~~CONFIDENTIAL~~

SAILING DIRECTIONS

DANGEROUS GROUND
IN THE
SOUTH CHINA SEA
1951

H.O.PUB 153 Formerly

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~~CONFIDENTIAL~~

Preface

This publication is the first edition of H.O. Pub. 951, Confidential Sailing Directions for Dangerous Ground in the South China Sea. It supersedes the Special Confidential Supplement to H.O. Pub. 125 and 126 (1944).

The principal sources examined in the preparation of this edition are:

British Admiralty, H.D. 384, Confidential Sailing Directions for the Dangerous Ground in the South-eastern Part of the China Sea, 1938 (corrected to 1944).

Japanese Confidential Hydrographic Data for Shinnan Gunto, H.D. 8150, 1943.

Japanese Confidential Sailing Directions for Taiwan, 1941.

United States Government surveys in 1935 and 1937.

British Admiralty surveys from 1926 to 1938.

Japanese surveys from 1937 to 1943.

Mers de Chine, Paris 1947, with Supplement to 1 Dec. 1950.

Security Classification.— This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32 as amended. Its transmission or the revelation of its contents, in any manner, to an unauthorized person is prohibited by law.

NOTE .— This publication includes information and corrections received to 1 September, 1951.

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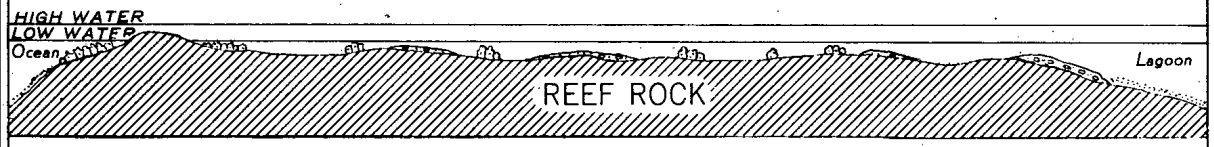
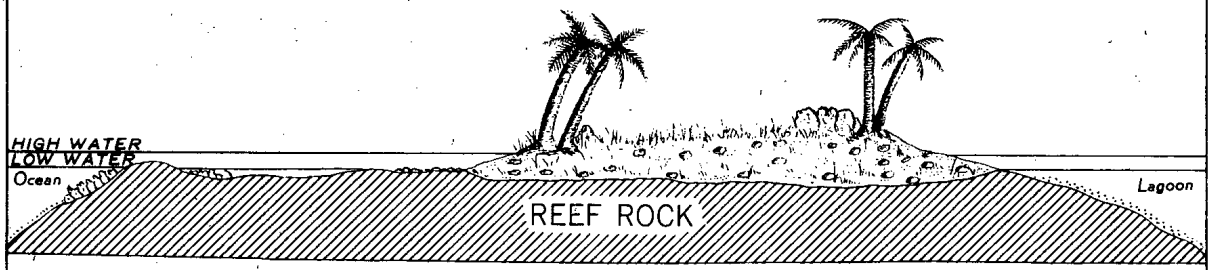
DIAGRAMS OF TYPICAL ATOLL—REEF RIMS IN DANGEROUS GROUND



REEF RIM AWASH AT LOW WATER

REEF RIM AWASH IN PLACES AT HIGH WATER



REEF ISLAND

FRONTISPIECE

LIST OF ILLUSTRATIONS

This publication should be used in conjunction with the following charts:

H.O. Confidential Chart 5503
H.O. Confidential Chart 5657
H.O. Confidential Chart 5658 (Prov.)
H.O. Confidential Chart 5659 (Prov.)

SAILING DIRECTIONS FOR DANGEROUS GROUND IN THE SOUTH CHINA SEA

INTRODUCTION

1—Plan of Text.— In the southeastern part of the South China Sea, westward of Palawan Passage, lies a little-known and incompletely surveyed region about 52,000 square miles in extent, studded with numerous dangerous sunken reefs and coral atolls awash, known as Dangerous Ground. This text consists of a description of Dangerous Ground and adjacent islets and known dangers westward of Palawan Passage included within the limits 7° N. to 12° N. and from 111° E. to 117° E. (See H. O. Confidential Chart 5503) and recommended routes are given through the area.

For convenience in description the area is divided roughly into quadrants by the parallel of 10° N. and the meridian of 115° E. The description is continued clockwise beginning with the southeastern quadrant.

2—Sovereignty.— In 1947 ownership of the area had not yet been clarified. In 1939 the Japanese Government announced annexation of the area lying between the parallels of 7° N. and 12° N. and between the meridians of 111° 30' E. and 117° E. which they named Shinnan Gunto (The New Southern Archipelago). The islets of Tizard Bank and North Danger are frequently visited by fishermen from Hainan Island. Some of them are said to have spent several years here. Annually junks from Hainan Island, loaded with rice and other necessities, tour the islets and reefs to trade for tortoise shell, trepang, and other marine products. The junks leave Hainan Island in December or January returning before the southwest monsoon begins.

3—Caution—Inaccurate Surveys.— Certain portions of this area, indicated on the charts, still remain unsurveyed and should be avoided. The positions of the atolls and dangers shown on H. O. Confidential Chart 5503 may be 2 or 3 miles in error. Celestial observations were used to fix their positions in some cases. Dead reckoning was used in other cases. Accurate fixes are essential prior to attempting any of the passages. The LORAN positions of the atolls and dangers within this area may not agree with the charted positions. The area of triangulation control in which the LORAN stations are located is outside Dangerous Ground. LORAN Rates 1L6 and 1L7 of the Asiatic Chain should provide vessels equipped with LORAN with a fix by day or by night.

It is considered probable that all dangers have been located, except in the areas indicated as unsurveyed on the chart. But due caution should be exercised. The positions of all dangers are doubtful. **Uncharted dangers may exist.** With the exception of North Danger and Tizard Bank the area has not been wire-dragged. It is recommended that vessels departing from the established routes be assisted by aircraft. A helicopter could give valuable reconnaissance assistance in locating the sunken reefs which may be marked only by discolored water or breakers. Vessels intending to enter lagoons should be assisted by lead boats equipped to lay temporary buoys.

METEOROLOGY AND OCEANOGRAPHY

4—Climate.— The climate of the South China Sea is greatly influenced by the continent of Asia on the west and the Pacific Ocean on the east, consequently, from October to March, when the continent of Asia is extremely cold, the density of the atmosphere increases, and the pressure rises, a large fixed high pressure area is formed. In summer, however, conditions are reversed. The continent is very warm and an area of comparatively low pressure is formed. The climate of the entire area of the South China Sea is sultry and damp during the southwest monsoon or rainy season, but the northeast monsoon season, when the region is comparatively dry, is cool and healthful. The direction of the winds and their seasonal variations are related to the changes in the distribution of atmospheric pressure mentioned above.

The following meteorological information is based on reports from vessels operating in the area of Dangerous Ground.

5—Northeast Monsoon.— The northeast monsoon begins in November and ends in April. It is the best season for navigating in the region of Dangerous Ground. There are very few squalls and these are of short duration and can be easily avoided by aircraft. The weather is comparatively dry and fair with the prevailing wind from northeast by east. In the early part of 1940, throughout a 47—day period, a vessel reported good celestial observations could be obtained, both by day and by night. Another report stated that in the vicinity of Ardasier Bank, during the first part of April, fixes were obtained each evening, with only 3 exceptions. Little or no swell was observed during the northeast monsoon. The temperature in March is usually about 82°.

6—Southwest Monsoon.— The southwest monsoon begins in May and ends in October. Successively from March to May cloud content and squalls increase. The wind velocity ranges from a dead calm to a strong breeze, becoming variable in direction. The sea may become mirrorlike and it is difficult to make out discolored water. Typhoons are rarely experienced during the spring of the year although a typhoon did strike Itu Aba on April 28, 1940, resulting in considerable damage. Such is unusual during this time of the year however. The southwest monsoon gathers strength in June. The sea becomes rough and the sky overcast, chiefly with stratocumulus and cumulonimbus clouds. Squalls are more frequently of fresh breeze to fresh gale force, but rarely more than a strong gale force, and accompanied by thunder. A fresh southwesterly breeze with a moderate to rough southwesterly sea along with heavy rains prevail through July and August until the middle of September. There are many days when it is impossible to obtain celestial observations. During the southwest monsoon a moderate southwesterly swell may arise. A survey vessel experienced a roll of about 5° during the northeast monsoon but 10° to 20° roll has been experienced during the southwest monsoon. The swell is usually greater in the western part than in the eastern part of Dangerous Ground. At the anchorages the sea may run higher. After September the southwest monsoon abates. It may be strong for about 10 days followed by a weak period of about 3 days, then shifting in direction. When the shift is southeasterly the wind force usually decreases. When the shift is northwesterly the wind force usually increases. The relative humidity, in June, July and August, ranges from 80 percent by day to 90 percent at night. The temperature during these months ranges from 77° to 87°. From September to November an average of one or two typhoons per month occur.

Considerable atmospheric disturbances to long wave radio broadcasts may be experienced. The high humidity may cause some damage to radio apparatus.

7—Visibility.— By day, in fine weather, the visibility is 9. During squalls it is not unusual for visibility to be reduced to about 100 yards. At night, with a clear atmosphere, objects may be identified at a distance of about 500 yards maximum, increasing with moonlight to about 5000 yards maximum. In clear weather, with a moderate breeze, atoll—reefs appear clearly marked by breakers. When the sun is low and there is reflection on the water and when the sea is smooth or mirrorlike, and when there is reflection of clouds, even with the sun behind the observer and the reefs dead ahead, they are difficult to make out. A complete absence of clouds is unknown. They are especially numerous on the horizon at sunset and sunrise. Fog and mist are practically unknown at any season.

Mirage.— This phenomenon is frequent in April or May during fair weather. Islets and reefs may loom elongated or enlarged in height. Small flat islets may appear as ramparts. Survey flags may appear double, one above the other. Difficulty may be experienced with celestial observations because of false horizons.

Typhoons.— Detailed information on the typhoons io the China Sea is contained in H. O. Pub. No. 125, Sailing Directions for the Western

Shores of the China Sea. The above remarks on monsoons will be valueless in cyclonic weather.

8–Tides.– The tides are almost entirely diurnal with a large diurnal inequality. Available tidal data and tidal current data for each atoll is given with the principal description.

Ocean Currents.– The principal ocean currents in the South China Sea are the northeast and southwest monsoon drifts. Their velocity averages about ½ knot. However, their direction and velocity depend greatly on local conditions. The region covered by this text is characterized by areas of great depth adjacent to reefs and shoal water. Currents across the deep areas are steady and usually conform to the moonsoon. Such currents become dangerous, taking on sudden changes in direction and increased velocity when they encounter restrictions such as reefs or land masses.

Accurate information on ocean currents is not available in the region of Dangerous Ground. With the northeast monsoon prevailing a southeasterly set is reported northward of North Danger. Between Tizard Bank and North Danger a westerly set with a rate of 1 to 1½ knots was experienced in March 1936. In April 1935 a southeasterly set was experienced in the same area. Navigational notes submitted by the U. S. S. Pecos in 1941 advise that throughout the year the tendency is to be set on, rather than off, the Dangerous Ground. This is apparently caused by a large countercurrent in the area. At the height of the northeast monsoon a strong northwesterly set is experienced in the southern part of Palawan Passage. In the vicinity of Royal Captain and Half Moon Shoals a westerly set is reported with the northeast moonsoon prevailing. In the vicinity of 11° N., 113° E. a southwesterly set, with average drift 0.9 knot, is reported with the northeast monsoon prevailing.

Southward of Investigator Shoal and Ardasier Bank there appears to be a fairly strong westerly set.

9– SEAMARKS OBSERVED IN DANGEROUS GROUND

NAME	BEARING FROM VESSEL (degrees true)	DISTANCE SIGHTED (in miles)	VISIBILITY (International Code)	HEIGHT OF EYE (in feet)
INVESTIGATOR SHOAL	141	6.5	8	65
	180	8.1	7	65
	008	7	7	65
	092	7.6	9	65
	094	5.4	9	Probably 36
Note: Sand dune seen 7 miles from bridge height of 29 feet.	160	12	8	
PEARSON REEF	165	9½	8	Probably 36
Sand dune	338	6.8	8	
ERICA REEF	285	4.6	8	65
	265	3.5	8	
DALLAS REEF	264	6.5	8	
DISCOVERY GREAT REEF	215	7.2	8	65

NAME	BEARING FROM VESSEL (degrees true)	DISTANCE SIGHTED (in miles)	VISIBILITY (International Code)	HEIGHT OF EYE (in feet)
FLORA TEMPLE REEF	167	7.1	8	65
	302	7.1	8	65
DISCOVERY SMALL REEF	348	8.5	8	65
	335	6.8	8	
FIERY CROSS	213	5.9	8	
	348	5.3	8	
UNION BANKS				
N. side, reef	180	4.8	7	
E. side, reef	313	4.0	7	
S. side, reef	337	5.0	7	
W. side, sand dune	289	4.0	7	
E. side, sand dune	242	8.0	9	
S. side, sand dune	035	9.0	8	65
S. side, sand dune	031	6.8	8	
S. side, sand dune	208	8.9	8	65
Eastside southern sand dune	058	10.5	8	65
W. extremity	131	8.6	8	65
W. side S. extremity, rocks	125	7.3	8	65
ITU ABA	031	13.0	8	
	065	15.7	8	65
	155	16.8	8	65
	139	14.1	8	Note: Lost to view.
	233	17.0	5	
THI TU ISLAND	350	13.6	8	
NORTH DANGER				
N. E. CAY	136	9.4	6	
Note: When first sighted resembles a sailing vessel.	201	11.4	8	
	145	11.5	8	Note: Lost to view.
	345	12.2	8	
S. W. CAY	147	9.1	6	
	156	12.5	9	
	345	12.2	8	Note: Lost to view.
WEST YORK ISLAND	126	14.5	9	65
	067	7.5	7	
Note: Sighted before daylight.	265	14.1	8	
LOAITA ISLAND	108	12.8	6	
	125	10.5	7	
	020	12.0	8	Note: Lost to view.
	059	13.5	8	65
	116	14.1	8	65

NAME	BEARING FROM VESSEL (degrees true)	DISTANCE SIGHTED (in miles)	VISIBILITY (International Code)	HEIGHT OF EYE (in feet)
ALICIA ANNIE REEF				
N. end, dune	185	8.3	8	65
W. side, reef	052	8.5	7	65
HALF MOON SHOAL				
S. W. side, reef	026	9.4	7	36
1st THOMAS SHOAL				
S. side, reef	211	8.2	8	65
2nd THOMAS SHOAL				
W. side	091	5	9	
E. side	248	8.7	9	65
N. side, sand dune	249	7	9	36
MISCHIEF REEF	268	8.3	8	65
MENZIES REEF	089	7.3	8	65
	095	6.1	8	
LOAITA BANK				
W. extremity	125	9.2	8	65
	108	6.8	8	
	031	6.5	8	
SWALLOW REEF		8		

10–Reefs–Appearance.– Most of the dangers, in the region of Dangerous Ground are atoll–shaped coral reefs, awash or sunken. A few are true atolls. All navigational equipment should be exploited to the maximum. However, navigators must depend mainly on lookouts aloft and favorable weather conditions. The reefs rise abruptly from ocean depths and soundings give no warning. Radar is of little value in conning. Clear weather with a gentle breeze enables the observer to spot the reefs in sufficient time to avoid them. A high sun behind the observer is favorable for detecting the discoloration of the shoals except when the sea is mirror–like and cloud or sun reflections interfere. Squalls frequently arise reducing visibility to zero. The sea is usually a greenish blue color with a transparency of 13 to 23 fathoms, and on clear days with the sun behind the observer at an altitude of more than 30°, it is possible to make out the bottom clearly at a depth of 16 fathoms.

