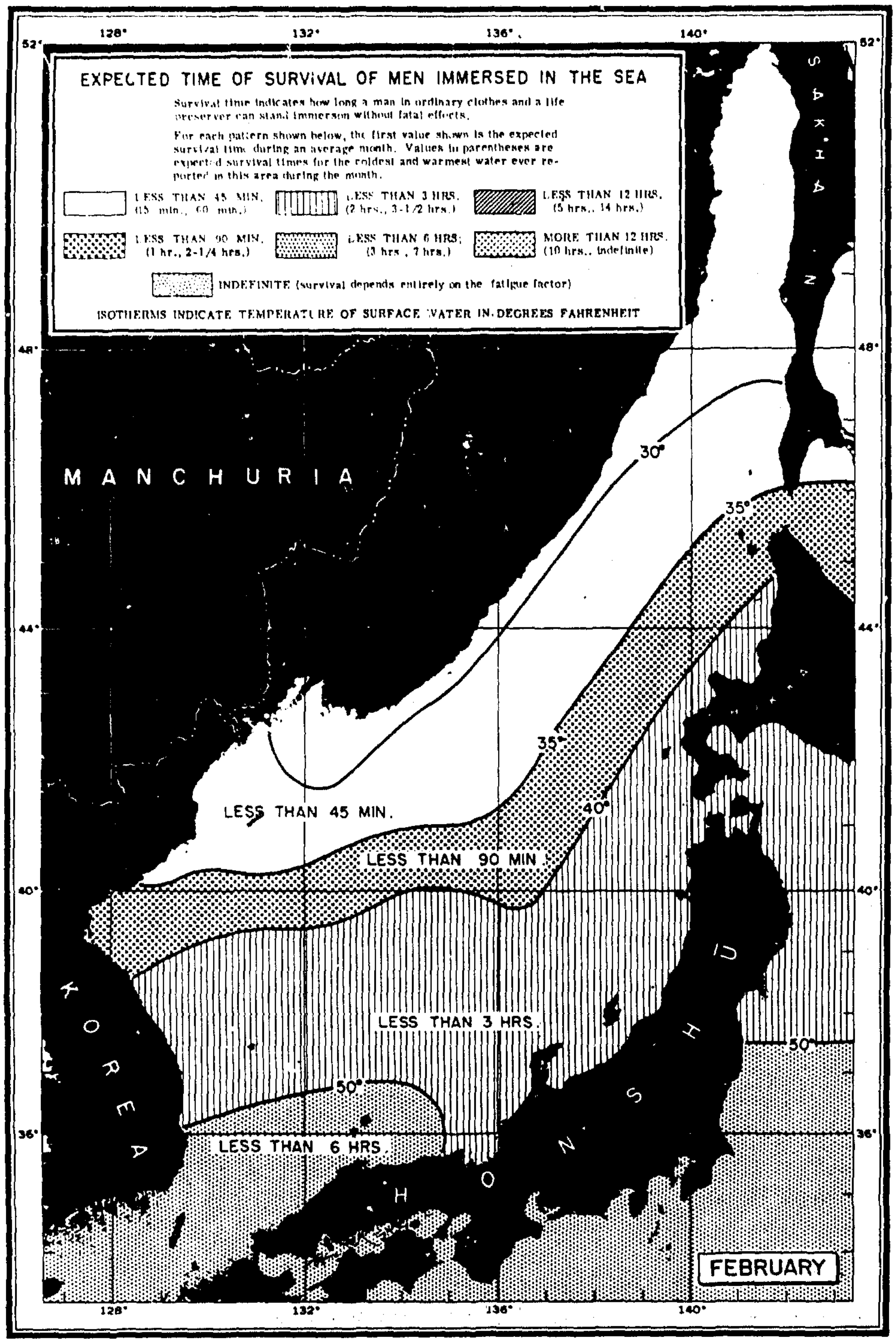
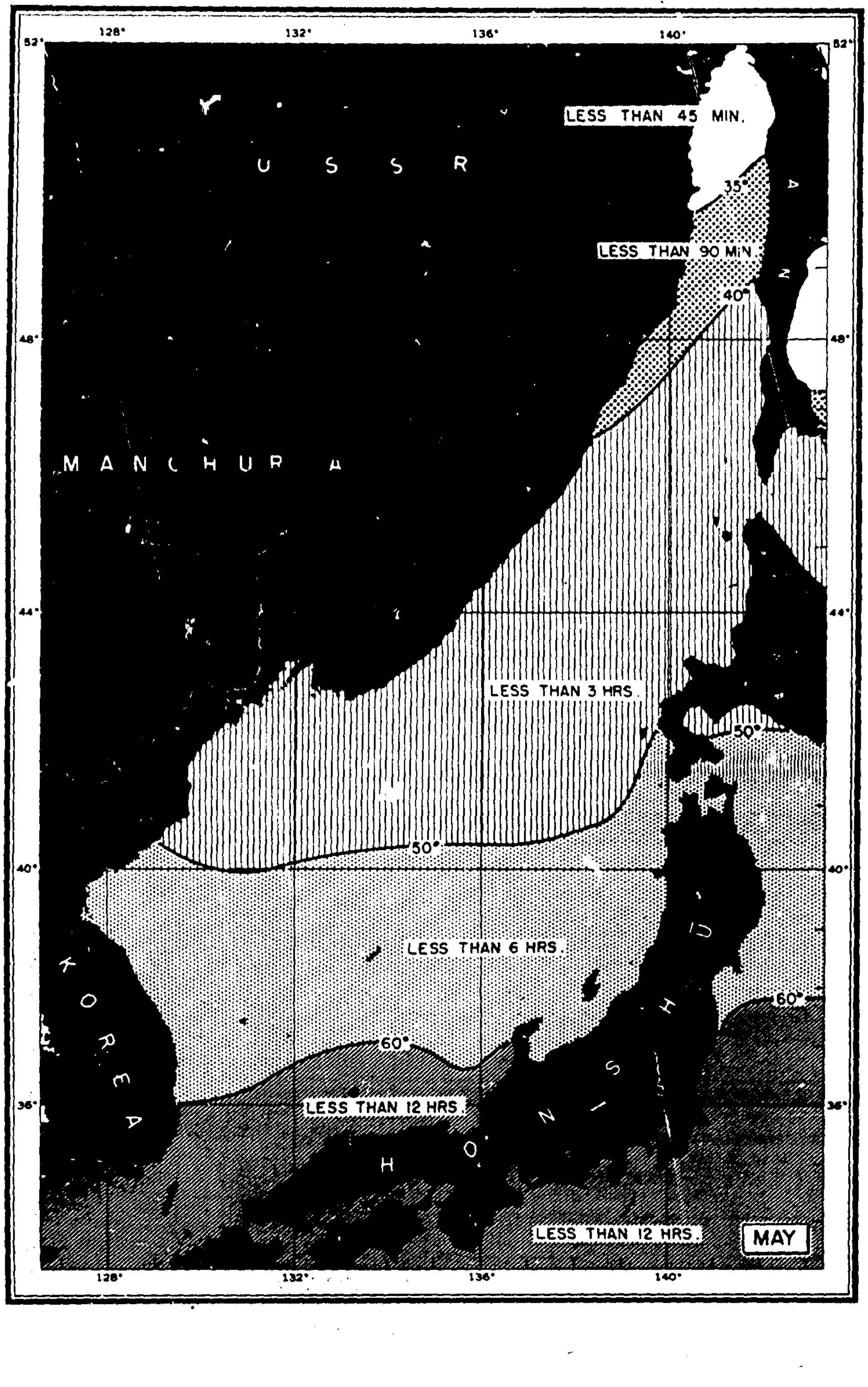