Anchoring on atoll–reefs.– The following procedures are recommended when anchoring with no swinging room and close to fringing coral: Stand in slowly, sounding, and keeping a lookout from aloft for patches. Do not depend entirely on the charts. Have the anchor lowered with between 8 and 17 fathoms of chain out or as necessary. Less than 8 fathoms is usually very close to the reef, and at more than 17 fathoms the reef falls away too steeply for the anchor to hold. Hold the anchor on the brake until it bites. Stop her headway, veering so as not to dislodge the anchor from the reef. Another anchor at open hawse is useful to prevent the vessel from dragging off.

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The following procedure has been used by small British naval vessels to prevent the stern from swinging towards the reef in calm weather: Hang a 500 lb. weight of scrap-iron over the stern at such a depth that it is clear of the bottom when the vessel is held up by the wind at right angles to the reef, but will foul the bottom is she swings toward the reef. The first 5 fathoms should be of chain or wire to resist chafing, the rest of manila to give the swell when the weight fould the reef.

Kedge anchors should not be used. They are often lost, fouling with the coral.

The following procedure for mooring to a fringing coral reef where an off-shore breeze is steady has been used by an LSM: An oil drum was attached to a wire rope made fast to a coral head of the fringing reef. A 5-inch manila line was secured to the drum and the LSM was allowed to drift out on 100 fathoms of line where the offshore breeze held her and offset the current.

Steam should be kept on very short notice at all such anchorages close to a fringing reef with little or no swinging room.

11- ADVANCED BASES

In 1937 the Japanese Government maintained a weather station in the area which aided their fishing vessels and also served as a distress station and supply base. Itu Aba, the largest phosphorite island served as a base for phosphorite mining operations.

Seaplane Alighting Areas.- A naval reconnaisance plane landed and took off from the sandy beach on the southwestern side of Itu Aba. With northeasterly winds and high water landing conditions are favorable. At low water the area between the beach and the fairway is dangerous unless it is dragged and buoyed.

Naval reconnaisance planes landed without difficulty at North Danger anchorage in March 1941 with a gentle northeasterly breeze prevailing. The western extremity of Northeast Cay is not suitable for landing and taking off because of the swell and the reef is shoal even at high water.

Weather conditions are favorable for the operation of aircraft. Squalls are encountered but can be easily avoided. Difficulty may be experienced with celestial observations during the southwest monsoon.

In 1931 flying boats of a British Survey used the western lagoon of Commodore Reef as an alighting area and refuelling base.

Airfield Sites.- A Japanese Survey of 1941 listed the following potential airfield sites:

Itu Aba Island could be made available, although the rough terrain would involve considerable labor in clearing.

Length - 3,674 feet.
Width - 1,050 feet.

Spratly Island could be made available with some preparation.

Length - 2,231 feet.
Width - 300 feet.

West York Island could be made available with some preparation.

Length - 1,640 feet.
Width - 164 feet.

North Danger:

N. E. Cay
Length - 2,027 feet.
Width - 629 feet.

S. W. Cay
Length - 1,535 feet.
Width - 629 feet.

Thi tu Island
Length - 2,362 feet.
Width - 1,574 feet.

Resources.- Phosphorite mining operations were formerly conducted by several Japanese concerns on Itu Aba Island and on the islets of North Danger. From 3,000 to 5,000 tons of guano were exported annually.

12-Fresh Water.- In the southwest monsoon season large quantities of pure fresh water may be obtained by the use of catchments during the heavy rains. Water with a brackish taste and an odor is obtained from wells on Itu Aba Island of Tizard Bank, on Southwest Cay of North Danger, on Thi tu Island, Nanshan Island, and on Spratly Island. The water is potable when boiled and is commonly used by visiting fishermen. The water on Itu Aba is reported to be better than that found on the other islets.

SOUTHEASTERN PART

This part consists of a description of the known islets and dangers lying westward of Palawan Passage included southward of 10° N. and eastward of 115° E. *(H. O. Confidential Chart 5503).*

13–Royal Captain Shoal *(9° 02' N., 116° 42' E.)* lies about 50 miles northwestward of Bulanjao Range on Palawan, contracting Palawan Passage to about 28 miles between it and the shoal heads on Paragua Ridge. In clear weather the high land of Mantalingajan is visible to the east–southeastward.

The shoal consists of a coral atoll–reef awash, elliptical in shape, 1¾ miles in length in a northwesterly and southeasterly direction with a breadth of 1 mile. The lagoon, completely enclosed by reefs, has depths up to 17 fathoms sand and coral. Several small groups of sunken rocks with depths of 1 to 5 feet over them encumber the lagoon. There is no entrance. During calm weather boats can cross the reef at high water.

There are several rocks on the reef which uncover. The largest of these, Observation Rock, located at the northwestern extremity, dries 4 feet. The outer edge of the reef is steep–to, having depths greater than 100 fathoms within 100 yards of the reef. A submarine reported that large black rocks on the southern end of the reef are very conspicuous.

14–Bombay Shoal, a coral atoll–reef awash, lying about 27 miles north–northeastward of Royal Captain Shoal, is circular in shape, about 1 mile in diameter, and steep–to. On the northeastern extremity of the shoal is Madagascar Rock *(9° 26' N., 116° 56' E.)* which uncovers at half tide. In clear weather Mantalingajan Mountain is visible bearing 130° distant about 59 miles. The lagoon, in which there are depths of 16 to 18 fathoms, sand, is completely inclosed by a coral reef on which three of four rocks show at half tide. It was high water at noon, 7 days after full and change. The rise was about 4 feet. The tidal current in this vicinity was observed to set northeastward at the flood. A **wreck,** reported visible at a distance of 10 miles, lies stranded on the eastern side of Bombay Shoal.

15–N. E. Investigator Shoal *(Plan on H. O. Confidential Chart 5657),* a coral atoll–reef about 1.4 miles long and 1 mile wide consisting of a drying reef which entirely encloses a lagoon, lies about 17 miles west–northwestward of Royal Captain Shoal. The lagoon is probably accessible to boats at high water.

16–Half Moon Shoal *(See Figure 1),* a coral atoll–reef awash, lies about 24 miles west–southwestward of Royal Captain Shoal. It is a quadrilateral–shaped reef, with a greatest length of 3 miles on its eastern side, and partly encloses a lagoon which can be entered by boats at the southeastern end. The rim of the atoll varies in width from 75 yards to 200 yards, with the outer side steep–to. The entrance is encumbered by a large sunken rock, and a 2–fathom shoal with coral heads extends from the northern side of the entrance. The lagoon is reported to have a depth of about 15 fathoms but it is foul in the southwestern corner and studded by coral heads in the northeastern and northwestern corners. Several coral heads encumber the center of the lagoon. From an elevation of 70 feet the shoal was visible at a distance of 6 miles. Breakers were observed on the weather side.

At high water the reef was observed to cover about 4 feet. Only three rocks, awash at high water, were visible on the western side of the atoll rim. One of these rocks is located near the northern end, one near the southern end, and the largest, Beacon Rock, lies about 0.8 mile northward of the southwestern corner. At low water numerous rocks are visible. Inclined Rock, 1 foot in height, lies about 800 yards

northeastward of the lagoon entrance. A minesweeper anchored in 20 fathoms, coral, off the southwestern extremity of the atoll. At riding scope she had 40 fathoms under her stem and 75 fathoms under her stern. It was high water at 10h. 45m., five days after full and change. The rise was about 4 feet.

17—Sabina Shoal *(Eastern end: 9°43' N., 116°36' E.)*, a sunken coral atoll—reef with the eastern half consisting of a number of reefs awash, while the western half consists of a bank on which there are reefs, with general depths of 2 to 10 fathoms, forming a lagoon. The atoll is steep—to, but anchorage can be found in many places on the edge of the bank in depths under 10 fathoms or within the lagoon in depths of 10 to 16 fathoms. Sabina Shoal has not been closely examined. It provides no shelter in foul weather.

18—Boxall Reef, which lies about 18 miles southwestward of Sabina Shoal, dries. It does not contain a lagoon nor are there any rocks visible at high water. There is no anchorage in the vicinity.

19—First (1st) Thomas Shoal nearly 5 miles long in an east and west direction, lies about 29½ miles northwestward of Half Moon Shoal, with its eastern extremity in position 9° 20' N., 115° 58' E. This atoll—reef, on which a few isolated rocks about 3 feet high have been observed, dries, and entirely encloses a shallow lagoon. No anchorage was obtained in this vicinity.

20—Second (2nd) Thomas Shoal, an atoll—reef about 10 miles long, north and south, lies with its southern end about 20 miles northward of the western end of 1st Thomas Shoal. 2nd Thomas Shoal contains a lagoon with depths of about 15 fathoms accessible to boats and which may possibly be accessible to vessels of moderate draft from the eastward, although no navigable passage is now known. The eastern side of the lagoon appears to have a general depth of about 5 fathoms with a number of isolated drying patches. The western side is almost continuous and dries. There are several large rocks near the southern end which should be visible at low water. No anchorage was found in the vicinity.

21—Mischief Reef *(Plan on Provisional H. O. Confidential Chart 5658)*, a circular atoll—reef about 4 miles in diameter lies awash with its eastern edge about 18 miles west—northwestward of 2nd Thomas Shoal. The reef, on which lie several drying rocks, forms an extensive lagoon in which there is an average depth of 14 fathoms. The southwestern part of the lagoon is free of dangers and affords good shelter. The northeastern part is encumbered with coral heads with less than 6 feet of water over them. Many of these heads are pinnacles, difficult to detect even with good light conditions.

There are three entrances to the lagoon, two located on the southern side, and the other on the southwestern side.

Southwest Entrance is about 100 yards wide and about 450 yards in length with a depth of 13 fathoms in the middle. A strip of coral reef nearly obstructs the inner end. Only boats can navigate the narrow tortuous passage.

Boat Channel, the eastern of the two entrances on the southern side, is very narrow, being only 20 yards wide and obstructed by patches with less than 6 feet over them at the inner end.

22—South Entrance, the western of the two southern entrances, is the main entrance to Mischief Reef. It has a navigable width of 120 feet and is 300 yards in length, with depths of over 10 fathoms. The axis of the deepest water, clearly defined in a good light by its deep blue color, lies in a slight curve, approximately parallel to the edge of the reef on the western side, commencing in a direction of about 005°, thence curving northward and terminating in a direction of about 354°. The reef on the western side is steep—to and that on the eastern side is slightly shelving. *H.M.S. Herald* entered in 1938 and experienced little set. Care is necessary since the tidal currents are strong at times, and set nearly across the entrance. At neap tides a tidal current of 1½ knots was observed. South Entrance is recommended for vessels under 300 feet in length. Temporary buoys should be laid at the ends and middle of each side to assist conning. Vessels should enter with good headway keeping slightly westward of the center of the deepest water.

HALF MOON SHOAL

Beacon Rock Lat. 8°53.6′N. Long. 116°15.2′E.

SOUNDINGS IN FATHOMS

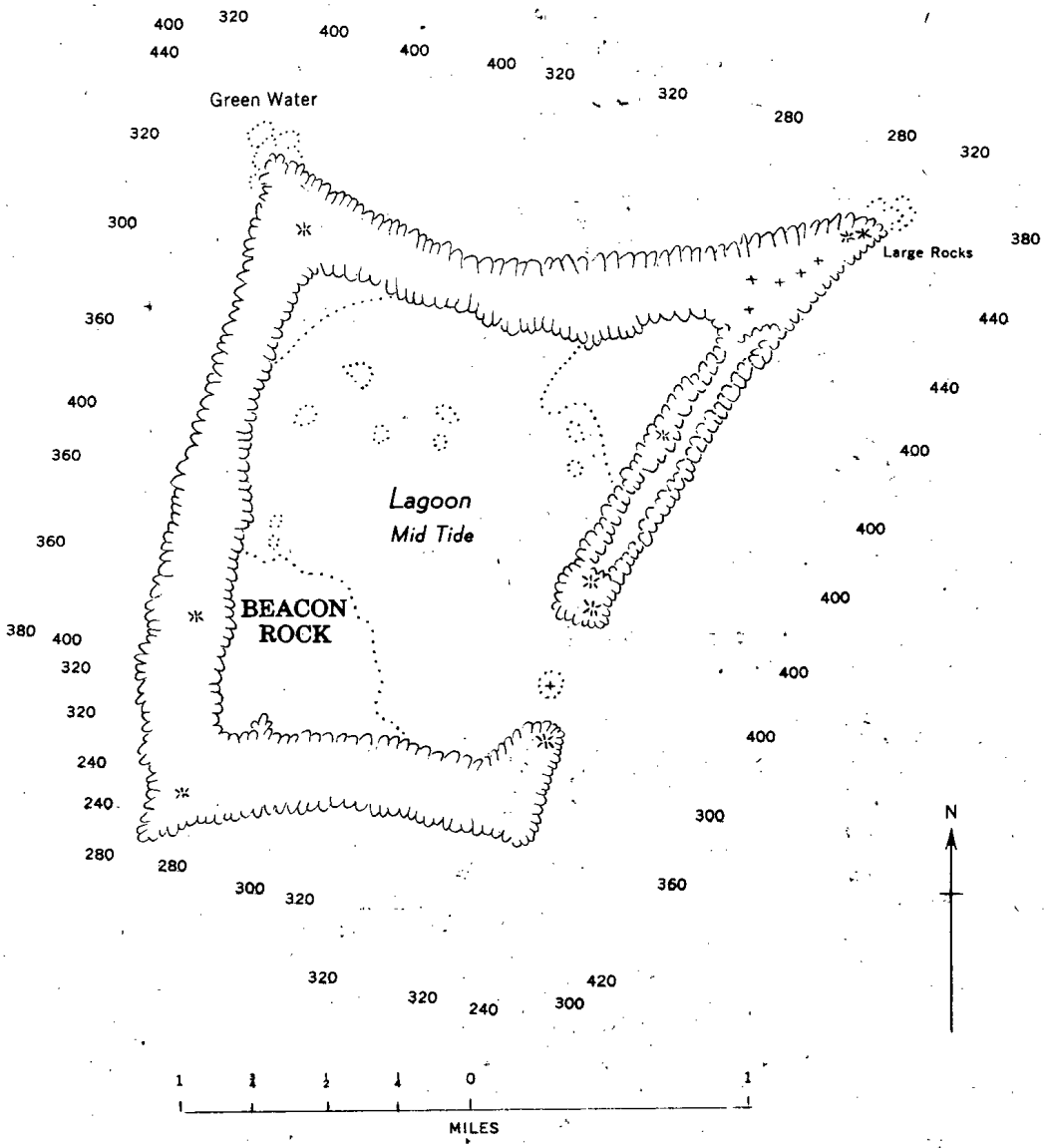

FIG. 1.

ALICIA ANNIE REEF

Obs. Spot Lat. 9°25.2′N. Long. 115°26.8′E.

SOUNDINGS IN FATHOMS

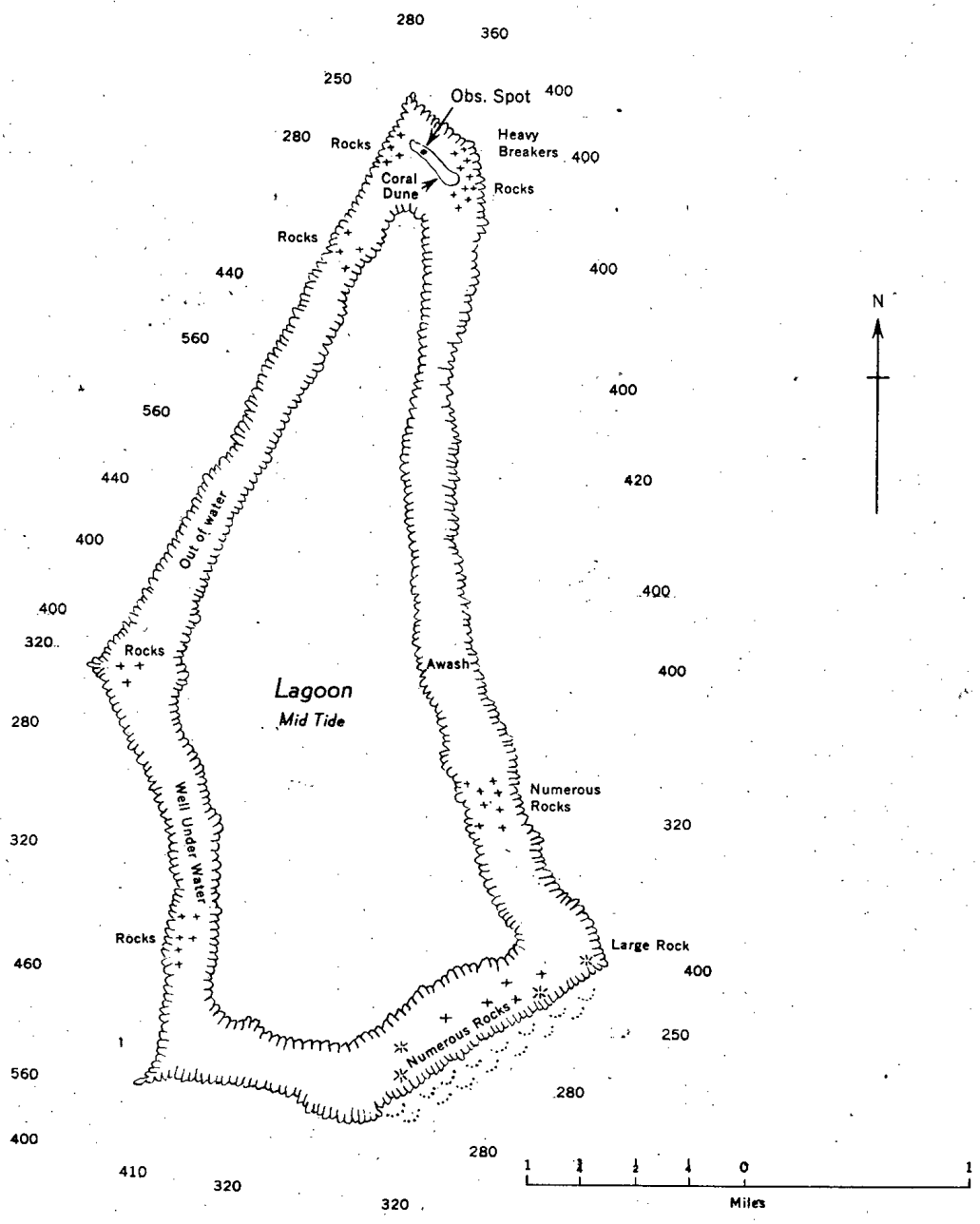

FIG. 2.

23—Alicia Annie Reef *(Northwestern Cay 9° 25' 12" N., 115° 26' 48" E.) (See Figure 2)*, an atoll—reef with no entrance, lies about 26 miles westward of 1st Thomas Shoal with its major axis in a north—south direction. The reef, which dries, completely encloses a lagoon which appears to be very deep. At low water the northern and southern ends are well out of water and the entire inner edge of the reef dries about 1 foot. At the northern end, a spit which appears to be white sand, lies 4 feet above high water. There are several large rocks on the southeastern corner and numerous small rocks. The outer edge of the rim of the atoll is steep—to and breakers were observed on the northeastern side with a moderate northeasterly breeze. Anchorage was obtained by *H.M. Survey Ship Iroquois* in 30 fathoms about 200 yards from the northern end of the atoll. The lagoon is probably accessible to boats at high water.

24—Commodore Reef *(East end: 8° 21' N., 115° 17' E., H.O. Confidential Chart 5503).*—Commodore Reef, an atoll—reef about 7 miles in extent east and west, lies with its eastern end about 59 miles southward of Alicia Annie Reef. Commodore Reef dries 5 feet on the western end and dries in patches around its whole circumference forming two lagoons with a sand cay 1 foot high on the neck between them. In 1931 there was a tree stump embeded in the sand which increased the height of the neck to 3 feet.

The western lagoon is accessible to boats at high water, and certain parts can even be crossed at or near low water. The best positions are about 2 miles from the western end, either on the north or south sides. During the survey carried out in 1931, two loaded cutters were anchored in this lagoon for about two months, and remained, unattended in perfect safety, during some periods of very heavy weather. The general depth is from 3 to 8 fathoms, but there are groups of rocks which come close to the surface in places. This lagoon was regularly used as a landing place and refueling base by flying boats which remained overnight in one instance.

The eastern lagoon has not been closely examined, but it also is probably accessible to boats; it appears to be shallow and full of rocks.

The encircling reef is completely covered at high water, except for the sand cay near the middle and Flat Rock at the eastern end. Flat Rock is 1 foot high. There is no anchorage outside the reef.

SOUTHWESTERN PART

25—Investigator Shoal is an irregular atoll formation lying with its eastern extremity about 25 miles southwestward of the western end of Commodore Reef. The shoal, which extends in an east—west direction for about 18½ miles with a width of about 8 miles, is surrounded by a coral reef on which there are a few drying sections, but over the larger part of which there are depths of 3 to 10 fathoms. The depth in the lagoon is probably over 25 fathoms. Large fishing vessels enter near the middle of the northern side and anchor in the lagoon which is believed to afford anchorage in fine weather but little or no shelter. The southern side is steep—to and there appears to be a good entrance at the southeastern end. This entrance is about 400 yards wide with a general depth of about 20 fathoms, except for two small patches with a depth of 6 fathoms over them. A few isolated rocks located at the western end may be visible at high water. There are two drying rocks on the southern side.

Anchorage was found in depths of 25 to 47 fathoms, coral, in a position about 546 yards 250° from the western edge of Investigator Shoal. *H.M.S. Iroquois* anchored in 25 fathoms about 400 yards off the western edge of the shoal. Currents with velocities up to one knot are reported on all sides of Investigator Shoal.

26–Erica Reef *(8° 06' N., 114° 07' E.)*, a drying reef of elliptical shape, 1½ miles long and 1 mile wide, entirely enclosing a shallow lagoon, lies about 23 miles westward of the western end of Investigator Shoal. A few drying rocks lie on the eastern side of Erica Reef and may show at high water. No entrance or anchorage was found. The lagoon is probably accessible to boats at high water.

27–Mariveles Reef, about 6 miles long in a general northwest–southeast direction, lies with its southeastern end about 18 miles northward of Ardasier Reef. Mariveles Reef dries and entirely encloses two lagoons. There is a sand cay, 5 feet high, on the neck between the two lagoons, and a few isolated rocks may be just visible at high water. No anchorage was found.

28–Ardasier Reef and Bank.– Ardasier Reef, a triangular shaped reef, 1½ miles in length, is the western extremity of Ardasier Bank and lies about 44 miles southwestward of the western end of Investigator Shoal in position 7° 36' N., 113° 55' E. Ardasier Reef dries, enclosing a shallow lagoon which is probably accessible to boats at high water. The reef is steep–to except on its eastern side where it joins Ardasier Bank.

29–Ardasier Bank extends about 37 miles northeastward from Ardasier Reef and consists of a sunken coral atoll about 12 miles wide with depths of 2 to 10 fathoms over the rim. The charted depths over the middle part of the bank are from 23½ to 35½ fathoms. At the northern, eastern, and southeastern parts, the depths are comparatively even and temporary anchorage is possible. Parts of Ardasier Bank may be discerned by discolored water. But when the sun is low shoal water can not be made out and caution must be used. There is no part of the bank awash even with a wind and the bank is not marked by breakers.

Caution.– Vessels are advised to avoid the vicinity of Ardasier Bank and navigate with caution, especially near the middle of the northern side where in depths of 22 to 27 fathoms there is no discoloration apparent. Currents with a velocity up to one knot are reported on all sides of Ardasier Bank. The tides are diurnal with a range of about 5 feet.

30–Dallas Reef lies with its eastern end about 5 miles westward of Ardasier Reef. Dallas Reef is about 5 miles long, east and west, and dries entirely enclosing a shallow lagoon. There is no anchorage in the vicinity of the reef.

31–Swallow Reef, formed of a belt of coral surrounding a shallow lagoon, is 3¾ miles in length, east and west, and 1¼ miles in width. At its eastern part are some rocks about 5 to 10 feet high, the highest of which is in 7° 23' N., 113° 59' E. There are also some prominent rocks on the southeastern side which are always visible. Swallow Reef is reported to be a good seamark. By day a vessel sighted it at a distance of 8 miles.

Currents.– In the area southward of Investigator Shoal and Ardasier Bank there appears to be a fairly strong westerly set.

32–Royal Charlotte Reef nearly rectangular in shape, and about 1 mile long, lies about 27 miles south–southwestward of Swallow Reef. Several boulders, 2 to 4 feet high, lie near its southeastern side and some rocks lie on its northeastern side.

In 1940, on a day with good weather and visibility, a careful search was made by a Japanese survey vessel but Royal Charlotte Reef was not found within 3 miles.

33–Barque Canada Reef is a long narrow atoll–reef, nearly all of which dries, lying with its southern end in position 8° 04.3' N., 113° 13' E., thence it extends about 15 miles northeastward to 8° 17' N., 113° 20' E. completely enclosing a lagoon which appears fairly deep and is not accessible even to boats. A detached reef, Ryugami Rock, the existence of which is doubtful is charted at the southern extremity. At the northeastern end there is a group of rocks 5 to 6 feet high. The northern part is not as steep–to as the southern part and temporary

anchorage may be taken depending on the weather. A survey vessel anchored on the northern part in February. *H.M.S. Iroquois* anchored in 20 fathoms on a spit on which there are usually heavy overfalls in a position about 400 yards from the northern extremity.

34–Amboyna Cay *(7° 52' N., 112° 55' E.) (Plan on H.O. Confidential Chart 5657)* lying about 23 miles southwestward of the southern end of Barque Canada Reef consists of an islet, 8 feet high, with a total length of about 185 yards in a north–south direction and about 98 yards wide formed of coral sand and guano rock. Coral banks, upon which the sea breaks heavily, extend about 1 1/10 miles northeastward from the northeastern part and about 875 yards northwestward from the northwestern part. In 1889 *H.M.S. Wanderer* reported a reef with a depth of 2 to 2½ fathoms over it lying about ¾ mile northwestward of the islet. A depth of 4 fathoms exists about 670 yards northeastward of the islet, and at the edge of the northeastern reefs the depths increase abruptly from 9 to 17 fathoms, thence to ocean depths. The western and southwestern part is fringed to a distance of about 450 yards by steep–to reefs which gradually shoal from a depth of 25 feet at 437 yards offshore to 5 feet at 32 yards offshore. The fringing reef has a depth of 23 feet about 220 yards southward of the southern end of the islet. The northern part of the islet is 8 feet high, with a gently shelving beach on the northwestern side and a comparatively steep irregular scarp, 3 to 5 feet high, on the northeastern side. The southern part consists entirely of coral sand, in general about 6½ feet high. The northern part of the islet is not accessible to boats because of the many sunken rocks and rough water; but the southern part has sandy beaches and boats can land on the leeward side when the sea is not rough. At low water there is a surf.

A beacon stands near the center of Amboyna Cay.

Anchorages.– *H.M.S. Rifleman* obtained fairly sheltered anchorage during the southwest monsoon in a depth of 5 fathoms on the reef extending northeastward from Amboyna Cay, and it is stated that anchorage can also be obtained northeastward of the cay in a depth of about 8 fathoms with the center of the islet bearing 224° distant about 1 mile. In 1933, the French survey vessel *Astrolabe* anchored in 6½ fathoms about 700 yards eastward of a mast which stood near the center of the islet. It is possible to anchor southeastward of the islet with the center of the islet bearing about 300° distant about 500 yards. In 1941 a Japanese survey vessel found sheltered anchorage at the southern edge of the northwestern reef and in this vicinity a French survey indicates anchorage is possible in a depth of about 31 feet with the center of the islet bearing about 109° distant about 650 yards. Caution is required when anchoring because the reefs are very steep–to.

Tidal Currents.– According to observations 2 days before neaps at Amboyna Cay the flood commenced at 2300 and set northward; the ebb commenced at 0600 and set westward. The maximum velocity was 1.5 knots.

35–Rifleman Bank lies about 70 miles westward of Amboyna Cay with its northern end, Bombay Castle, in 7° 56' N., 111° 45' E. which is the shoalest spot with a depth of 1¾ fathoms. This shoal is marked by breakers, except in the finest weather. Rifleman Bank extends about 28 miles southward from Bombay Castle and has a maximum breadth of 13 miles. The general depths are from 12 to 45 fathoms, sand and coral, within a rim of shallow patches with depths of 4 fathoms and over.

Johnson Patch, with a depth of 4 fathoms, lies on the western side of Rifleman Bank; Kingston Shoal, with a depth of 6 fathoms, lies at the southern end; and Orleana Shoal, with a depth of 4½ fathoms lies on the eastern side. Caution is necessary because other small shoal patches may exist on the bank.

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36—Owen Shoal, the existence of which is doubtful, was reported in approximate position 8° 09' N., 112° 00' E. by the *David Scott* in 1835 and was stated to have a depth of 3½ fathoms over it and several detached coral heads with less than 1 fathom over them within an area of about 8 miles in diameter.

In 1941 a Japanese survey vessel searched for 11 miles on all sides of the reported position of Owen Shoal and found no depth less than 636 fathoms.

37—Ladd Reef *(8° 39.8' N., 111° 40.6' E.)* extends 1.7 miles east—northeastward and 1.6 miles westward from this position enclosing a long narrow lagoon with a greatest width of 0.7 mile. There are many places on the edge of the coral reef that dry at half tide. In calm weather its southern side is indistinct. At low water it is almost impossible for boats to cross the reef and enter the lagoon which is believed to have a general depth of about 15 feet, white sand. There is no entrance. Temporary anchorage can be taken on a reef extending westward from the western end of the rim of Ladd Reef. The wreck of a submarine lies stranded on the southern side of Ladd Reef in a position about ¾ mile eastward of the western end.

38—Spratly Island (Storm Island) *(South end: 8° 38.4' N., 111° 55.7' E.) (Plan on H.O. Confidential Chart 5657).* According to a Japanese survey of 1941, Spratly Island is a flat island, 6 feet high, and 33 feet high to the tree tops, with a triangular outline. From the northwestern extremity a beach, showing white sand in places, extends southward about 525 yards, thence northeastward about 744 yards, thence westward about 525 yards to the northwestern extremity. Three coconut palms stand on the northeastern part of the island and there is a grove of coconut palms at the southwestern end. A well is located in the grove. The water is clear but not suitable for drinking because of large quantities of salts. The nature of the island is coral with a thin topsoil of sand and mud overgrown with coarse grass.

A Japanese survey states that an airfield suitable for emergency landings could be constructed on the island.

Sea turtles and birds frequent the island. During the hatching season motionless birds may resemble thickets of scrub from a distance of 3 or 4 miles. During June and July fishermen from Hainan visit the island.