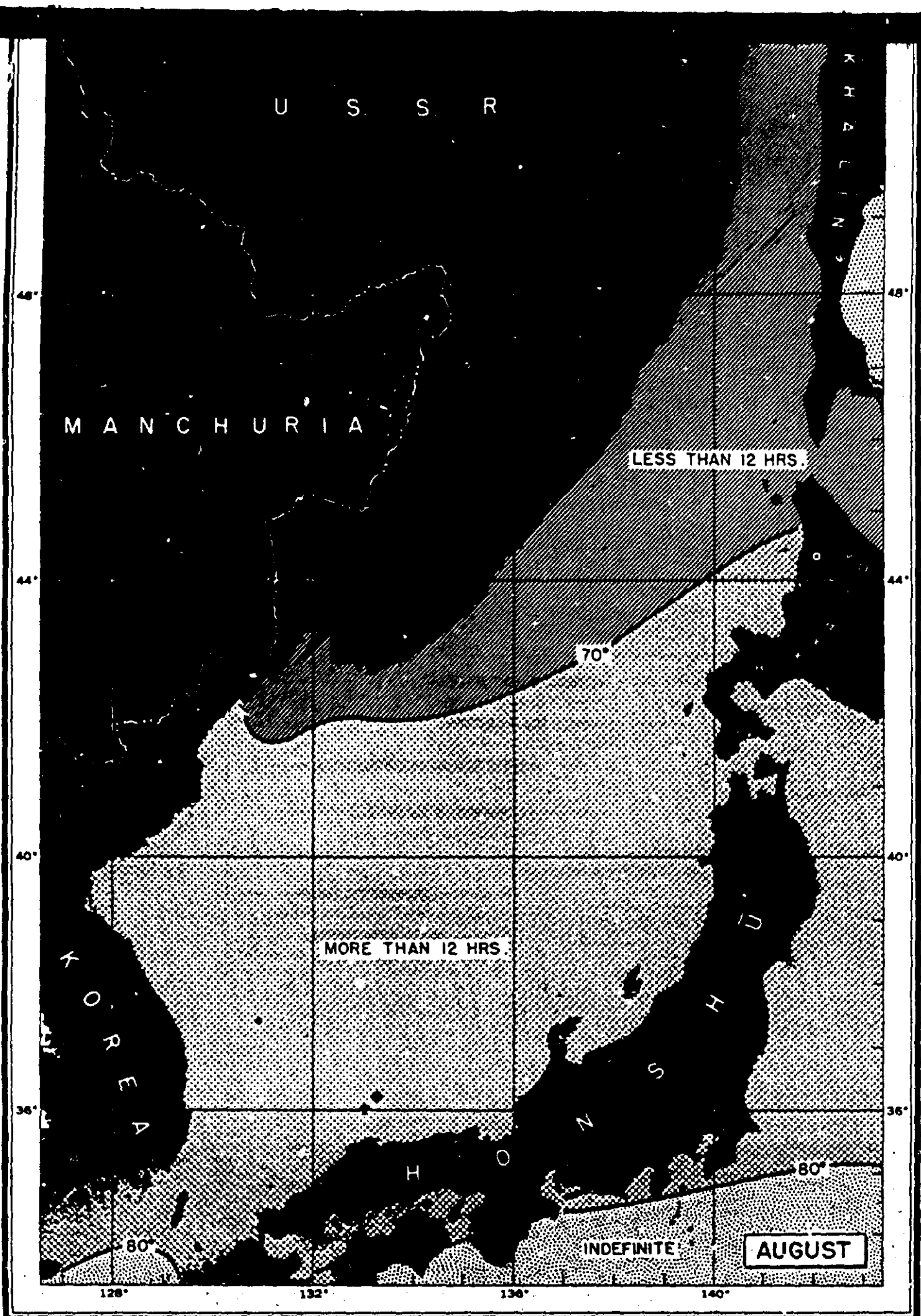