Fringing Reef.— A coral reef, which dries in places at low water, fringes the island. Landing is possible on the lee side of the island during the southwest monsoon but is dangerous with any sea because of the numerous coral heads found within 25 yards offshore.

Depths.— A coral reef, which is steep-to, extends about 9/10 mile northward and about 2/10 mile southwestward from Spratly Island. According to a Japanese survey of 1941, the greatest width of the reef is about 765 yards. Previous accounts describe the width of a bank extending northward as nearly ¾ mile. Depths of 3½ to 12 fathoms exist close to the edge of the reef in a position about ¾ mile northward of the island decreasing toward the shore. A depth of 8 fathoms exists about ½ mile northeastward of the island, decreasing gradually toward shore. Depths of less than 4 fathoms exist within 200 yards off the western side of the island increasing abruptly to about 34 fathoms at about 400 yards offshore. Except in very fine weather, the sea breaks heavily on the reef.

Anchorages.— A vessel can anchor on the bank either northeastward or southwestward of the island. The latter is stated to be a temporary anchorage. The northeastern anchorage appears to be the better, even with a northeasterly wind. Anchorage can be obtained with the coconut grove bearing 220° distant about 2/3 mile in a depth of about 8 fathoms, coral. In very fine weather it is possible to anchor closer in on the same bearing. Vessels can anchor with difficulty about ½ mile southwestward of the coconut grove in a depth of 35 fathoms with 135 fathoms of chain out. Vessels can anchor in a depth of 20 fathoms at a distance of about

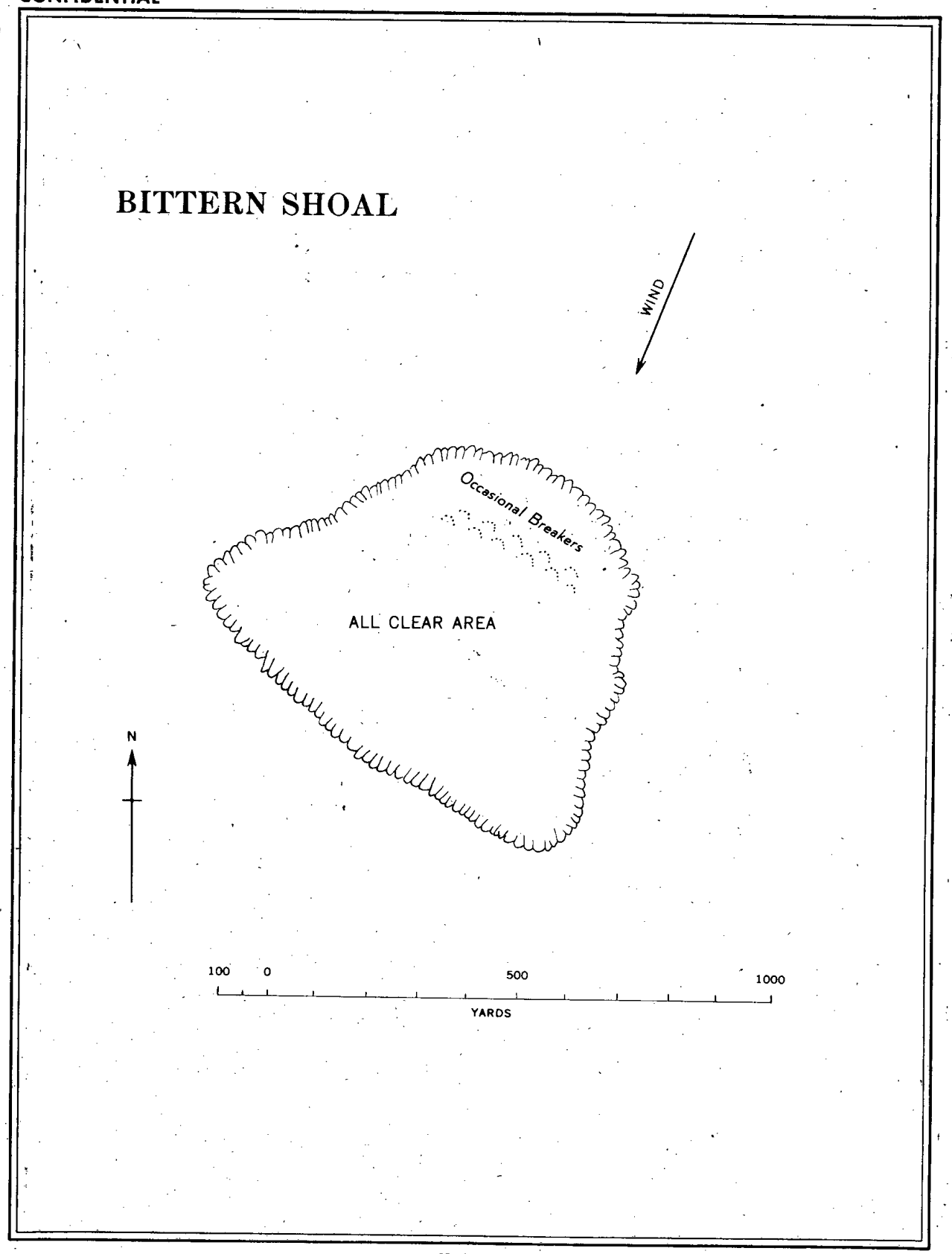


FIG. 3.

PIGEON REEF

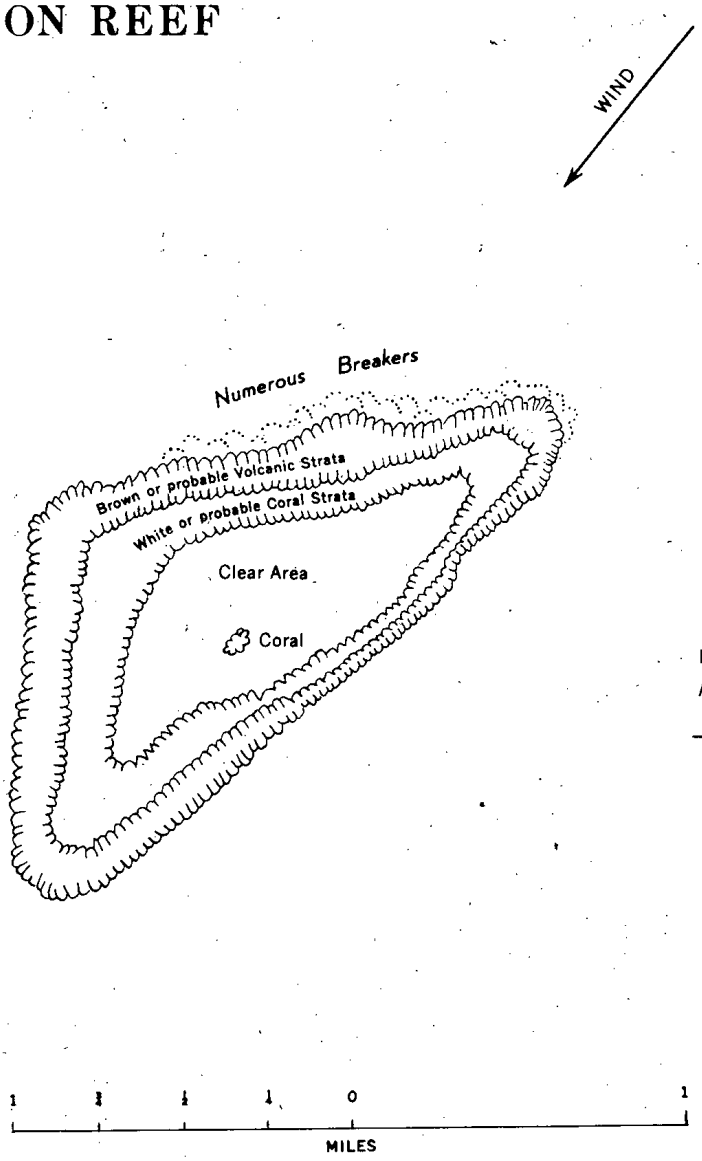


FIG. 4.

500 yards from the southwestern side of the island with the coconut grove bearing 021°, and the southeastern extremity bearing 037°.

H.M.S. Rifleman found anchorage fairly sheltered from the southwestward, on the northeastern part of the bank in a depth of 6 fathoms with the southeastern extremity of the island bearing about 221°, the northwestern extremity bearing about 224°, and the northern extremity of the breakers on the western edge of the bank bearing 264°.

Tides – Currents.– Observations during the summer at Spratly Island showed that the tide was of a diurnal character; high water occurred at 9 a.m. in the early part of July, the range being 5¼ feet.

On the northeastern end of the bank the current set southwestward during the rising tide and southeastward to east–northeastward during the falling tide. A drift of 1.3 knots has been observed and dragging has been experienced.

39–London Reefs, consisting of four coral atoll–reefs, West, Central, East, and Cuarteron Reefs lie within an area extending 38 miles eastward of a position about 21 miles northeastward of Spratly Island. Vessels should navigate with caution in the vicinity of these reefs and only under favorable conditions of visibility.

40–West Reef *(Western end: 8° 51.2' N., 112° 10.6" E.),* a sunken coral atoll–reef, extends about 6½ miles in an east–northeasterly direction. The northern side is marked by conspicuous breakers. In calm weather the southern side is almost impossible to make out. The center has depths of 6 to 10 fathoms with several coral heads. According to a Japanese survey of 1941, there appears to be a wide entrance at its southeastern part but no details are available. Previous accounts state that this approach is hazardous because of numerous coral patches. A sand cay, 2 feet high, lies on the southeastern side of the atoll and is visible when approaching from northward. A sunken wreck, with only bow and boiler remaining (1941), probably the *Saint–Francois–Xavier* reported to be conspicuous in 1933, lies on the southwestern side of the atoll in 8° 50.7' N., 112° 11.8' E. The vicinity of the wreck is steep–to with depths of 137 fathoms about 328 yards off the wreck. A reef extends somewhat from the western end of the atoll–reef. At 218 yards off the atoll this extending reef is very narrow. A vessel obtained temporary anchorage on it in 1941.

41–Central Reef *(Center: 8° 55.8' N., 112° 21.5' E.)* a small atoll–reef awash, with a radius of about 656 yards, forms a shallow lagoon apparently with a depth of 6 feet. At the eastern and southwestern ends lie small white sand cays. The wreck of a wooden fishing vessel, stranded on the eastern cay in 8° 56' N., 112° 21.8' E., is the only anchorage mark (1941). A continuous reef extends between the northern and western parts. At the southeastern part there is an entrance to the lagoon. Temporary anchorages were found in a depth of about 22 fathoms about 547 yards off both the northwestern and western parts of the atoll. Central Reef is not always marked by breakers.

42–East Reef *(Western end: 8° 49.8' N., 112° 32.6' E.)* extends about 7 miles east and west with a greatest width of 2.3 miles forming a lagoon with depths of 4 to 8 fathoms and scattered with coral heads. A narrow tortuous entrance with an estimated depth of 5 fathoms exists in the western part of the atoll but entrance is impossible without very close examination. There are no conspicuous marks. The sea breaks heavily on the reef. Northward of the western entrance lies a sharp rock with a height of 3 feet. Other rocks are visible at the eastern and and southern parts.

Temporary anchorage may be found at distances from 220 to 540 yards on a reef extending from the northwestern part of the atoll.

43–Cuarteron Reef *(Western end: 8° 54.3' N., 112° 49' E.),* an atoll–reef which dries, extends about 2.7 miles east and west completely enclosing a shallow lagoon with depths estimated at about 1½ fathoms. There is no entrance.

Several rocks, 4 to 5 feet high, lie on the northern side. The atoll-reef is steep-to except at the western end where the reef extends northwestward for about 1,970 yards affording temporary anchorage. *H.M.S. Herald* anchored about 200 yards off the northern side in a depth of about 15 fathoms.

The tides at Cuarteron Reef are apparently diurnal, the rise being from 6 to 7 feet. The tidal current along the northern side sets westward during the flood and eastward during the ebb.

44–Fiery Cross Reef (N.W. Investigator Reef) is about 14 miles long lying in a northeast-southwest direction with a maximum width of 4 miles. Breakers may be visible at a distance of about 6 miles but in fine weather the sea does not break over the reef. Upon nearer approach the water gradually discolors and at a distance of 2 to 3 miles the reef can be made out easily. The reef is steep-to consisting of patches of coral, several of which dry or are awash. There are depths of 8 to 22 fathoms between the patches. At high water the whole reef is covered except a conspicuous small rock about 2 feet high near the southwestern end of the reef in approximate position 9° 33' N., 112° 53' E., (According to a Japanese survey this rock is about 6 feet high).

Anchorages.– In 1933 the French vessel *Alerte* anchored between two shoals near the northeastern end of the reef in a depth of 11 fathoms. Anchorage is also obtainable at a distance of about 400 yards from the reef, with the small rock bearing 062°, distant 1,400 yards, in a depth of 13 fathoms. Anchorage is stated to be unsuitable during strong breezes.

45–Bittern Shoal (Moralie Reef) *(See Figure 3)*, discovered and named by the *U.S.S. Bittern* on 3 March, 1935 was located by dead reckoning in position 9° 16' 00" N., 113° 40' 30" E. It is charted in 9° 13' 30" N., 113° 40' 30" E. *(H.O. Confidential Chart 5503)*, which is the position according to a Japanese survey. A British survey located Moralie Reef in 9° 12' N., 113° 40' E. These are all believed to be the same danger. The *U.S.S. Bittern* reports that the shoal is approximately circular in shape and appears to be of volcanic origin without coral except in the southwestern part. It does not contain a lagoon and is entirely covered with water. It is considered very dangerous because no telltale breakers show and its sides are very steep-to. No coral heads or rocks were observed in its center. Its greatest diameter is estimated at less than ½ mile. Anchorage may be obtained for one small vessel off the southern side. The *U.S.S. Bittern* anchored here in 12 fathoms of water with 25 fathoms of chain. When the ship rode to her anchor no bottom at 60 fathoms was obtained under her bow. According to a Japanese survey the least depth on the shoal is ½ fathom and the discoloration of Bittern Shoal is visible from the bridge for about 3½ miles and from the masthead for about 4½ miles with a high sun behind the observer.

46–Pearson Reef *(Southwestern Cay: 8° 58' N., 113° 39' E. approx.)* is a drying steep-to atoll-reef about 5 miles long and 1 mile wide in a west-southwesterly direction enclosing a lagoon to which there is no apparent entrance, but which is probably accessible to boats at high water. On the northeastern extremity of the reef there is a sand cay, 6 feet high, which has a length of 492 feet and a width of 164 feet. When viewed from a distance the northeastern cay resembles a low rampart. Flocks of seabirds may collect here appearing to be palms from a distance. On the southwestern extremity of the reef there is a cay about 3 feet high, with a length of about 230 feet and a width of 98 feet. About 2 miles eastward of the southwestern cay lies a group of 3 rocks 5 feet high.

Anchorage in about 15 fathoms can be obtained about 500 yards from the northeastern edge of the reef. Both cays are strewn with small rocks. Landing may be accomplished with difficulty.

47–Alison Reef is a drying atoll-reef about 11 miles long in a general northwesterly and southeasterly direction forming a lagoon which appears to be shallow and foul. It lies with its western end about 13 miles scutheastward of

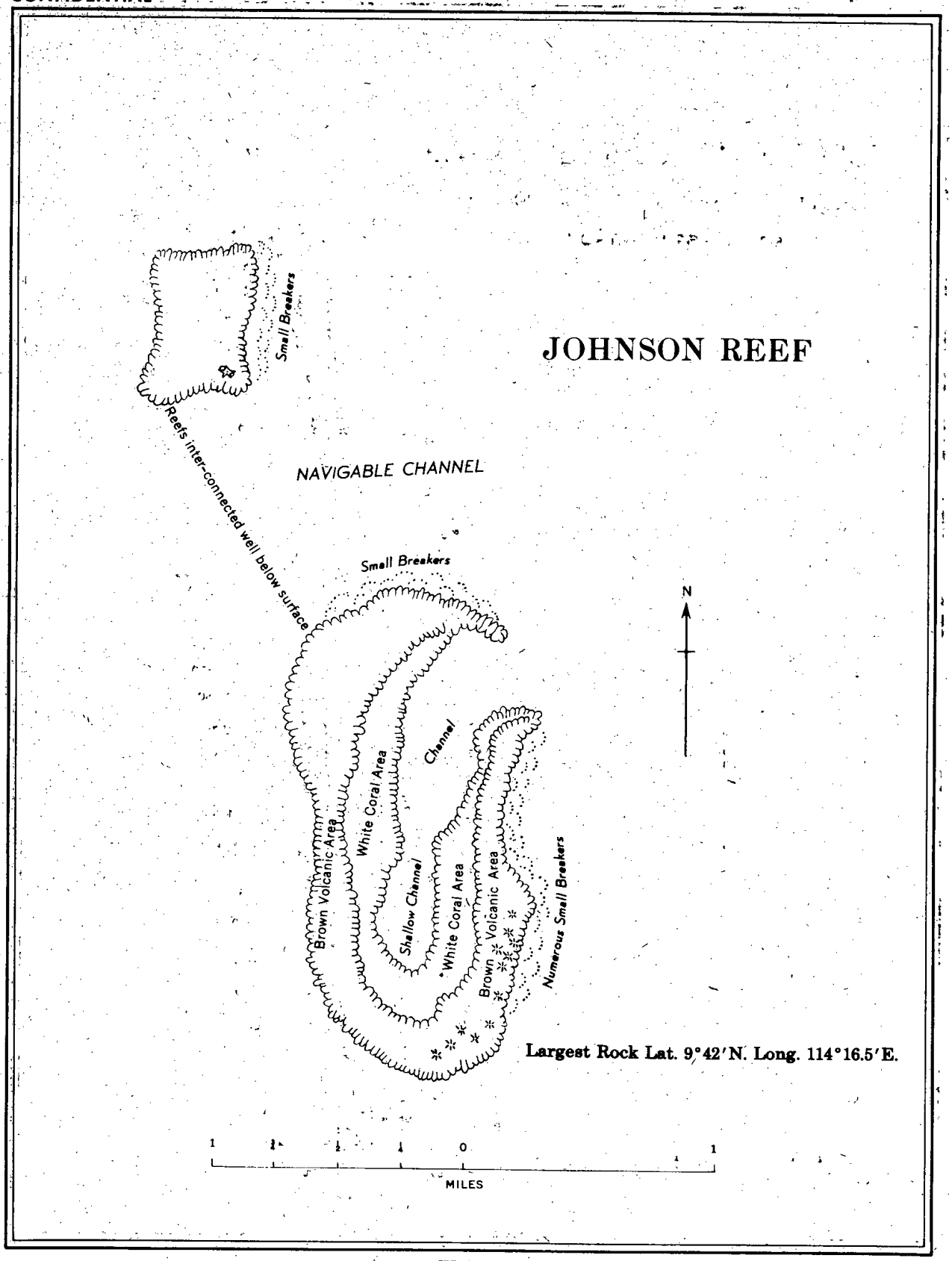


FIG. 5.

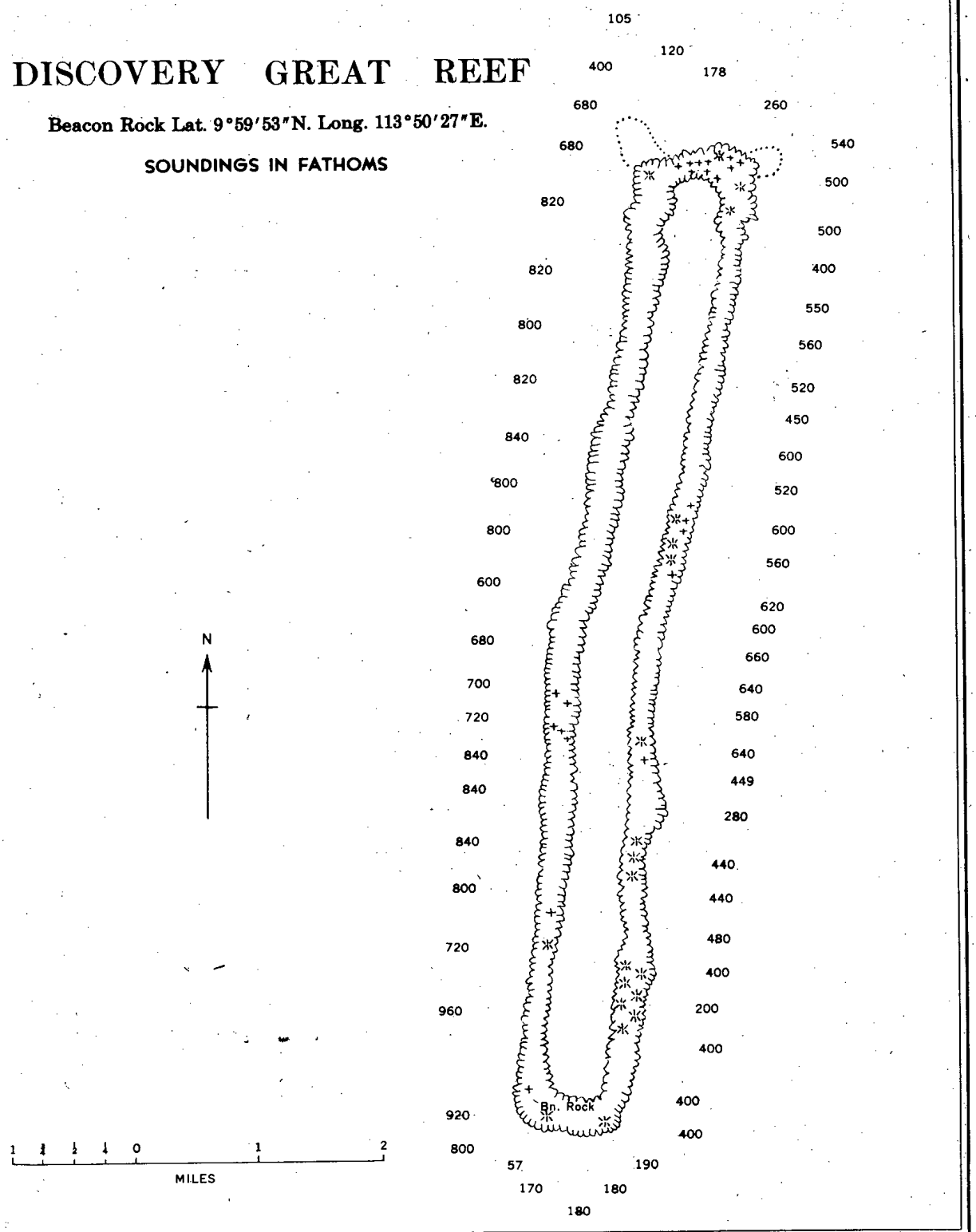


FIG. 6.

Pearson Reef. On the northern side in a position about 2½ miles eastward of the western end there is an entrance 700 yards wide with a depth of 5 fathoms. The northern side is strewn with small rocks. At low water some of these uncover about 3 feet. The southern side consists of a number of isolated, drying patches between which there are narrow channels with depths of about 5 fathoms. Anchorage can be obtained close to the western and southeastern extremities in a depth of about 33 fathoms. At the northern entrance to the lagoon and along the southern side anchorage can be obtained in a depth of about 5 fathoms. At high water Alison Reef does not uncover but it can be located by the breakers which can be seen at a distance of 5 or 6 miles on a clear day.

48—Cornwallis South Reef, stated to lie about 5½ miles eastward of Alison Reef, consists of a drying atoll—reef forming a lagoon with depths of about 5 fathoms which is entered from the southern end but has not been closely examined. The entrance is less than 400 yards wide containing several coral patches. According to a Japanese account this atoll cannot be entered except from the westward and only by boats. There are small drying rocks on the southeastern side. With a northeasterly wind there are breakers. Even at high water it is easy to make out.

49—Pigeon Reef (Tennent Reef) *(See sketch 4) (Southwestern end: 8° 50' N., 114° 37' E. on H.O. Confidential Chart 5503)* located by dead reckoning in approximately 8° 46' N., 114° 35' E. and named by the *U.S.S. Pigeon* on 2 March, 1935, is a triangular shaped drying atoll—reef completely enclosing a lagoon which appeared deep and clear except for one coral head. There is no entrance. The reef is brown in color, and appears to be of volcanic origin with a lining of white coral around the inside of the rim. A number of small rocks are awash on the reef, the largest being on the southeastern side. With northeasterly winds the northern side is marked by breakers.

Anchorage can be obtained off the southwestern tip in 18 fathoms, coral bottom. The *U.S.S. Bittern* anchored here using 65 fathoms of chain. At riding scope there was 23 fathoms under her stem and 85 fathoms under her stern.

50—Union Banks and Reefs *(Plan on H.O. Confidential Chart 5657),* a coral atoll with a greatest width of about 30 miles in a northeasterly and southwesterly direction consists of a rim, upon which are located 19 drying reefs and 3 small cays, surrounding a lagoon with large shoal areas and affording anchorage.

At the southwestern end of Union Banks lies **Johnson Reef** *(See Figure 5)* a fish—hook shaped reef of brown volcanic rock with white coral around the inner rim about 2 miles long in a north—south direction and about 1 mile wide at its widest point. Johnson Reef partly encloses a lagoon entered from the northeastward which has a depth of 3 fathoms in the entrance and 1 fathom within the lagoon which is reported used by junks. The largest rock on Johnson Reef, about 4 feet high and 5 feet in diameter, is stated to be located in 9° 42' 00" N., 114° 16' 30" E. and that about 6 rocks show above water on the southeastern part of the reef. The remainder of Johnson Reef was found covered.

Anchoring in the vicinity of Johnson Reef is not recommended because of the steep banks and large fissures in the coral, although 3 mine sweepers have anchored at the same time on the southwestern side in 17 to 30 fathoms.

Collins Reef, a small reef with a coral dune on its southeastern part lies about 1½ miles north—northwestward of Johnson Reef and is separated from it by a navigable channel.

Sin Cowe Island, 12 feet high and the highest of the group, lies about 10 miles north—northeastward of Johnson Reef.

Whitsun Reef, the largest reef of the group, is triangular in outline and lies at the northeastern end of Union Banks. Whitsun Reef is stated to lie about 1½ miles northeastward of the position charted on H.O. Confidential Chart 5657. Rocks on Whitsun Reef uncover at low water. With a

moderate breeze Whitsun Reef is marked by breakers which can be seen for a distance of about 6 miles. Discolored water can be made out at 4 miles.

Grierson Reef, a small islet lying about 5 miles southwestward of Whitsun Reef, is formed by sandy beaches with 2 black above–water rocks to the southward.

Lansdowne Reef, a shoal with a white sand dune, lies about 6 miles northeastward of Johnson Reef. The sand dune is about 2/3 the size of the islet on Grierson Reef.

Anchorages–Directions.– It is stated that two vessels of 1,500 tons displacement can be accommodated during the southwest monsoon in a depth of 28 fathoms coral, with Grierson Reef bearing 110° distant 4,400 yards. This anchorage is approached from northward and is bounded by shoals to the eastward, southward, and westward.

Anchorage is recommended for several vessels northeastward of Grierson Reef in a depth of 19 fathoms coral and east–northeastward of Grierson Reef. Depths of 5 to 19 fathoms obtain over this area. Anchorage is approached from the southeastward. Vessels should navigate close to the western side of Ross Reef to avoid two 22–foot shoals with discolored water, one lying 656 yards east–southeastward of Grierson Reef and the other 765 yards southeastward of Grierson Reef.

Anchorage for a vessel of 1,500 tons is stated to be obtainable in a depth of 19 fathoms, coral, southward of the eastern end of Union Banks. Vessels approach from southward and anchor under sternway with the eastern extremity of Whitsun Reef bearing 030° distant 1,470 yards. This anchorage is exposed to the southwestward. No anchorage was found on the northern side of the eastern end of Union Banks.

NORTHWESTERN PART

51–Discovery Small Reef *(10° 02' N., 114° 03' E. Approx.)* lying about 18 miles northwestward of Sin Cowe Island is a round coral patch, 670 yards in diameter. The patch dries in places at low water, and has ocean depths all around.

52–Discovery Great Reef *(See Figure 6)* lying about 9 miles westward of Discovery Small Reef is a narrow coral reef about 8 miles long in a north–south direction and about 1 mile wide. Beacon Rock lies on the southern extremity of Discovery Great Reef in position 9° 59' 53" N., 113° 50' 27" E. At mid–tide only 2 rocks are visible at the southern end. Several are visible along the eastern side and a large number at the northern end. At low water numerous rocks are visible on the southern and southeastern sides.

The lagoon is shallow and narrow, showing green water only. There is no entrance to the lagoon. A bank extends in a northwesterly direction from the northwestern tip on which soundings of 100 fathoms were obtained ½ mile from the rim of the atoll. A survey vessel anchored in 42 fathoms about ½ mile from the rocks at the northern end. Three mine sweepers anchored off the southwestern extremity in 16 fathoms, coral.

Discovery Great Reef can be seen from a distance of about 9½ miles from a height of 70 feet.

53–Western Reef (Flora Temple Reef) *(10° 15' N., 113° 37' E.)* is a dangerous narrow reef about 1½ miles long in a northeast–southwest direction lying about 17 miles west–northwestward of the northern end of Discovery Great Reef. There are rocks just covered in the southwestern part and depths of 1 to 3 fathoms in other places. Depths of 20 to 70 fathoms exist close to the reef, and depths of 200 fathoms, no bottom, a little farther out.

54–Tizard Bank *(Provisional H.O. Confidential Chart 5659)* lies with its western end about 16 miles northeastward of Discovery Small Reef. The bank is about 32 miles in length in an easterly and westerly direction. The greatest width of the atoll is about 10 miles. In the lagoon are several coral heads with depths of 3¾ to 7 fath–

FIG. 7A.