EXPECTED TIME OF SURVIVAL OF MEN IMMERSED IN THE SEA
Survival time indicates how long a man in ordinary clothes and a life preserver can stand immersion without fatal effects.
For each pattern shown below, the first value shown is the expected survival time during an average month. Values in parentheses are expected survival times for the coldest and warmest water ever reported in this area during the month.
LESS THAN 45 MIN. (15 min., 60 min.)
LESS THAN 3 HRS. (2 hrs., 3-1/2 hrs.)
LESS THAN 12 HRS. (5 hrs., 14 hrs.)
LESS THAN 90 MIN. (1 hr., 2-1/4 hrs.)
LESS THAN 6 HRS. (3 hrs., 7 hrs.)
MORE THAN 12 HRS. (10 hrs., indefinite)
INDEFINITE (survival depends entirely on the fatigue factor)
ISOTHERMS INDICATE TEMPERATURE OF SURFACE WATER IN DEGREES FAHRENHEIT
128°
132°
136°
140°
52°
48°
44°
40°
36°
MANCHURIA
SAKHALIN
KOREA
HONSHU
30°
35°
40°
50°
LESS THAN 45 MIN.
LESS THAN 90 MIN.
LESS THAN 3 HRS.
LESS THAN 6 HRS.
FEBRUARY