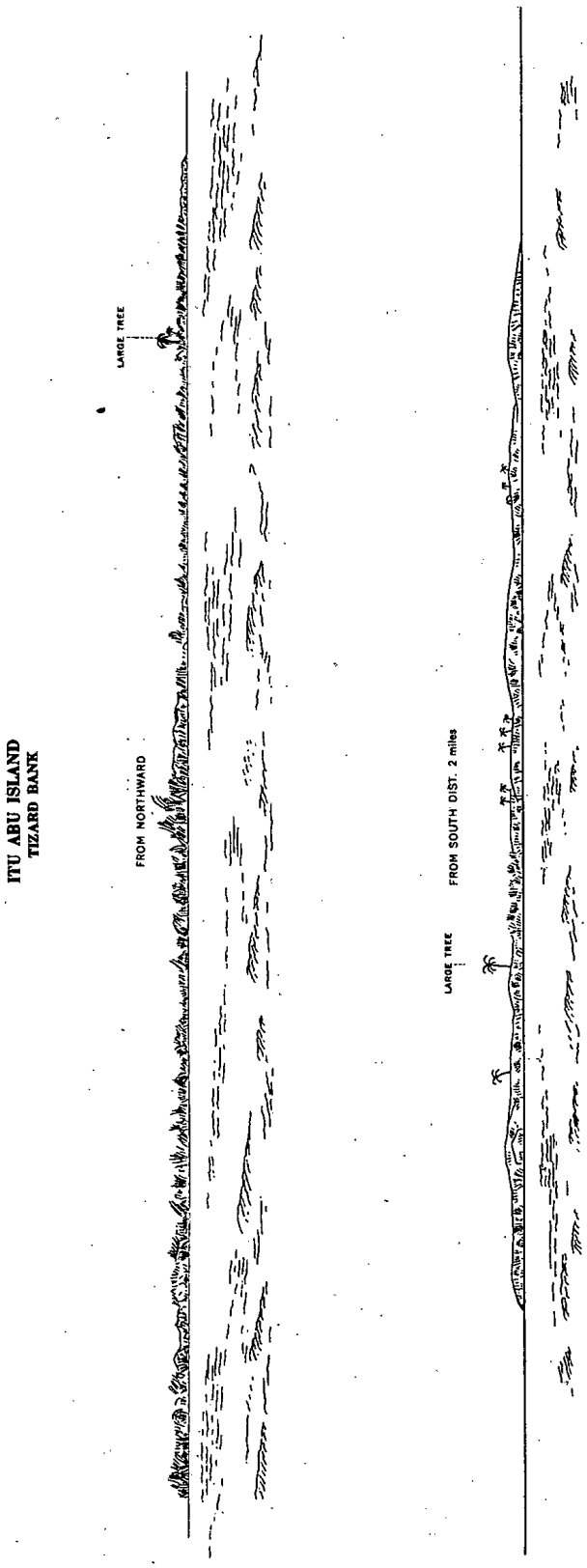


FIG. 7.

oms within the dragged area indicated on the chart.

55–Itu Aba *(10° 23' N., 114° 22' E.) (Plan on H.O. Confidential Chart 5657),* the largest island in the area described in this publication, lies at the northwestern end of Tizard Bank. Itu Aba has a length of 3,674 feet and a width of 1,050 feet. The reef fringing the island is usually marked by breakers and extends in some places for a distance of nearly ½ mile offshore. The island is covered with trees and scrub to a height of 99 feet. There is a coconut grove at the southwestern end where a well is located *(See Figure 7 and Figure 8).*

The ruins of a narrow pier extends about 328 feet southward from the southwestern end of the island. During the southwest monsoon this pier is reported to be awash. The ruins of a naval radio station and weather station existed on the island in 1945.

In 1941 a drum buoy was moored about 690 feet off the pier in 11 fathoms of water and another westward in about 17 fathoms. These buoys were used as lighter moorings. Small boats anchor in the channel off the pier but with southwesterly winds there is a heavy sea and it is unsuitable for anchorage. The best time to approach the pier is at high water with northeasterly winds. A depth of 17 feet is stated to exist at the head of the pier.

Tides.– Mean sea level is 3 feet above lowest low water at Itu Aba.

56–Other Reefs and Cays on Tizard Bank.– A reef, which dries about 2 feet and is easily seen at high water, lies about 2½ miles eastward of Itu Aba. A 3¼ fathom coral reef easily seen, lies about ¾ mile eastward of Itu Aba in the area dragged to a depth of 3 fathoms indicated on the chart.

A grassy sand cay, about 10 feet high, well grown with trees 30 feet high to their tops, lies about 6½ miles eastward of Itu Aba. The cay is surrounded by reefs that dry 4 feet which make the cay difficult of access even to boats.

Petley Reef, lying about 12 miles eastward of Itu Aba, dries 3 feet and lies on the extremity of a coral ledge which is steep–to and projects about 5 miles northward from the northeastern side of Tizard Bank.

Eldad Reef, lying at the eastern extremity of Tizard Bank, is about 5 miles long in a northnortheasterly and south–southwesterly direction. The middle part of Eldad Reef is about 4 feet high. At the northeastern end of the reef a rock dries 4 feet. Other parts of the reef dry as much as 3 feet. A narrow steep–to ledge on which the depths gradually increase from 5 to 50 fathoms extends about 1 mile northeastward from the northeastern extremity of Eldad Reef.

Nam yit, a small cay about 10 feet high and 62 feet to the tree tops, lies about 12 miles southward of Itu Aba on the southwestern side of Tizard Bank. Nam yit is grown over with numerous palms and scrub and surrounded by a drying reef.

Gaven Reefs, two in number, about 2½ miles apart in a northwesterly direction, form the southwestern end of Tizard Bank. The southeastern reef lies about 6½ miles westward of Nam yit and is easily seen. The northwestern reef has a small white sand dune 6 feet high at its northeastern end.

57–Channels – Northern Side of Tizard Bank.– There are four entrances on the northern side of Tizard Bank as charted. The usual entrance is Third North Pass.

First North Pass has a width of 1,420 yards and is dragged to a depth of 9.8 fathoms.

Second North Pass has a width of 437 yards between the reefs and is dragged to a depth of 9.8 fathoms.

Third North Pass, the usual channel, has a width of 656 yards and is dragged to a depth of 9.8 fathoms.

Fourth North Pass, close eastward of Itu Aba, has a width of 437 yards and is dragged to a depth of 9.8 fathoms.

Channels – Southern Side of Tizard Bank.– First South Pass on the northeastern side of Nam yit has a width of 656 yards and is dragged to a depth of 9.8 fathoms.

Second South Pass, on the western side of Nam yit is 874 yards wide and dragged to a depth of 9.8 fathoms.

West Pass.– From about 2 miles southwestward of Itu Aba West Pass leads in an easterly direction with a width of more than ½ mile dragged to a depth of 9.8 fathoms. The reefs on each side of the channel are easily made out by their discoloration.

58–Anchorages – Directions – Tizard Bank.– Anchorage is possible in a depth of 18 fathoms, coral sand, in a position 1,200 yards northnortheastward of the palms at the eastern part of Itu Aba. This is stated to be a good anchorage during the southwest monsoon and may be easily cleared in an emergency. Anchorage is possible up to 2,000 yards westward of this position during the southwest monsoon. Approach is made from the north–northeastward heading for the above–mentioned palms on a bearing of 202°. With attention to the color of the water and continuous use of the sonic depth finder vessels may anchor under sternway.

The French vessel *Astrolabe,* in 1933, anchored in a depth of 10 fathoms coral 1.2 miles southward of Itu Aba. The shelter is good when the wind is from northward and northeastward, but when the monsoon freshens the swell may run very high.

Vessels can anchor with safety on the ledge eastward of Second North Pass in depths of 7 to 10 fathoms.

Several vessels can find anchorage in suitable depths in a position about 900 yards northnortheastward of the sand dune on the northwestern of the Gaven Reefs. This anchorage is sheltered from the long swell of the southwest monsoon and can be cleared easily in an emergency.

59–Loai ta Bank and Reefs *(Plans on H.O. Chart 2786 and H.O. Confidential Chart 5657),* about 40 miles in length from the southwestern end to Menzies Reef at the northeastern extremity, is steep–to consisting of two lagoons tapering toward each other where they are separated by a navigable passage about 1¼ miles in width with a least known depth of 18 fathoms.

Loai ta Island *(10° 41' N., 114° 25' E.) (See Figure 8)* an islet lying at the southern end of Loai ta Bank about 18 miles northward of Itu Aba is about 10 feet high and about 300 yards in diameter and thickly grown with bushes and trees with some coconut, banana, and papaya. There is a well on the islet. The islet is fringed with reefs which extend 1,000 yards from the northern side and less distance in other directions.

Anchorage may be obtained with the center of the islet bearing 260° distant 0.4 mile.

Lankiam Cay and adjacent reefs on Loai ta Bank.– An unnamed coral patch, about ½ mile long and partly dry at low water lies 2 miles east–northeastward of Loai ta Island. Lankiam Cay, a sandbank, lies about 6¾ miles east–northeastward of Loai ta Island in the center of a reef about ¾ mile in diameter. Two coral reefs, which dry at low water, lie 3 and 4½ miles, respectively, northeastward of Lankiam Cay forming the southeastern side of Loai ta Bank.

The southwestern side of Loai ta Bank consists of a 3–fathom shoal lying about 2 miles westward of Loai ta Island; a drying reef with a sand cay near the center lying about 5 miles northwestward of Loai ta Island and another reef lying ¾ mile southwestward of the latter.

The northwestern side as far as the passage has a least known depth of 4 fathoms and the northeastern side as far as the passage has a least known depth of 6 fathoms.

60–Menzies Reef *(Plan on H.O. Confidential Chart 5657),* awash at low water, lies about 35 miles northeastward of Loai ta Island and forms the northeastern end of the northern extension of Loai ta Bank. The least depth obtained on the rim of the sunken lagoon tapering south–southwestward from Menzies Reef was 2 fathoms.

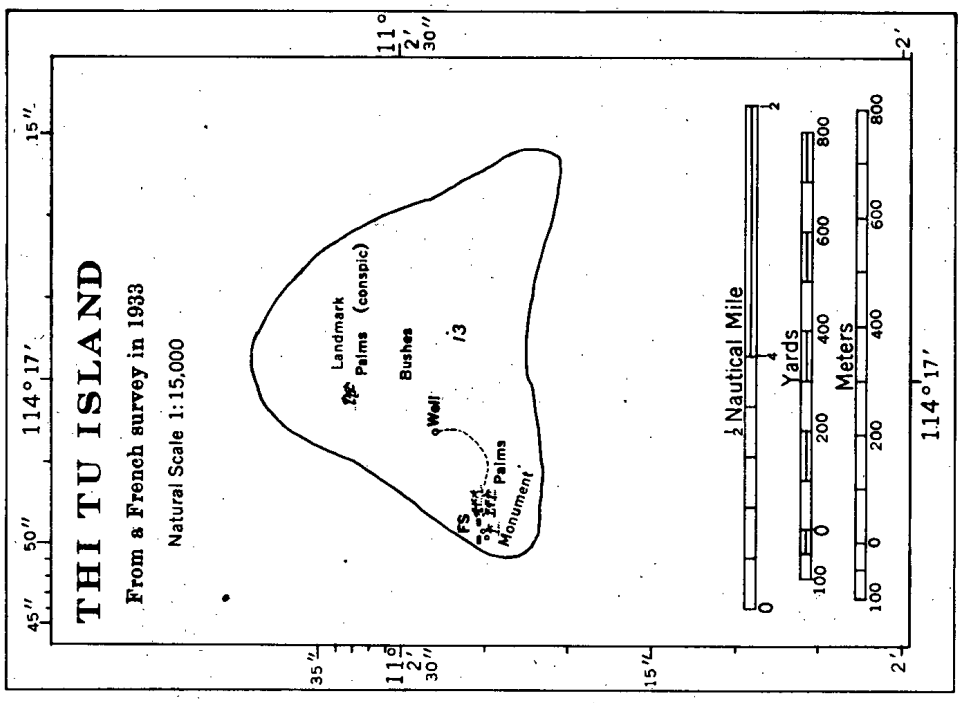


FIG. 9.

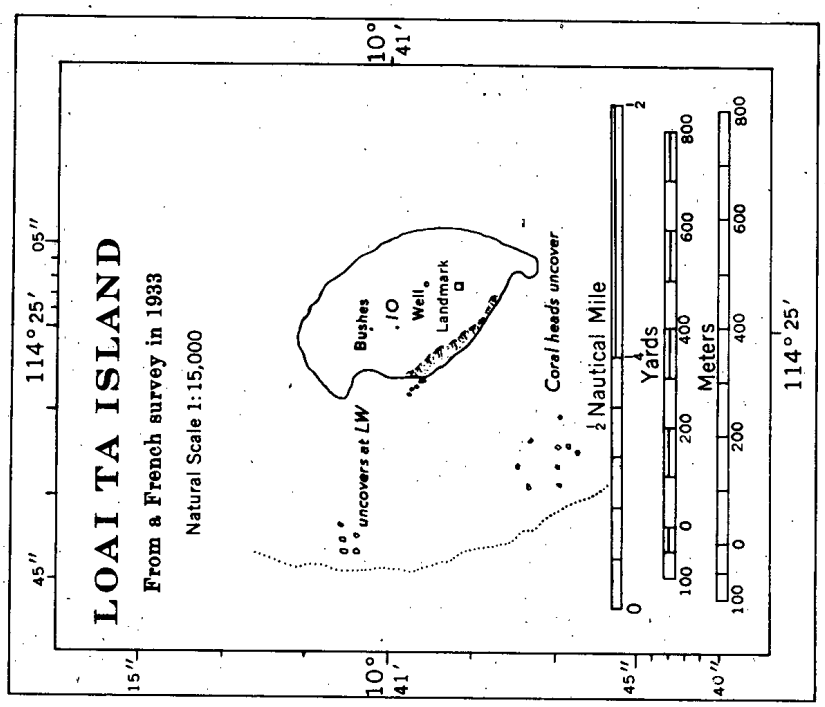


FIG. 8.

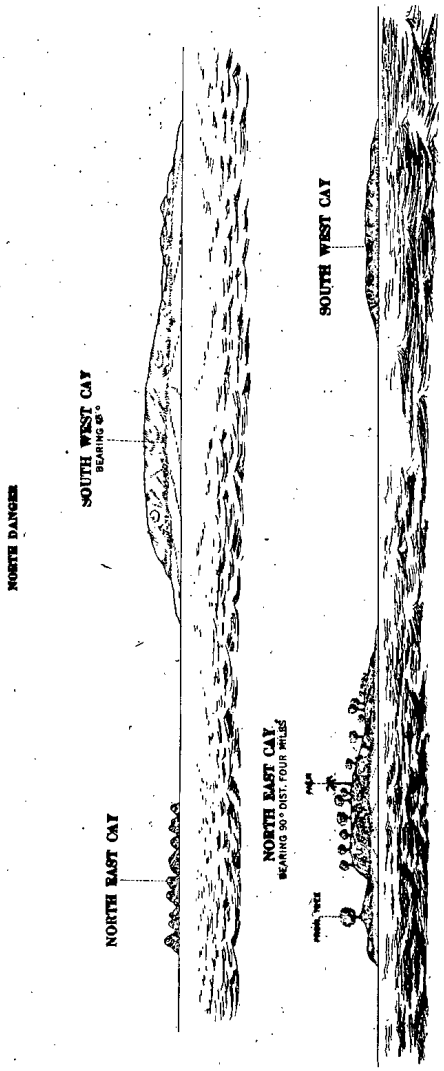


FIG. 10.

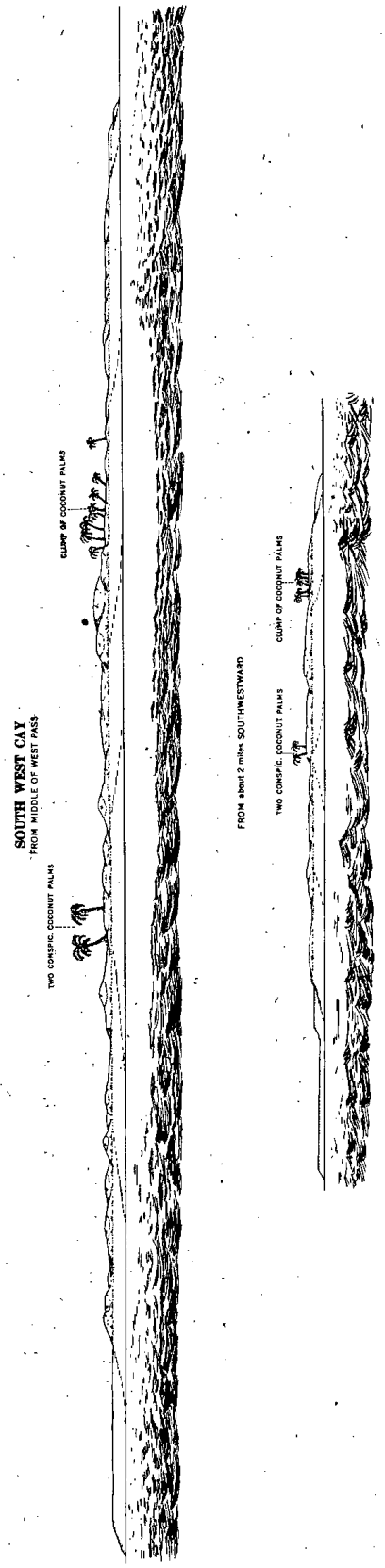


FIG. 11.

Subi Reef *(Plan on H.O. Chart 2786),* which usually breaks, and is apparently steep-to, lies about 21 miles northwestward of Loai ta Island. The reef is composed of coral, which dries, and surrounds a lagoon into which there appears to be no passage.

61–Thi tu Island and Reefs *(Plan on H.O. Chart 2786).–* Thi tu Island and reefs consist of several dangerous patches upon two coral banks, extending 12 miles in an east–west direction and separated by a narrow and deep channel.

Thi tu Island *(11° 03' N., 114° 17' E.) (See Figure 9),* about 800 yards in extent and 13 feet high, lies on the reef at the eastern extremity of the westernmost of the two coral banks. It is covered with grass and impenetrable bushes to a height of 60 feet. A conspicuous leaning palm and some other trees stand in a grove at the southwestern corner. Drinking water with a brackish taste and an odor may be obtained from a well on the island. The island is reported to be rich in guano and phosphorite deposits.

Banks.– The western bank, about 7 miles long and a maximum of 3¼ miles wide, has a lagoon accessible through a passage on the northern side. There is a detached 5–fathom shoal in the middle of the passage. A sand cay lies on a drying reef on the western side of the passage. Other reefs, nearly always marked by breakers, extend to the western extremity of the bank from the sand cay. The southern side of the bank is not so dangerous as the northern side.

The eastern bank is studded with reefs and shoal patches.

Anchorages.– Small vessels can anchor on the southern side of the western bank with the sandy cay bearing between 328° and 036°. Anchorage may be obtained with the reef in sight about 1 mile southwestward of Thi tu in a depth of 10 fathoms. The best landing in the northeast monsoon is in the middle of the western side where there is a bay in the fringing reef.

62–North Danger *(Provisional H.O. Confidential Chart 5658),* a coral atoll–reef formation about 8½ miles long, northeast and southwest, and 4½ miles wide, lies from 20 to 28 miles northward of Thi tu Island. The reef is steep–to and surrounds, but does not shelter, a lagoon with even depths the major part of which is dragged to a depth of 9.8 fathoms.

North Reef, at the northeastern end, dries in patches and the sea breaks heavily on its weather side during the northeast monsoon.

South Reef, at the southwestern end, also dries in patches and a rock dries 3 feet forming a good mark for vessels abreast the reef. The sea breaks heavily on the weather side of this reef during the southwest monsoon. In calm weather North and South Reefs appear greenish white and can be easily made out.

63–Northeast Cay *(Southwestern end: 11° 27' N., 114° 21' E.) (See Figure 10)* is an islet 8 feet high, low and flat in the center, overgrown with scrub to a height of 13 feet around the circumference with two conspicuous coconut palms, 40 feet high, on the eastern side. There are some deposits of phosphorite and small amounts of guano on the islet. In the middle of islet is a water pool unsuitable for drinking. During the northeast monsoon Chinese fishing vessels visit the islet. The beaches of Northeast Cay are sandy and from 50 to 150 yards wide. In rough weather and storms the slope of the beaches increases. A rapidly growing drying coral reef fringes the cay. Small boats must land at high water with careful attention to currents. With a heavy swell landing is dangerous. Eastward of the coconut palms is a boat channel.

Shira Islet, consisting of a conspicuous hummock about 100 yards in circumference and 6 feet high, lies about 300 yards southwestward of Northeast Cay. The reef between Shira Islet and Northeast Cay dries at low water.

64–Southwest Cay *(See Figure 11)*, about 1½ miles southwestward of Northeast Cay and a somewhat smaller islet, 16 feet high at its highest part, has a quarry located at the center of the island which is scattered with the relics of former phosphorite mining operations. Several coconut palms stand near the beach on the eastern side and two others, conspicuous from a distance, stand near the highest ground on the southwestern side. There are two wells near the coconut grove on the eastern side but because of the large salt content the water is not recommended for drinking. However, it is used for drinking by fishermen. During the egg-laying season countless sea birds visit the island. Landing is possible on the southeastern side of the islet during the southwest monsoon, even when it freshens. A boat channel is stated to exist on the southwestern side of the islet.

Jenkins Patches, with a least depth of 2 fathoms, lie nearly midway between Southwest Cay and South Reef. Breakers are occasionally seen on Jenkins Patches.

On the **eastern side** of North Danger are Day Shoal, Farquharson Patches, and Sabine Patches. Day Shoal, about 1 mile southward of North Reef, has a least depth of 9 feet and always breaks in rough weather. Farquharson Patches, with a least depth of 16 feet, lie at the southeastern corner of the encircling reef, at a position about 2½ miles south-southwestward of Day Shoal. Sabine Patches, with a least depth of 13 feet, lie about ½ mile farther southwestward and about 3 miles eastward of South Reef. Iroquois Ridge, with numerous shoal spots of less than 5 fathoms, lies in the northeastern part of the lagoon and extends from Northeast Cay to Day Shoal. There are deep but narrow channels over the ridge.

65–Channels.– There are five entrance channels. North Pass is not recommended, except for small boats. **Middle Pass**, 1,420 yards wide and dragged to a depth of 21 feet is easy to negotiate but is limited to vessels drawing less than 20 feet. The fairway favors Southwest Cay a little. Tidal currents with a velocity of 1.8 knots have been experienced in Middle Pass.

West Pass, between Southwest Cay and South Reef, is divided into two parts by Jenkins Patches. Deep-draft vessels from northward should enter the northern part of West Pass, which is dragged to a depth of 32 feet, passing about 1,000 yards southward of Southwest Cay. This channel which is comparatively easy to locate has a width of about 300 yards.

East Pass, dragged to depths of from 25 to 30 feet over a width of 2,180 yards can be negotiated by using the coconut palms on Southwest Cay as fore and aft marks. The reefs of the channel can be made out from the vessel.

South Pass, a narrow channel by comparison, is dragged to a depth of 27 feet. It can be negotiated with the palms on Southwest Cay as fore and aft marks.

Tides–Currents.– The tides are almost entirely diurnal with a large diurnal inequality. When the moon's declination is north the higher high water follows the moon's lower transit. When the moon's declination is south the higher high water follows the moon's upper transit. The mean lunitidal interval is about $9^h\ 10^m$ and the mean rise of higher high water is about 5 feet.

The currents near and within North Danger seldom exceed 1½ knots in velocity. The currents appear to be mainly seasonal, depending on the prevailing monsoon. There is very little relation between the tides and the currents. In the center of the lagoon a velocity of ½ knot is never exceeded except during strong breezes. Near the reefs currents with velocities of a little over 1 knot may be experienced with the direction depending on the prevailing wind. Weak counter currents probably due to eddies forming in the shallow water over reefs may be experienced.

66–Anchorages – Directions.– A good anchorage during the northeast monsoon was found about ½ mile southward of the palms on Northeast Cay in a depth of 18 fathoms. Shira Islet can be used for anchor bearings. A Japanese vessel entered via West Pass and anchored in a depth of 23 fathoms 1¼ miles south-southeast–

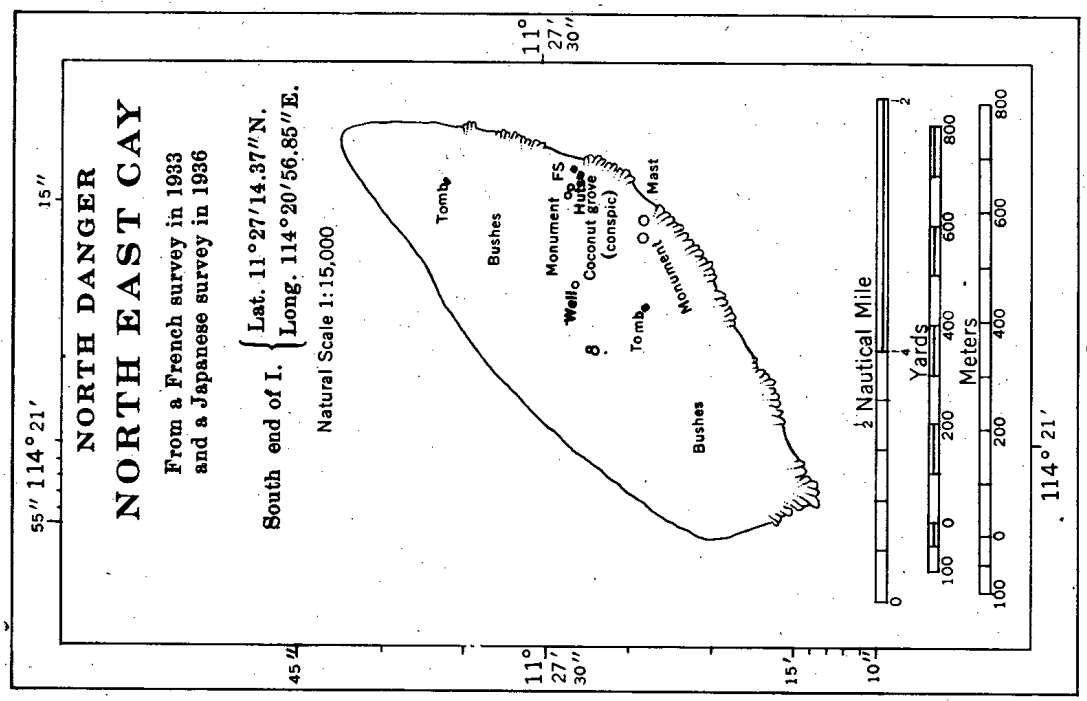


FIG. 10A.

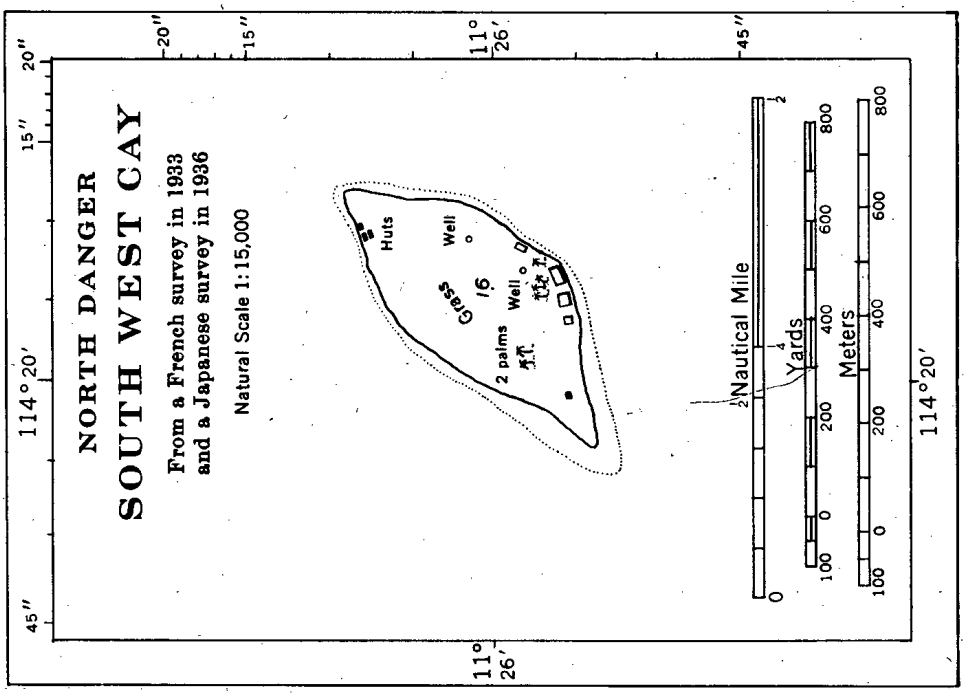


FIG. 11A.

ward of Southwest Cay. During the northeast monsoon calm water may be found in the lee of North Reef. During the southwest monsoon calm water may be found in the lee of South Reef. *H.M.S. Caradoc* obtained anchorage in the following positions:

In 24 fathoms with a mast near the center of Southwest Cay bearing 301°, distant 1,800 yards.

In 18 fathoms with the mast on Southwest Cay bearing 022°, distant 4,900 yards.

In 20 fathoms with the conspicuous palm on Northeast Cay bearing 347°, distant 1,300 yards.

There is a good holding ground, coral sand, and mud, but there is little difference between North Danger lagoon and the open sea as far as shelter is concerned. The depth over the sunken rim of the atoll are too great to stop the seas.

67—Trident Shoal *(Plan on H.O. Confidential Chart 5657)*, lying 16 miles eastward of North Danger, is a coral atoll—reef about 10 miles long with a width of 5 miles at the northern end tapering to 2 miles at the southern end. The rim consists of shoal patches surrounding a lagoon with depths of 19 to 34 fathoms. The shoalest spot, at the northern end, dries at low water. At the eastern extremity is a 2¼—fathom patch. The information available is incomplete and no anchorages or entrances to the atoll can be recommended.

Lys Shoal, about 4 miles long, lies about 1 mile southward of Trident Shoal and consists of a number of patches with depths less than 10 fathoms over them surrounding a sunken lagoon. A patch, with a depth of 2¾ fathoms over it, lies near the southwestern end of the shoal and a 5—fathom patch lies near the northeastern end.

68—West York Island *(11° 04' 30" N., 115° 00' 00" E.)* lies about 12 miles east—southeastward of Menzies Reef. In size and shape it resembles Nam yit Island. The island is about 550 yards by about 350 yards in extent, and is covered with grass, trees and bushes, with some tall coconut palms near the southern end. The island has a sandy foreshore. A fringing reef extends about ¼ mile off the eastern, southern, and western sides, and about 2 miles off the northern side of the island. The *U.S.S. Nanshan*, a collier, obtained anchorage in 1905 in 14 fathoms about 2½ miles north—northeastward of the northern extremity of the island. This position is exposed and uncharted dangers may exist in the vicinity. A Japanese vessel anchored in 35 fathoms with the coconut palms bearing 213°. Anchor with caution since a shoal lies about 300 yards southwestward of this anchorage. It is completely exposed and during the southwest monsoon there are heavy swells.

69—Irving Reef *(H.O. Confidential Chart 5657)*, lying about 12 miles south—southwestward of West York Island, dries in patches enclosing a small shallow lagoon. A small sand cay is located near the northern end. Shoal water extending from the western end of the reef has a least depth of 8 feet at its western extremity. Between this depth and the reef, depths of 7 and 8 fathoms were obtained.

NORTHEASTERN PART

70—Southampton Reefs *(H.O. Confidential Chart 5657)*.— Southampton Reefs consist of two drying reefs. **Livock Reef**, the southwestern and larger, lies about 18 miles northwestward of Mischief Reef, in 10° 10' N., 115° 18' E. **Hopps Reef**, the northeastern of the two reefs, lies about 3 miles northeastward of Livock Reef. Livock Reef encircles a lagoon and has a few isolated rocks on it which may be visible at high water. The only anchorage obtained by *H.M.S. Iroquois* was in a depth of about 25 fathoms about 400 yards from the southeastern edge of the reef. Hopps Reef has no lagoon and there are no rocks of appreciable size on it. The lagoon in Livock Reef is probably accessible to boats at high water.