128°
132°
136°
140°
52°
48°
44°
40°
36°
LESS THAN 45 MIN.
U S S R
35°
LESS THAN 90 MIN.
40°
M A N C H U R A
LESS THAN 3 HRS.
50°
LESS THAN 6 HRS.
K O R E A
60°
LESS THAN 12 HRS.
H O N S H U
MAY




The criterion for determining the limit of time of survival of a person is the point where his rectal temperature declines to 78.6°F. At this po vidual is expected to die. There are, of course, exceptions since surviv depend ultimately on the endurance of the particular individual involved.

In water colder than 68°F., it has been found that continuous moveme struggling will lengthen greatly the time of survival. In water near the f tinuous movement by the individual should produce about as much heat c he should not die of cold as long as he is able to swim or struggle. An rescued while swimming or struggling would not necessarily need rewarr muscles which have been exercised hard may remain warm enough to pre coming stiff. If individuals try to preserve their strength by clinging to on their life belts, they will die from cold much faster than if they had k struggling.

The survival times shown on the charts are those which may be expe dressed in ordinary shipboard clothing and kept afloat by life jackets. times will be increased considerably if the individuals are aboard life r creased severalfold if the individuals are wearing survival suits. The l times shown in this study are based on actual survivor data accumulated period as well as on laboratory experiments.

References:

Alexander, Major Leo, "The Treatment of Shock from Prolonged Exposure to Cold, Especially in Water," Combined Intelligence Objectives Subcommittee, 1945.

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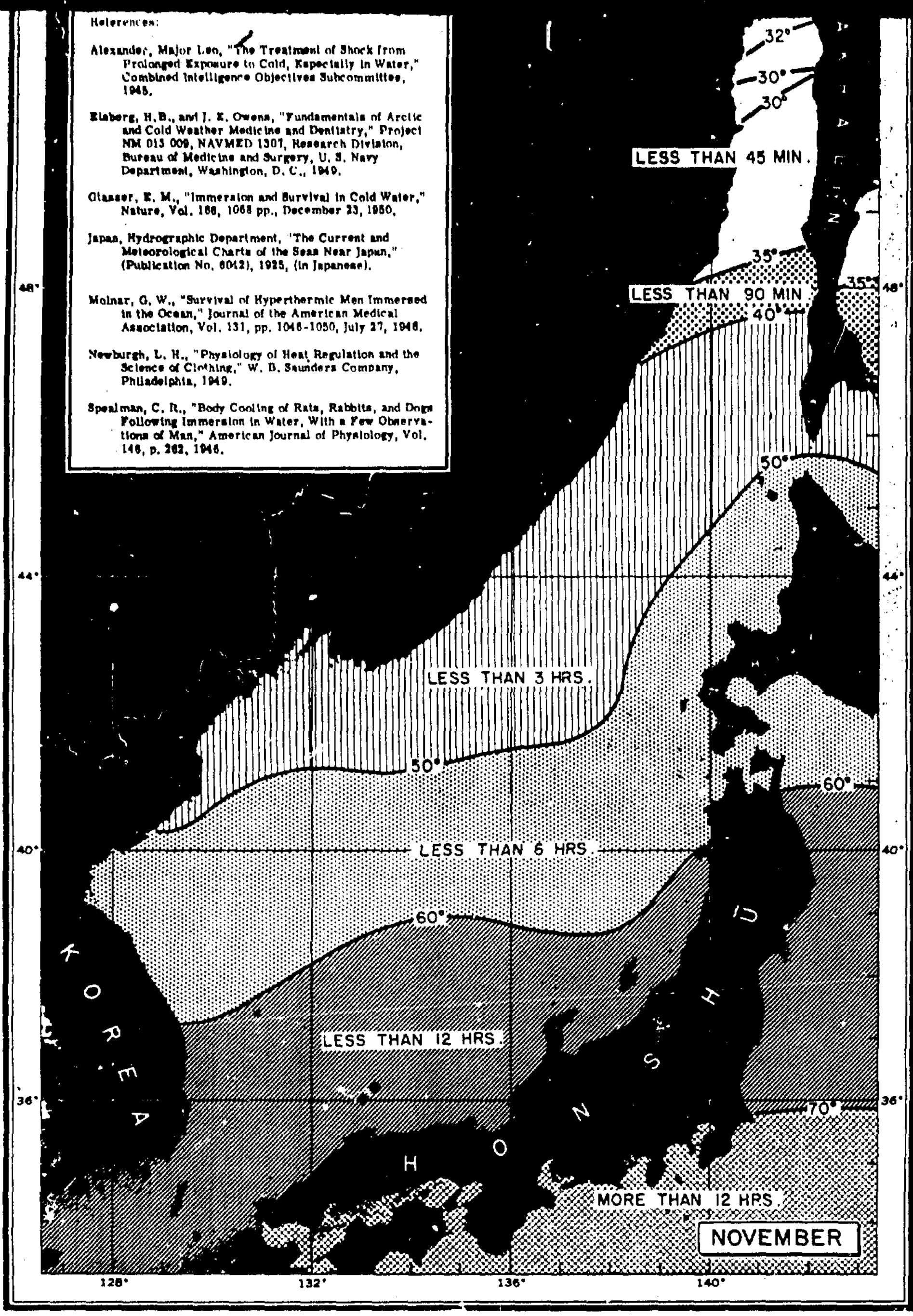