71—Jackson Atoll *(Plan on Provisional H.O. Confidential Chart 5658)* lies about 33 miles north—northeastward of Mischief Reef, and consists of a nearly circular atoll about 6 miles in

diameter, enclosing a lagoon with depths of 10 to 26 fathoms. Five reefs, drying in patches, lie on the rim of the atoll.

Channels.— There are four main entrances to the lagoon, namely Northwest, North, Northeast, and East Entrances. Northwest Entrance is about ¾ mile wide with a least depth of 27 feet and lies between Hoare and Deane Reefs. North Entrance, about 2 miles wide, lies between Hoare and Dickinson Reefs, and has a least depth of 34 feet near the middle. Fly patches, which have depths of about 5½ to 10 fathoms, lie in the eastern part of the entrance. Northeast and East Entrances are each over 1 mile wide and have depths of over 8 fathoms. These entrances are separated by Middle Shoal, with a least depth of 4 fathoms, and lie between Dickinson and Petch Reefs. There are also channels with depths of over 10 fathoms on the southern side of the lagoon, between Petch and Hamson Reefs, and between Hampson and Deane Reefs, but they are very narrow.

Anchorage, with good holding ground, can be obtained anywhere within the lagoon over a bottom of sand and coral, but there is no shelter from bad weather.

72—Flat Island *(10° 49.7' N., 115° 49.2' E.) (H.O. Chart 5657)*, lying about 18 miles northward of Jackson Atoll, is a flat sandy islet about 262 yards long. Another account states that it is a cay about 100 yards long and 40 yards wide with no vegetation and subject to erosion. A fringing reef is stated to extend about 2 miles southeastward and about the same distance northeastward from Flat Island. A shallow reef is stated to extend southward from the southern side of Flat Island to within about 1 mile of Nanshan Island, but this does not agree with the chart.

73—Nanshan Island, *(H.O. Chart 5657)*, lying about 5½ miles southward of Flat Island, is about 634 yards long and 8 feet high, sandy and covered with coarse grass. There are two wells of brackish water, and the island is frequented by fishermen. Myriads of sea birds nest here and there are large guano deposits. Southward of Nanshan Island there are depths of 7 and 12 fathoms and it is possible that there may be less water in the vicinity.

A large bank of anchorage water with depths of about 25 fathoms is stated to extend southeastward from Flat and Nanshan Islands for a distance of about 6 miles, but no anchorage can be recommended because of lack of detailed information. It is known that fishermen from Manila frequent this bank.

74—Hardy Reef, which dries and has a narrow strip of sand in the middle, lies about 28 miles southeastward of Jackson Atoll. There is no anchorage in the vicinity.

75—Hopkins Reef, lying about 15½ miles eastward of Flat Island, has a depth of 3 feet in the center surrounded by depths of 20 to 23 feet dropping off to 82 fathoms at a distance of about 100 yards. Hopkins Reef breaks heavily.

76—Iroquois and Baker Reefs.— These two reefs lie on the southern extremity of Amy Douglas Bank about 21 miles eastward of Nanshan Island. Iroquois Reef is L-shaped with a patch above water about 1 mile northward of the southwestern corner and provides some shelter from the southwestward. *H.M.S. Iroquois* obtained anchored within the horns of this reef in 1928. Baker Reef, about 4 miles northward, is a small isolated reef with a depth of 3 feet, except for patches which dry.

77—Amy Douglas Bank is believed to be connected to the unsurveyed bank extending southward from Marie Louise Shoal.

Caution.— Nothing can be added to the information shown on the chart eastward and northeastward of Amy Douglas Bank as far as Seahorse Bank and it is considered dangerous to navigation.

78—Seahorse (Routh) Bank *(Southern end: 10° 43' N., 117° 46' E.)*, the northeastern most known danger, consists of a pear-shaped atoll about 8½ miles long in a north-northeasterly and south-southwesterly direction and about 3 to 5 miles wide. The least known depth on

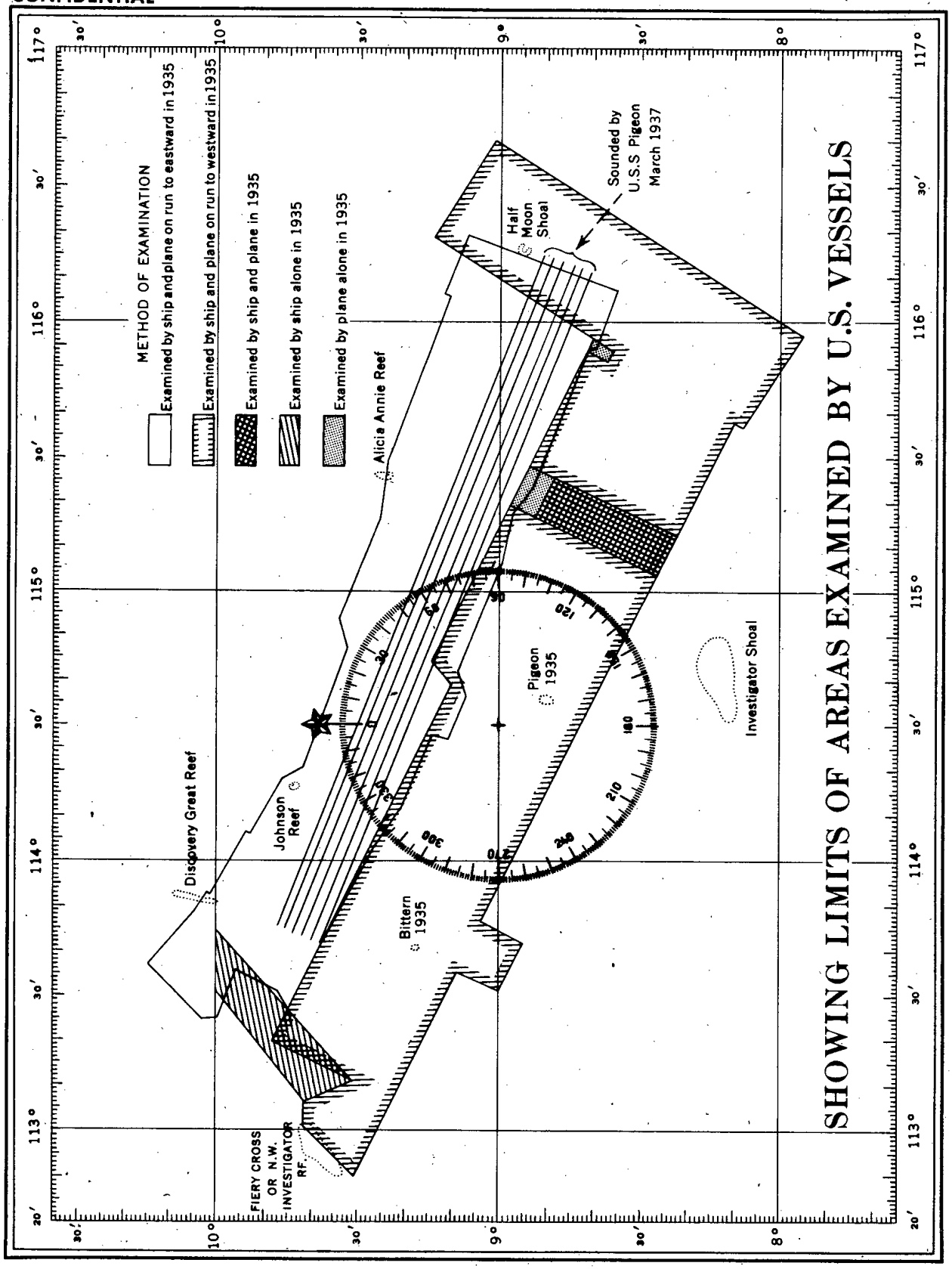
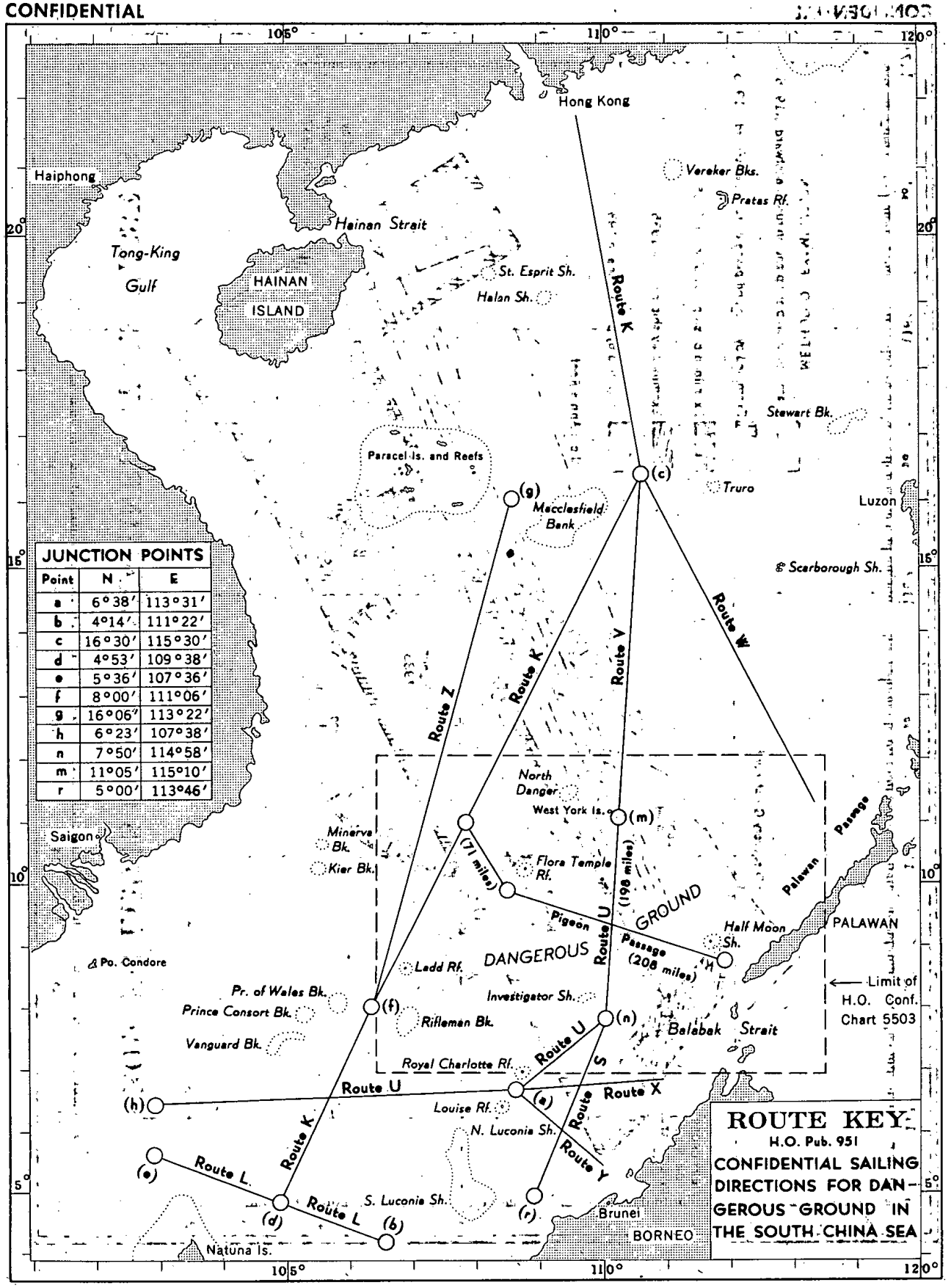


FIG. 12.



JUNCTION POINTS		
Point	N	E
a	6°38′	113°31′
b	4°14′	111°22′
c	16°30′	115°30′
d	4°53′	109°38′
e	5°36′	107°36′
f	8°00′	111°06′
g	16°06′	113°22′
h	6°23′	107°38′
n	7°50′	114°58′
m	11°05′	115°10′
r	5°00′	113°46′

ROUTE KEY

H.O. Pub. 951

CONFIDENTIAL SAILING DIRECTIONS FOR DANGEROUS GROUND IN THE SOUTH CHINA SEA

FIG. 13.

the rim is 4½ fathoms on a patch about ¾ mile in extent at the northern end. No depth less than 6 fathoms has been obtained on any other part of the atoll–reef. Inside the lagoon the depths vary from 19 to 29 fathoms.

ROUTES

79–General.– A competent navigator using these Sailing Directions in conjunction with the charts can negotiate either the U.S.S. Pigeon Passage or Route U by day with the largest deep–draft vessel in comparative safety. Accurate fixes are essential prior to attempting any of the passages. Under favorable conditions, with a good fix, the U.S.S. Pigeon Passage can be negotiated at night.

80–U.S.S. Pigeon Passage.– In 1937 the *U.S.S. Pigeon* conducted a hydrographic survey in Dangerous Ground and developed a 10–mile wide channel clear of dangers on a course of 291° taking departure with Half Moon Shoal bearing 021° distant 3 miles. In lieu of departure from Half Moon Shoal vessels should obtain an accurate fix. From eastward, with a width of 5 miles on either side of the recommended track, the examined passage leads from 8° 40' N., 116° 30' E. for 208 miles on a bearing of 291° to 9° 55' N., 113° 15' E. thence a passage examined by a Japanese survey leads for 71 miles on a bearing of 327° to 10° 55' N., 112° 35' E. Soundings of less than 600 fathoms are charted near the recommended track south–southeastward and south–southwestward of Alicia Annie Reef. Soundings of less than 700 fathoms are charted near the recommended track southward of Discovery Great Reef.

81–Route U.– This passage, established by a British Survey, leads in a northerly and southerly direction through the central part of Dangerous Ground as indicated on the charts. Route U is recommended for daylight passage only. No known dangers lie within 7 miles either side of the recommended track.

82–Japanese Passage.– An examined zone with a width of 40 miles and a length of 210 miles extending from 10° 30' N., 112° 51' E. to 7° 30' N., 114° 55' E. was developed by a Japanese survey. Vessels using this passage were accompanied by aircraft by day and temporary lights were rigged on the shoals by night. The usual route from northwestward passed eastward of Bittern Shoal and Pearson Reef, southwestward of Alison Reef and Cornwallis South Reef, and northward of Investigator Shoal. Vessels using this passage were advised to avoid Ardasier Bank and to keep close to Investigator Shoal. The use of this passage depended on favorable monsoon conditions.

83–Departure from Recommended Routes.– Throughout the area of Dangerous Ground vessels must rely heavily on seaman's eye navigation. An uncharted sounding of less than 600 fathoms should at once call for extreme caution. Navigation should not normally be attempted except in daylight and with the assistance of aircraft. Air observers can spot shoals at distances of from 10 to 20 miles, while alert masthead lookouts can make them out as far as 8 miles under ideal conditions of visibility and 2 miles under less favorable conditions. Vessels intending to enter lagoons should be assisted by lead boats equipped to lay temporary buoys. There is great variation in the ability to make out the reefs depending on the state of the tide. Drying patches and rocks make it easier to locate them at low water. With a gentle to moderate breeze breakers become easily visible marking the reefs awash. Sunken reefs may not show discoloration when the sun is low and the sea is mirror–like and when the sky is overcast. Occasionally the presence of an atoll may be detected by the reflection of the discolored water on the under side of clouds directly above it. Close to shoal water the discoloration may not be clear but the flow of currents against the wind may cause a belt of rips.

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