2

limit of time of survival of a person immersed in the sea ature declines to 78.6°F. At this point an average indi- e, of course, exceptions since survival in cold water will o. the particular individual involved.

s been found that continuous movement by swimming or time of survival. In water near the freezing point, con- should produce about as much heat as he loses, so that he is able to swim or struggle. An individual who is ng would not necessarily need rewarming because the hard may remain warm enough to prevent them from be- reserve their strength by clinging to wreckage or floating n cold much faster than if they had kept swimming or

charts are those which may be expected by individuals ing and kept afloat by life jackets. Of course, survival y if the individuals are aboard life rafts, and will be in- ls are wearing survival suits. The limits of survival d on actual survivor data accumulated over a considerable eriments.

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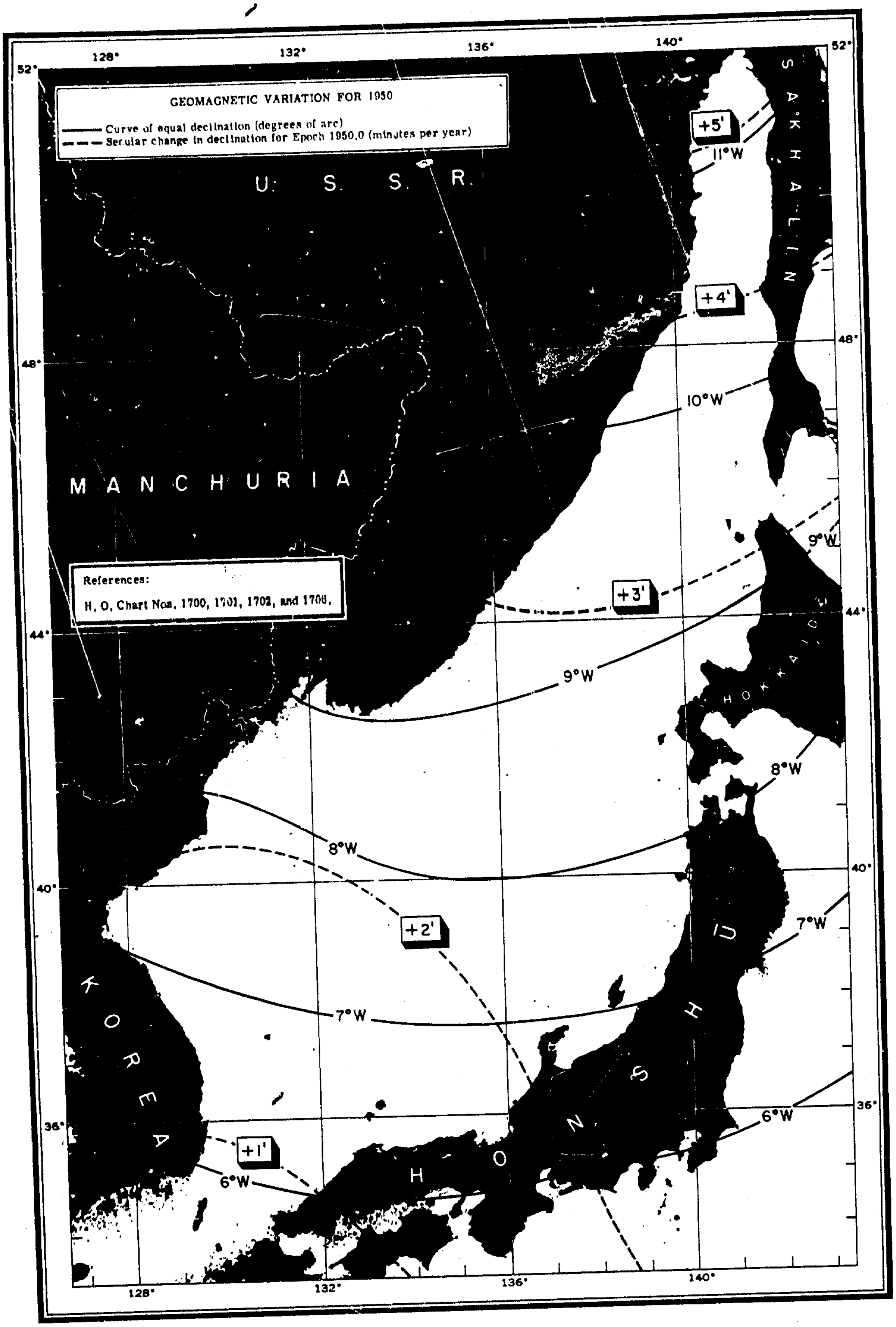
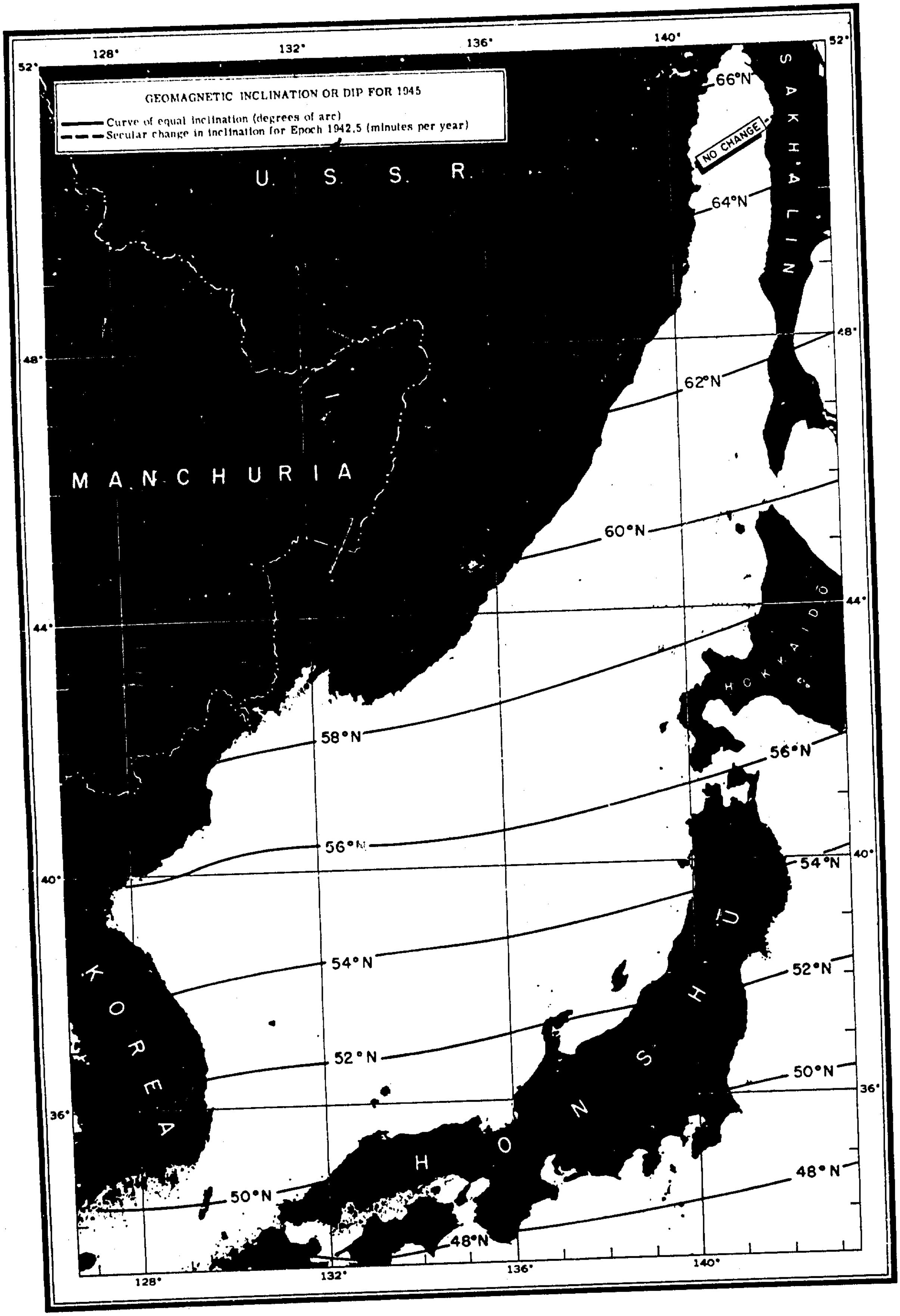
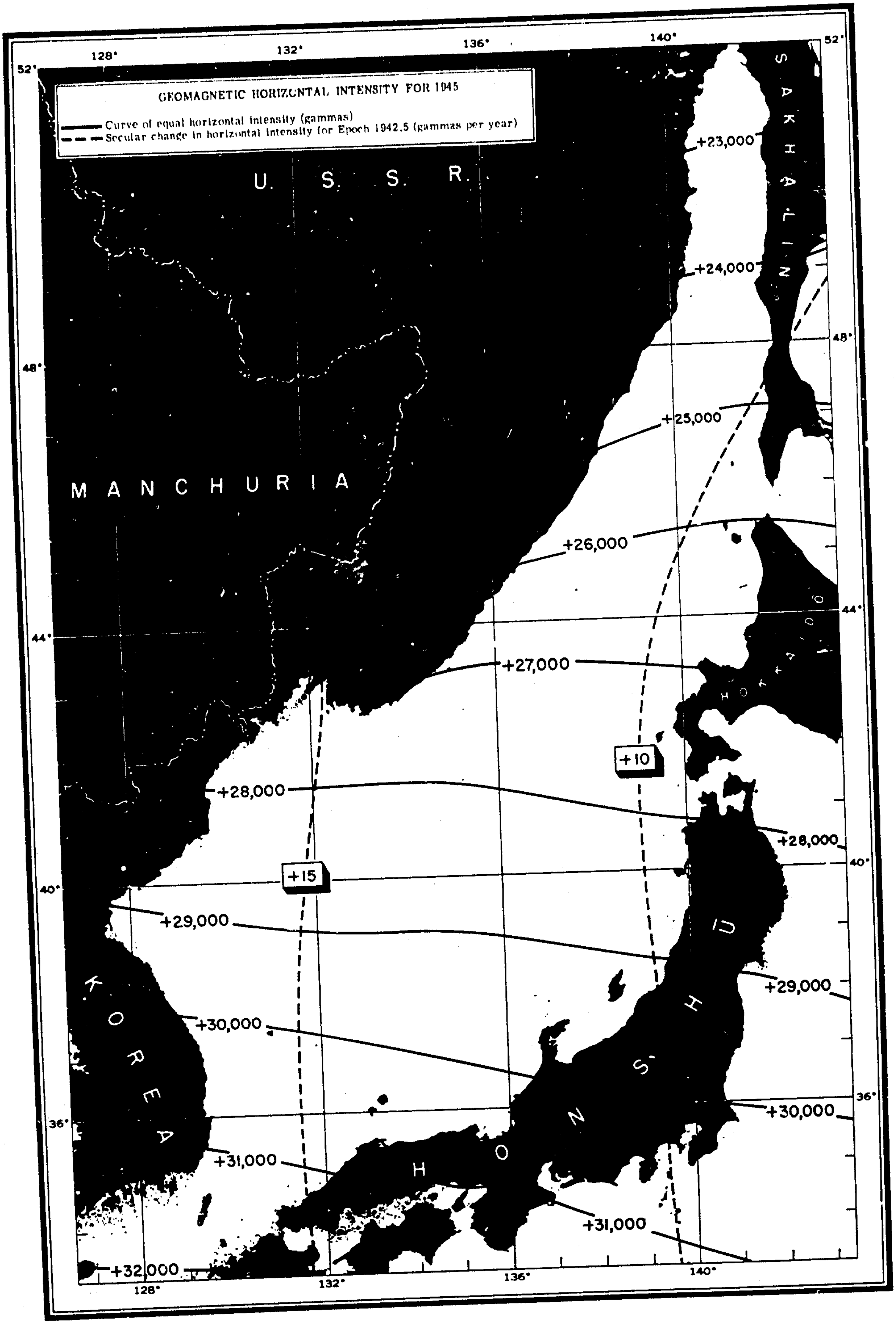
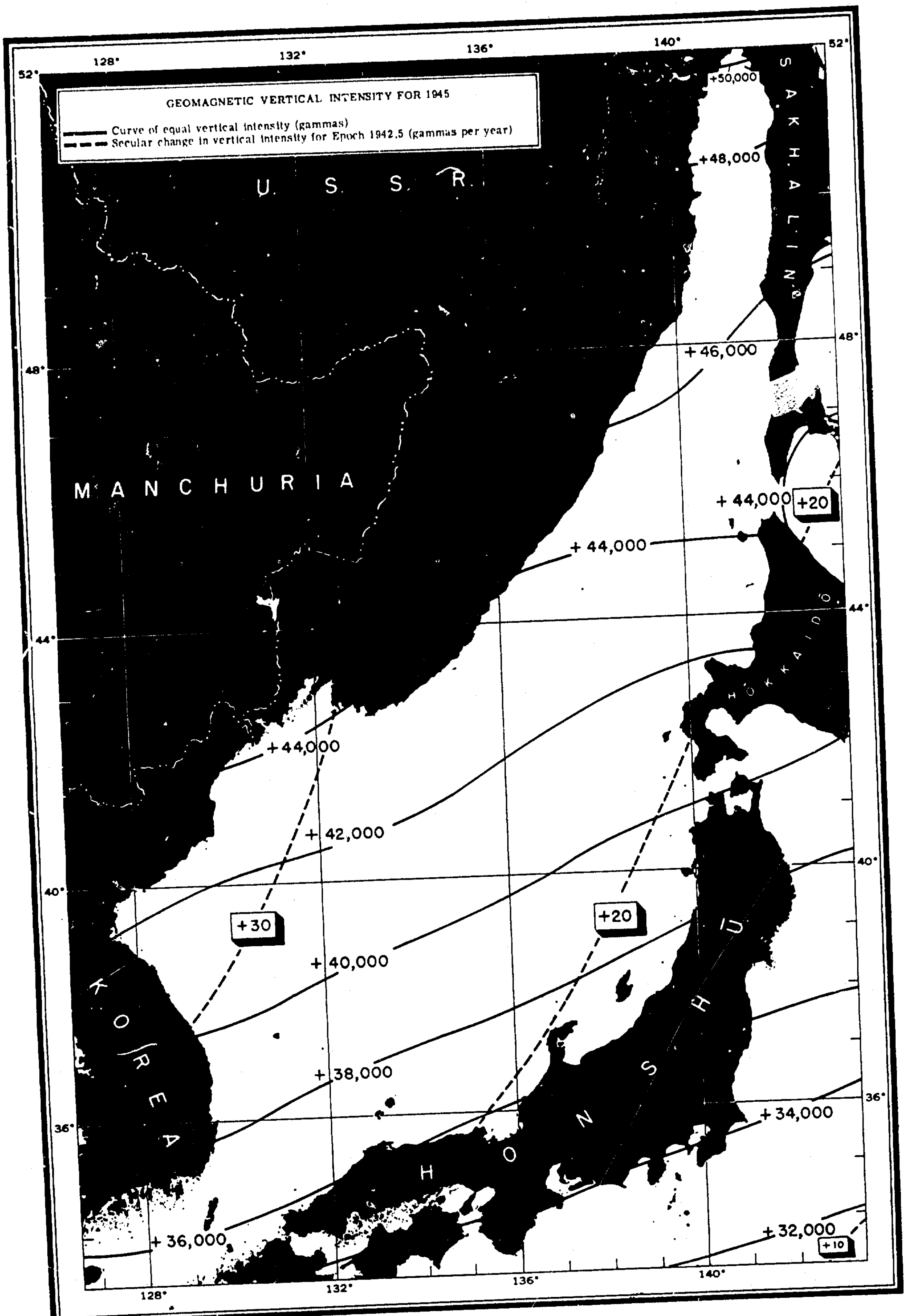

GEOMAGNETIC VARIATION FOR 1950
Curve of equal declination (degrees of arc)
Secular change in declination for Epoch 1950.0 (minutes per year)
References:
H. O. Chart Nos. 1700, 1701, 1702, and 1708.
U. S. S. R.
MANCHURIA
SAKHALIN
HOKKAIDO
HONSHU
KOREA
11°W
10°W
9°W
8°W
7°W
6°W
+5'
+4'
+3'
+2'
+1'
128°
132°
136°
140°
52°
48°
44°
40°
36°


GEOMAGNETIC INCLINATION OR DIP FOR 1945
Curve of equal inclination (degrees of arc)
Secular change in inclination for Epoch 1942.5 (minutes per year)
U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
NO CHANGE
66°N
64°N
62°N
60°N
58°N
56°N
54°N
52°N
50°N
48°N
128°
132°
136°
140°
52°
48°
44°
40°
36°

2


GEOMAGNETIC HORIZONTAL INTENSITY FOR 1945
Curve of equal horizontal intensity (gammas)
Secular change in horizontal intensity for Epoch 1942.5 (gammas per year)
U. S. S. R.
MANCHURIA
KOREA
SAKHALIN
HOKKAIDO
HONSHU
+23,000
+24,000
+25,000
+26,000
+27,000
+28,000
+29,000
+30,000
+31,000
+32,000
+10
+15
128°
132°
136°
140°
52°
48°
44°
40°
36°

3

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